Physical Activity mHealth Tailored to Postpartum Individuals with Lumbopelvic Pain

by

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BSc, University of Victoria, 2010
DC, Canadian Memorial Chiropractic College, 2013
MRSc, University of British Columbia, 2019

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of

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We acknowledge and respect the Lək̓ʷəŋən (Songhees and Xʷsepsəm/ Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and W̱SÁNEĆ Peoples whose historical relationships with the land continue to this day.

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Abstract

Background: Postpartum moderate-to-vigorous intensity physical activity (MVPA) is essential for the health of the birth parent, their future pregnancies, and their children. Unfortunately, over 55% of postpartum individuals are not meeting recommended MVPA guidelines and face significant barriers to MVPA participation such as lack of childcare, sleep, and time. Up to 67% of postpartum individuals suffer from lumbopelvic pain (LPP) which can affect their ability to be active. Mobile health applications (mHealth apps) have great potential for promoting MVPA amongst postpartum individuals; however, those currently available lack quality and evidence-based recommendations and have limited effectiveness and engagement.

Objectives: To design and develop an evidence-based, acceptable, usable, feasible, scalable, and low-cost MVPA promotion mHealth app tailored to postpartum individuals with LPP. A series of three studies, following the IDEAS (Integrate, Design, Assess, and Share) framework, were conducted to meet this overarching objective.

Methods: This proposal consists of six chapters. Chapter 1 provides an introduction with a brief overview of the background literature and dissertation objectives. Chapter 2 provides a more thorough background literature review. Chapter 3 is a systematic review of mediators of postpartum PA behaviour change interventions. Chapter 4 is a cross-sectional study to determine predictors of MVPA intention-PA translation among postpartum individuals. Chapter 5 is a co-design study, in partnership with key knowledge users (i.e., individuals with lived expertise of postpartum LPP and healthcare providers) to tailor a previously existing theory-informed and evidence-based MVPA promotion mHealth app to postpartum individuals with LPP. Chapter 6 is a general discussion to synthesize the findings of the aforementioned three studies and make suggestions for future directions.

Significance: The findings of this research program illuminates the unique barriers, needs, and considerations for MVPA and mHealth when intervening with postpartum individuals with LPP. They also inform future large scale trials with the ultimate intents of optimizing health and reducing chronic disease for postpartum individuals themselves, their future pregnancies, and their children.

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Dedication

This dissertation is dedicated to all of the postpartum women and people out there, juggling everything there is to juggle during one of the most beautiful yet challenging phases of life! May you find a moment each day to prioritize your own health, even for just a few minutes of deep breathing exercises — and may perinatal research continue to grow.

Chapter 1: Introduction

Regular moderate-to-vigorous intensity physical activity (MVPA) is associated with many health benefits for postpartum individuals and can influence the health of their future pregnancies as well as the health behaviours of their children (Deprato et al., 2025; Dipietro et al., 2019; Dodd et al., 2018; Jones, Moolyk, et al., 2025; Prioreschi et al., 2018; Teulings et al., 2019). Historically, international and national postpartum physical activity (PA) guidelines recommended 150-minutes of MVPA per week (Brown et al., 2022; Bull et al., 2020; Evenson et al., 2024a); however, the postpartum PA guidelines were recently updated (Davenport, Ruchat, et al., 2025), and now recommend a 120-min/week threshold (including exercises such as brisk walking, muscle-strengthening exercises, and exercises that target the lower back). Light-intensity PA after childbirth is encouraged and progression towards MVPA recommendations and beyond should be individualised and based on symptoms, healing, physical and mental health, and readiness to engage in postpartum PA (Davenport, Ruchat, et al., 2025). Unfortunately the onset of parenthood, especially of the birthing parent, is associated with a decline in regular physical activity (PA) behaviour (Abbasi & van den Akker, 2015; Bellows-Riecken & Rhodes, 2008), particularly MVPA (Hesketh et al., 2018).

A sound theoretical understanding of postpartum MVPA behaviour is important for effective promotion (Baranowski et al., 1998). This involves both identifying predictors of MVPA as well as mediating variables that contribute to intervention success. Observational research has largely focused on social cognitive and socio-ecological factors, demonstrating lack of time and childcare responsibilities as the strongest barriers and social support as the strongest predictor to postpartum physical activity (Edie et al., 2021; Evenson et al., 2009). Postpartum MVPA intervention research has mainly been informed by social cognitive (i.e., behaviour resulting from intentions informed by expected outcomes of the behaviour) and action control (i.e., behaviour resulting from planning and self-regulation strategies that translate intentions into behaviours) frameworks, which have demonstrated a moderate effect on increasing postpartum PA overall (inclusive of all intensities) and MVPA frequency; however, their effect on MVPA volume and meeting MVPA guidelines is inconclusive (Gilinsky et al., 2015; Lim et al., 2020; Turner et al., 2023). Whether this effect of interventions on increasing PA is clinically meaningful or consistent across postpartum clinical populations is unknown.

There is a need to explore other key theories that augment the social cognitive approach in relation to postpartum PA. A limitation to the social cognitive approach is that it doesn't account for the commonly observed gap between PA intentions and behaviours (Sheeran & Webb, 2016). An estimated 47.6% of individuals who intend to be physically active, do not follow through with regular behaviour (Feil et al., 2023). It has been suggested that action control (i.e., strategies for translating intentions into behaviours) and non-conscious (i.e., automatic processes such as habits or self-schemas that develop in response to repeated actions and responses to cues over time) processes might help individuals to overcome this gap (Rhodes, La, et al., 2021). In fact, planning, habit, and especially exercise identity have predicted translation of the intention-behaviour gap in postpartum individuals (Rhodes et al., 2021).

In addition, postpartum PA research, particularly studies that were informed by behaviour change theory, often do not make consideration for clinical populations (aside from excluding those with contraindications to PA from participating). Establishing appropriate tailoring recommendations of PA promotion to postpartum individuals with varying clinical conditions is important since a large percentage of postpartum individuals can experience them. For example, up to 67% of postpartum individuals suffer from postpartum lumbopelvic pain (LPP) (Wu et al., 2004), which has been associated with increased levels of disability, fear of movement, disturbed body perception, body mass index (BMI), sleep impairment, weight retention, and a three-fold increase in depressive symptoms (Beales et al., 2016; Gutke et al., 2007, 2011; Mogren, 2006; To & Wong, 2003). Postpartum LPP is described as low back pain and/or pelvic girdle pain that started either during pregnancy or in early postpartum (Vleeming et al., 2008). It often subsides during the first year postpartum; however, nearly 20% of individuals with LPP can still experience pain over a decade later (Bergström et al., 2017; Ostgaard et al., 1997). Pelvic girdle pain disorders are often reported as potentially separate from low back pain disorders, however, they frequently coincide and are functionally interrelated (Beales et al., 2020; Vleeming et al., 2012; Vora et al., 2010). Clinical practice guidelines for postpartum LPP recommend PA that is modified for pain symptoms (Simonds et al., 2022; Vleeming et al., 2008; Weis et al., 2021), yet little is known in regards to theoretical application of cognitive, action control, or non-conscious processes that are important for uptake and maintenance of PA behaviour in this population.

Historically, postpartum PA interventions have been delivered through face-to-face or group setting educational sessions and exercise classes however these can result in low attendance given their substantial time constraints (Fjeldsoe et al., 2010; Østbye et al., 2009; Peralta et al., 2021). Mobile health applications (mHealth apps) are flexible, accessible, and have potential to overcome such time constraints faced by postpartum individuals (Sherifali et al., 2017). Postpartum individuals have expressed a positive response to receiving lifestyle information through digital health interventions, such as mHealth apps, and report a high preference and value for online information sources (Dol et al., 2022; Lim et al., 2019). mHealth apps don’t necessarily need to replace health provider care, but they can assist in educating postpartum individuals on health behaviours for the cases they lack time or resources to seek health provider care. Furthermore, mHealth apps can act as a co-intervention in a healthcare provider's prescribed management plan.

Many postpartum PA mHealth apps exist, however, the majority lack high quality, particularly in engagement and content, they lack evidence-based recommendations, and are often not informed by behaviour change theory (Tinius et al., 2021). Recent intervention studies on postpartum PA mHealth have demonstrated limited efficacy and effectiveness and often low adherence and engagement (Kernot et al., 2019; Napolitano et al., 2021; Teychenne et al., 2021). The mHealth apps in these studies were informed by social cognitive and action control theories but none have integrated reactive regulation processes, such as emotion regulation (i.e., tactics to manage one's own emotions), or reflexive processes (i.e., automatic process that develop as a result of repeated actions over time) which might be more important for sustained behaviour change (Rhodes, La, et al., 2021). Further, although these postpartum PA mHealth interventions have targeted some clinical populations, such as postpartum individuals with a high BMI or at risk for postpartum depression (Nicklas et al., 2020; Teychenne et al., 2021), none have been tailored to postpartum individuals with LPP. mHealth might be particularly beneficial for postpartum individuals with LPP given that self-care, which includes staying active and maintaining normal activities where possible, is an essential component for recovery (Beales et al., 2020; Gutke et al., 2021; Pulsifer et al., 2022; Weis et al., 2021).

Given the complexity of the postpartum experience, it may be beneficial to involve postpartum individuals in the development and design of postpartum PA behaviour change interventions. Co-design is a form of knowledge user engagement that involves active participation with potential users of behaviour change interventions and other related research outputs, with an emphasis on improving applicability and acceptability of the intervention

(Greenhalgh et al., 2019; Sanders & Stappers, 2008). Recent postpartum PA interventions have applied co-design methods (James, 2025; Makama et al., 2024; Racey et al., 2025; Wilkinson et al., 2023); however, these interventions have yet to be evaluated for their effect on changing postpartum PA. Furthermore, no PA interventions have been co-designed in collaboration with postpartum individuals with LPP.

Thus, the **purpose** of this dissertation is to develop an evidence-based, acceptable, usable, feasible, scalable, and low-cost PA promotion mHealth app that is tailored to postpartum individuals with LPP using a behaviour change intervention development framework, behaviour change theory, and co-design methods. The dissertation will be conducted in five chapters with research questions that will be explored using distinct methodologies.

Chapter two comprises a literature review to summarize current evidence on postpartum PA behaviour, postpartum LPP, postpartum PA mHealth, the IDEAS (Integrate, Design, Assess, and Share) framework which is the theoretical framework that will guide the development and design of the mHealth app (Mummah et al., 2016), and co-design methodology in relation to postpartum PA behaviour change. The mHealth app for this dissertation will be a tailored version of a pre-existing PA mHealth app that has already undergone the first seven phases of the IDEAS framework (Hollman, Sui, et al., 2025). This has involved empathizing with target users of inactive adults aged 18-64, specifying target PA behaviour of meeting Canadian Society for Exercise Physiology PA guidelines (Ross et al., 2020), grounding in the multi-process action control (M-PAC) framework (Rhodes, La, et al., 2021), ideating implementation strategies, prototyping potential products with the research team, gathering user feedback, and building a minimum viable product.

Chapter three will build on the second phase of the IDEAS framework, specifying a target behaviour, by conducting a systematic review on postpartum PA intervention mediators. This review will provide a summary of key constructs that need to be targeted by postpartum PA behaviour change interventions for effective PA promotion.

The **research question** that will be addressed in Chapter three:

1. What are the mediators, organized by the theoretical domains framework (TDF) (Cane et al., 2012), of PA behaviour change interventions among postpartum individuals?

Chapter four will build on the second phase of the IDEAS framework by determining theoretical predictors to postpartum PA intention-behaviour translation. It will apply reflective, regulatory, and reflexive constructs of the M-PAC framework, as well as LPP, fear of movement, and perceived change in walking/running gait, which are postpartum-relevant variables (Moore et al., 2021).

Research questions that will be addressed in Chapter four:

1. What is the intention-PA behaviour gap in postpartum individuals?
2. What are the predictors of intention-PA translation among postpartum individuals?
3. Are the intention-PA gap and predictors of its translation moderated by the presence of LPP?

Together the findings from chapters two, three, and four will inform the development and design of the first prototype of the tailored mHealth app. **Chapter five** will build on phase six of the IDEAS framework and involve the co-design of an evidence-based, theory-informed, PA promotion mHealth app to postpartum individuals with LPP. Specifically, this chapter will involve three iterative phases of prototyping a tailored mHealth app based on feedback and contributions from key knowledge users: 1) individuals with lived expertise in postpartum LPP and are not meeting postpartum PA guidelines and 2) healthcare providers with experience in managing postpartum PA. The co-design methods will involve two interviews, two online surveys, and opportunities for participant/partners to contribute to changes to the mHealth app. It will also involve descriptions of iterative modifications made to the mHealth app in response to each phase of knowledge user feedback.

The **research question** that will be addressed in Chapter five:

1. How can co-design methods be used to tailor an evidence-based, theory-informed PA promotion mHealth app to postpartum individuals with LPP?

Chapter 2: Literature Review

2.1 Benefits of Physical Activity

There is irrefutable evidence to support the health benefits of moderate- to vigorous-intensity physical activity (MVPA), making it an essential component for health promotion worldwide (World Health Organization, 2019). Regular MVPA has been associated with the prevention of 35 chronic health conditions (U.S. Department of Health and Human Services, 2018), with the majority of those being non-communicable diseases (i.e., cardiovascular diseases, cancers, respiratory diseases, and diabetes) which are the leading cause of death (World Health Organization, 2013). In fact, a recent meta-analysis found that as little as 5min/day increase in MVPA could prevent up to 6-10% of deaths (Ekelund et al., 2026). MVPA is also highly beneficial for mental health, demonstrating improved symptoms of depression, anxiety, and distress across a wide range of adult populations (Singh et al., 2023).

Promoting PA is also important for the broader economy and climate. In 2013, a global analysis demonstrated that physical inactivity costed healthcare systems $53.8 billion worldwide and that physical inactivity related deaths contribute to $13.7 billion in productivity losses (Ding et al., 2016). Along these lines, a report from the International Sport and Culture Association and Centre for Economics and Business Research concluded that cutting inactivity by a fifth would save Europe 16.1 billion euros in physical inactivity-related costs (International Sport and Culture Association / Centre for Economics and Business Research, 2015). With regards to climate, PA, particularly in the form of active transportation, has been shown to reduce greenhouse gases, while large-scale sporting event logistics (e.g., optimizing food supply chains, improving waste management, and investing in renewable energy projects) can also positively impact climate action (Silva et al., 2024). Altogether it is clear from an individual, community, and global stand point that PA promotion across populations should be prioritized.

2.2 Benefits of Postpartum Physical Activity

In addition to the health benefits of PA known to all adults, PA has also demonstrated specific health benefits for postpartum individuals. To support maternal mental health, there is moderate certainty evidence that postpartum MVPA reduces postpartum depressive symptoms, anxiety symptoms and the odds of postpartum depression by 45% (Deprato et al., 2025). Furthermore, initiating MVPA prior to 12-weeks postpartum is associated with an even greater reduction in depressive symptoms (Deprato et al., 2025). To support maternal physiological and physical health, there is moderate certainty evidence that postpartum MVPA reduces the odds of developing diabetes by 28%, reduces systolic and diastolic blood pressure (Jones, Moolyk, et al., 2025), and it is not associated with increased risk of injury (Jones, Moolyk, et al., 2025). Additionally, postpartum MVPA contributes to reduced weight by 1.34 kg, BMI by .73kg/m,^{2} and fat mass by 1.55kg with low certainty evidence that postpartum MVPA has no effect on lean body mass (Gervais et al., 2025). Of note, weight loss following childbirth is not only important for the health of the birthing parent (Rooney et al., 2005), but is also important to the health of their future pregnancies and developing fetus' (Teulings et al., 2019). Specifically, interpregnancy weight gain has been associated with higher risk of gestational diabetes, pre-eclampsia, pregnancy-induced hypertension, and large-for-gestational age births, while interpregnancy weight loss has been associated with a lower risk of delivering a large-for-gestational age neonate (Teulings et al., 2019). Thus, supporting interpregnancy weight management and health through PA should be encouraged.

PA has also demonstrated associations with well-being outcomes and can influence health behaviour and outcomes of postpartum individuals' children. There is moderate certainty evidence that MVPA improves sleep quality as well as daytime/general fatigue (Jones, Ruchat, et al., 2025) as well as growing evidence that it improves overall well-being (Bahadoran et al., 2014), self-efficacy (Lesser et al., 2023), self-compassion (Lesser et al., 2023), and PA identity (Lesser et al., 2023). In relation to infant health, there have been no adverse outcomes on infant growth and development or breast milk quality or quantity in relation to postpartum MVPA (Jones, Moolyk, et al., 2025). Modeling healthy PA patterns during postpartum is important for the entire family systems given that parental PA is related to child PA (Prioreschi et al., 2018; Rhodes, Guerrero, et al., 2020; Yao & Rhodes, 2015).

There is moderate certainty evidence that muscle-strengthening exercises, particularly those targeting the trunk muscles, are associated with a reduction in lumbopelvic pain (LPP) symptom severity, related disability, and bodily pain (Ruchat et al., 2025). Furthermore, muscle-strengthening exercises that target abdominal musculature have demonstrated reduced inter-rectus distance among postpartum individuals with diastasis rectus abdominus (Beamish et al., 2025). Muscle-strengthening exercises might have particular importance given that postpartum individuals have demonstrated greater fatiguability (i.e., weakness) in their abdominal, low back, and pelvic musculature up to 6-7 months following childbirth (Deering et al., 2019; Deering et al., 2018). Muscle-strengthening exercise might also support other modes of postpartum PA with one study showing that biweekly resistance training during postpartum is associated with improved strength, self-efficacy, and PA outcomes (LeCheminant et al., 2014). Finally, muscle-strengthening exercise when combined with aerobic exercise has demonstrated reduced lumbar spine bone mineral density loss at 20-week and 1-year follow-ups in lactating postpartum individuals (Colleran et al., 2019; Lovelady et al., 2009). As such, including muscle-strengthening activities in postpartum PA promotion is encouraged and a key component of current postpartum PA guidelines (Davenport, Ruchat, et al., 2025).

In order to prevent and manage commonly experienced postpartum pelvic floor dysfunctions, such as urinary incontinence, anal incontinence, pelvic organ prolapse, and sexual dysfunction (e.g., pain with sex), pelvic floor muscle training (PFMT) is often prescribed. The recent postpartum PA guidelines recommend daily PFMT to reduce the risk of urinary incontinence and rehabilitate pelvic floor muscles impacted by pregnancy, labour and/or delivery (Davenport, Ruchat, et al., 2025). Additionally, a recent systematic review and meta-analysis concluded moderate certainty evidence that PFMT during postpartum reduces the odds of urinary incontinence by 37% and pelvic organ prolapse by 56%; however, the effect on risk of anal incontinence and diastasis recti abdominis, as well as severity of anal or urinary incontinence, pelvic organ prolapse, and sexual function are limited (Beamish et al., 2025).

Few negative effects of postpartum PA have been identified, however one study reported a negative association between postpartum PA and body satisfaction (Lesser et al., 2023). Altogether studies looking at the outcomes of postpartum PA have demonstrated irrefutable beneficial effects on postpartum PA on physical and mental health, safety for lactating infants, and even encourages child health behaviours and ultimately child health and, therefore, postpartum PA promotion should be a priority for public health efforts.

2.3 Postpartum Physical Activity Recommendations

To obtain optimal mental and physical health benefits, the World Health Organization recommends for postpartum individuals to perform at least 150-minutes of moderate-intensity PA (MPA) throughout the week, they should incorporate a variety of aerobic and muscle-strengthening activities, and limit their time being sedentary (Bull et al., 2020). Moderate-intensity PA is defined as a 5 or 6 on a perceived exertion scale from 0 to 10 (Bull et al., 2020) and examples can include walking briskly, riding a bike, hiking, dancing, playing volleyball, and raking the yard (National Health Service, 2021; Piercy et al., 2018). Up until recently, most national postpartum PA guidelines echoed these recommendations (Brown et al., 2022; National Health Service, 2021; Piercy et al., 2018; see Table 1), with some countries, such as the UK also recommending that PA be gradually increased following a 6-week postnatal health check from a healthcare provider (National Health Service, 2021).

Table 1

Postpartum Physical Activity Guidelines Preceding 2025

Author & Country	Year	Guideline Recommendations
(Davies et al., 2003) Canada	2003	Postpartum individuals can continue or resume physical activity during postpartum period, with consideration of the mode of delivery. Intensity or duration of physical activity might need to be reduced to compensate for fatigue of delivery and newborn care. Postpartum individuals who underwent caesarean delivery can gradually resume aerobic and strength training exercise with consideration of their comfort levels and other complications such as anemia or wound infection. Return to physical activity can be discussed at the 6-week postpartum evaluation.

		Pelvic floor exercises can be initiated immediately to prevent urinary incontinence. Moderate exercise during lactation doesn't affect the quantity or composition of breast/chest milk or impact infant growth.
American College of Obstetricians and Gynecologists (ACOG) USA (Mota & Bø, 2021)	2021	Exercise routines can be resumed gradually as soon as medically safe, depending on delivery mode and any medical or surgical complications. Pelvic floor exercises can be initiated in the immediate postpartum period. Abdominal strengthening exercises can decrease the incidence of diastasis rectus abdominus and decrease the inter-rectus distance and postpartum individuals of vaginal or cesarean births. Postpartum individuals should engage in both aerobic and strength conditioning exercises. Regular aerobic exercise does not affect milk production, composition, or infant grown. Lactating individuals should consider feeding their infants or pumping prior to exercise to avoid discomfort of breast engorgement. They should also aim to be adequately hydrated prior to physical activity.
(U.S. Department of Health and Human	2018	At least 150-min of moderate-intensity aerobic activity spread throughout the week.

Services, 2018) USA		Individuals who habitually engaged in vigorous-intensity physical activity prior to pregnancy can continue to do so during pregnancy and postpartum. Individuals can consult a health care provider about whether or how to adjust their physical activity after the child is born.
(Bull et al., 2020) World Health Organization	2020	All postpartum individuals without contraindication should: Undertake regular physical activity throughout postpartum. Do at least 150-min of moderate-intensity aerobic physical activity throughout the week. Incorporate a variety of aerobic and muscle-strengthening activities. Add gentle stretching. In addition: Women who, before pregnancy, habitually engaged in vigorous-intensity aerobic activity or who were physically active can continue these activities during pregnancy and postpartum. *Strong recommendation* Limit the amount of time spent being sedentary and replace it with physical activity of any intensity (including light intensity). *Strong recommendation* Gradually increase frequency, intensity and duration over time. Pelvic floor muscle training may be performed on a daily basis to reduce the risk of urinary incontinence.

		Postpartum individuals should return to physical activity gradually after delivery and in consultation with a healthcare provider in the case of delivery by caesarean section. Additional safety considerations are provided for pregnant but not postpartum individuals.
(Lee et al., 2021) Asia-Pacific	2021	Physical activity should be gradually resumed in the postpartum period when it is medically safe depending on the mode of delivery and the presence of any complications. Pelvic floor muscle training can be initiated in the immediate postpartum for individuals with uncomplicated vaginal deliveries and caesarean sections. Low impact exercise should be followed for the first 3-months followed by return to running between 3- and 6-months. Abdominal strengthening exercises may be done to decrease the incidence of diastasis recti abdominus.
(National Health Service, 2021) UK	2021	Postpartum individuals can follow the guidelines for adults (age 18-64): At least 150-min of moderate intensity activity a week or 75 minutes of vigorous intensity activity a week Strengthening activities that work all the major muscle groups (legs, hips, back, abdomen, chest, shoulders and arms) on at least 2 days a week. Spread exercise evenly over 4 to 5 days a week, or every day.

		Reduce time spent sitting or lying down and break up long periods of not moving with some activity. Following childbirth, physical activity choices should reflect activity levels prior to pregnancy and postpartum individuals should perform strength training. More intense physical activity can be done after the 6- to 8- week postnatal check. Vigorous activity is not recommended for individuals who were inactive prior to pregnancy.
(Brown et al., 2022) Australia	2022	Postpartum individuals without contraindications should be encouraged to meet the Australian Physical Activity and Sedentary Behaviour Guidelines for Adults (age 18 to 64) (Brown et al., 2012): 150-300 minutes of moderate intensity physical activity or 75-150 minutes of vigorous intensity physical activity, or an equivalent combination of both moderate and vigorous activities, per week. At least 2 muscle strengthening activities per week. Break up long periods of sitting often. Pelvic floor exercises. Modifications to physical activity/exercise may be required to accommodate the physical changes that occur during pregnancy. Seek advice from a qualified health professional if there are any concerns of warning signs or contraindications.

	Health professionals should be familiar with contraindications, signs and symptoms which suggest that physical activity/exercise during pregnancy should be modified or avoided. Absolute and relative contraindications to physical activity and warning signs to stop physical activity/exercise are provided for pregnant individuals but not for postpartum individuals.

Recently, the 2025 Canadian guidelines for PA, sedentary behaviour and sleep throughout the first year postpartum was published (Davenport, Ruchat, et al., 2025). The guideline was informed by seven systematic reviews that described the effect of PA, sedentary behaviour, and sleep on 'critical' and 'important' outcomes and to determine the balance between the benefits and potential harms of PA (Beamish et al., 2025; Deprato et al., 2025; Gervais et al., 2025; Jones, Moolyk, et al., 2025; Jones, Ruchat, et al., 2025; Khan-Afridi et al., 2025; Ruchat et al., 2025). Additionally, it was informed by feedback from potential end users of the guidelines, including healthcare providers, exercise professionals, researchers, policy organizations, and postpartum women and people. To complement the guidelines, the Guideline Consensus panel also developed the Get Active Questionnaire (GAQ) for Postpartum (Davenport, Christopher, et al., 2025). This questionnaire can be used by postpartum individuals to determine whether they should seek medical guidance before beginning or continuing MVPA in the first year after childbirth. A key feature to the GAQ for postpartum is that it can be self-administered by postpartum individuals, ultimately empowering them to be in control of their own health and well-being (Davenport, Christopher, et al., 2025).

The 2025 Canadian guideline for PA, sedentary behaviour and sleep throughout the first year postpartum includes nine recommendations (Davenport, Ruchat, et al., 2025): 1) all postpartum individuals without contraindications should be physically active to obtain clinically meaningful benefits (e.g., prevent and reduce depressive symptoms); 2) postpartum individuals with potential contraindications to PA (see Table 2) should obtain medical clearance from a primary healthcare provider (e.g., family physician) about beginning or continuing MVPA following childbirth; in most cases, MVPA may proceed, but modifications may be required until the medical problem has resolved; 3) postpartum individuals should accumulate at least 120 minutes of MVPA (e.g., brisk walking, cycling) spread over four or more days of the week that incorporates a variety of aerobic and resistance training activities; 4) postpartum individuals should perform PFMT daily to reduce the risk of urinary incontinence and rehabilitate pelvic floor muscles impacted by pregnancy, labour, and/or deliver; instruction on proper technique from a pelvic floor physiotherapist is recommended to obtain optimal benefits; 5) postpartum individuals should begin or return to MVPA in the first 12 weeks following childbirth to support mental health; 6) postpartum individuals should initiate early mobilization with light-intensity physical activity (e.g., gentle walking, PFMT) and progress to MVPA once surgical incisions or perineal tears have sufficiently healed and vaginal bleeding (lochia) does not increase with MVPA; 7) postpartum individuals should follow an individualized, gradual, and symptom-based progression toward at least 120 minutes/week of MVPA; 8) postpartum individuals should adopt a healthy sleep hygiene routine (e.g., avoid screen time and maintain a dark, quiet environment before bed) to support maternal mental health; and 9) postpartum individuals should limit sedentary time to 8 hours or less, including no more than 3 hours of recreational screen time, and breaking up long periods of sitting when possible.

Table 2

Relative Contraindications to MVPA in the First Year after Childbirth

Severe abdominal pain.
Vaginal bleeding not associated with menses.
Postpartum cardiomyopathy.
Caesarean section with symptoms that worsen with MVPA (eg, surgical incision pain).
High blood pressure (>140/90 mm Hg SBP/DBP) that is not stable.
Eating disorder.

Malnutrition.
Excessive fatigue suggestive of anaemia or low energy availability (eg, relative energy deficiency in sport).
Fractures or other significant musculoskeletal injuries.
Calf pain or swelling suggestive of deep vein thrombosis.
Haemodynamic instability.
Acute systemic infection accompanied by fever, body aches or swollen lymph glands.
Breathing difficulties such as shortness of breath at rest not relieved with medications.
New onset of chest pain, discomfort and other angina-like symptoms with exertion.
Dizziness or light-headedness during MVPA.
Loss of consciousness for any reason.
Neurological symptoms such as ataxia or muscle weakness affecting balance.
Kidney disease.
New symptoms of heart disease or stroke.
Other medical or physical conditions that may affect the ability to be physically active.

Note: DBP = diastolic blood pressure; MVPA = moderate-to-vigorous physical activity; SBP = systolic blood pressure

The guideline noted that there are several outstanding gaps in the literature pertaining to postpartum PA recommendations. First, more research is needed on different modalities and intensities of PA (e.g., group vs. individual-based activity, resistance training, yoga, light-intensity to vigorous-intensity physical activity, occupational vs recreational activity) (Davenport, Ruchat, et al., 2025). There are several modes of PA that are unique to the postpartum period, including baby wearing and pushing a stroller. Both of these activities can alter biomechanics and potentially result in musculoskeletal complaints and, therefore, further research is needed to provide guidance on these unique modes of PA (Havens et al., 2022; O'Sullivan et al., 2016; Sandbakk et al., 2020). Second, research is needed to develop and validate evidence-based individualized progressions for beginning or returning to MVPA. Most postpartum return to MVPA guidelines recommend an "individualized approach" however, more research is needed to determine what an individualized approach might look like (Bouwer & Brandt, 2025). Third, research is needed to inform specific recommendations regarding the type and timing of activities following vaginal versus caesarean delivery and for those who experienced pregnancy complications resulting in an increased risk of cardiometabolic diseases such as gestational diabetes, gestational hypertension, and pre-eclampsia (Davenport, Ruchat, et al., 2025).

An important consideration for postpartum MVPA is return to higher impact exercise, such as running, as it may be problematic for some individuals. Studies have shown that between 35-84% of postpartum individuals who engage in running report musculoskeletal pain, most commonly in the low back, pelvis, and lower limbs and 27-29% reporting stress urinary incontinence (Blyholder et al., 2017; Moore et al., 2021). Guidance for return-to-running postpartum has seen a recent surge in the literature. In 2025, a scoping review of postpartum return-to-running guidance reported that all sources were published in the last decade (2016-2024), highlighting the novelty of this field (Bouwer & Brandt, 2025). A key concern amongst the sources was data recycling whereby only seven peer-reviewed articles provided new data while the remain sources were expert opinions, commentaries, or literature reviews summarizing existing literature or experiences. Importantly, none of the guidelines have been applied in a clinical setting to determine their clinical effectiveness. The majority of articles recommended waiting at least 12-weeks postpartum before returning to running; however, one of the most recent sources (Christopher et al., 2024), a Delphi study of exercise professionals, suggested a person-specific timeline and that a walk/run program could commence as early as 3-weeks postpartum, given that all birth injuries had healed at the time of returning to running. There is consensus amongst the guidelines that returning to running should be individualized, incorporate a whole-systems screening framework and a pelvic floor evaluation, and be initiated with low-impact strengthening exercises and a run/walk progression (Bouwer & Brandt, 2025).

A potential limitation to the 2025 Canadian guideline for PA, sedentary behaviour and sleep throughout the first year postpartum is that the guidelines were largely informed by the health and wellness effects of postpartum PA and did not account for literature on PA promotion (Davenport, Ruchat, et al., 2025). For example, while the guidelines recommend PA and PFMT to reduce the risk and symptomatology of LPP and pelvic floor dysfunction (Beamish et al., 2025; Ruchat et al., 2025), it does not provide recommendations on how PA recommendations may need to be tailored to individuals who are experiencing these common musculoskeletal complaints. This is because at the time of the development of the guidelines, there was insufficient research to determine whether or not PA should be modified for individuals with musculoskeletal conditions (a research gap that this dissertation intends to help fill). Prior research has shown that end-users of adult PA guidelines have expressed desire for more information as to how the guidelines can be tailored to varying abilities (Hollman, Updegraff, et al., 2022). Between 15-30% of postpartum individuals experience urinary incontinence (Milsom et al., 2014), 18-56% experience pelvic organ prolapse (Durnea et al., 2014, 2015), and 0.3-67% experience LPP (Wu et al., 2004). The GAQ for postpartum confirms that these conditions are not relative contraindications to MVPA and that postpartum individuals do not need to seek medical clearance prior to engaging in MVPA (Davenport, Christopher, et al., 2025). However, given the high prevalence of these conditions, it would be helpful if the guidelines also provided some recommendations as to how MVPA recommendations might need to be tailored to these populations to ensure these conditions don't act as barriers to MVPA.

2.4 Postpartum Physical Activity Participation

Although engaging in MVPA during the postpartum period is important for health and social benefits, unfortunately the onset of parenthood, particularly of the birthing parent, has been associated with a significant decline in MVPA compared to pre-conception (Abbasi & van den Akker, 2015; Bellows-Riecken & Rhodes, 2008). A comprehensive review of barriers and facilitators to postpartum PA can be found in section 2.5 of this dissertation, however, in brief, several primary contributors to this drop in PA include a lack of time, childcare responsibilities, and reduced energy/fatigue (Edie et al., 2021). Research to date on postpartum PA surveillance has applied 150min/week MVPA threshold, as up until 2025, this was the recommendation worldwide (Bull et al., 2020). The proportion of postpartum individuals meeting 150-minutes of MVPA per week, based on available research, has ranged from 8% to 78% (44% on average) (Albright et al., 2006; Alsobayel et al., 2020; Baattaiah et al., 2022; Barbacsy-MacDonald, 2012; Durham et al., 2011; Evenson et al., 2012, 2013; Ferrari et al., 2010; Guardino et al., 2018; Hall et al., 2018; Hoedjes et al., 2012; Koh et al., 2010; Lesser et al., 2023; Mielke et al., 2021; Nomura & Araki, 2022a; Pereira et al., 2007; Smith et al., 2005; van der Pligt et al., 2016a), with the majority of studies reporting that most postpartum individuals are not meeting the 150min/week threshold. Of note, due to the recency of the 2025 Canadian guideline for PA, sedentary behaviour and sleep and new 120min MVPA per week threshold (Davenport, Ruchat, et al., 2025), this section on PA participation will reflect the prior recommended MVPA threshold of 150min/week (Bull et al., 2020).

The proportion of postpartum individuals meeting MVPA guidelines is largely variable across studies and across time-points postpartum; furthermore, it may depend on PA measurement. In a large sample of 4,000 postpartum individuals from Brazil, 8% were meeting the threshold at 12-months (Mielke et al., 2021), while in two large samples (n = 1,442 and 1,581) from USA the proportion ranged from 65 to 78% meeting this threshold at 5 to 9 months and 6-months respectively (Guardino et al., 2018; Pereira et al., 2007). However, other samples of postpartum individuals from USA demonstrated lower proportions meeting the 150 min/week threshold at 6-weeks (34%) (Durham et al., 2011) and 3-months postpartum (18%) (Ferrari et al., 2010). The majority of studies measuring postpartum PA participation have applied self-report PA measures; however, two studies used accelerometers, both from the USA, and while they did not report the exact proportion of postpartum individuals meeting MVPA guidelines, both reported that most participants were not meeting them (Evenson et al., 2012, 2013).

Some studies have shown a modest increase in MVPA over time during postpartum (Evenson et al., 2012, 2013; Hall et al., 2018). For example, in a sample of 286 postpartum individuals from USA, 40% were meeting the 150min/week threshold at 4-6 weeks postpartum, 53% at 4-months, and 56% at 7 months (Hall et al., 2018). In two other studies that demonstrated a significant increase over time, absolute values of MVPA remained low with the majority of individuals not meeting the 150min/week threshold at both 2-7 months and 12-17 months (Evenson et al., 2013) and similarly at both 3-months and 12-months (Evenson et al., 2012). Other studies have not demonstrated a change in PA between 3-months and 12-months

(Borodulin et al., 2009; Hoedjes et al., 2012). Therefore, PA promotion efforts are likely needed through all phases of the postpartum journey.

To date, there have been few studies that specifically measured the proportion of Canadian postpartum individuals meeting MVPA guidelines. One thesis of 73 postpartum individuals found that 52% were moderately active (Barbacsy-MacDonald, 2011). A study of 4,231 Canadian females found that women with children were significantly less likely to meet PA guidelines compared to those without (Carson et al., 2018). Additionally, there was a larger odds ratio of not being physically active for women with two or more children in the household and with children ages 5 and under. The recent Canadian Health Measure Survey, 2022 to 2024 reported 39.2% of females were meeting MVPA guidelines, however they did not measure parent status as a covariate (Statistics Canada, 2025).

Less is known about muscle-strengthening exercise and PFMT behaviours among postpartum individuals. There is evidence of prior studies removing weight and strength training items from PA questionnaires as they were thought to be inappropriate for pregnant and postpartum individuals at the time (Pereira et al., 2007). One longitudinal study found that PFMT compliance for postpartum individuals with stress urinary incontinence was moderate but had a decreasing trend over time (Wang et al., 2024).

2.5 Understanding the Antecedents of Postpartum Physical Activity: Application of Behaviour Change Theory

In order to better understand postpartum PA behaviour, a sound theoretical examination of PA determinants and target variables should be considered (Baranowski et al., 1998). Applying behaviour change theory to postpartum PA helps to explain why, when, and how the behaviour occurs and ways in which it can be altered with the ultimate goal of improving health

(Michie et al., 2018). Postpartum PA guidelines recommend PA, muscle-strengthening exercises, and PFMT and, therefore, a holistic understanding of postpartum PA would need to consider behaviour change strategies for all of these modes of exercise. This section will focus largely on behaviour change theory for PA, specifically intentional PA, since theoretical understanding of muscle-strengthening exercise and PFMT behaviour among adults in general is still preliminary (Ma et al., 2022).

There are six key PA theoretical frameworks that assist in describing PA behaviour and can be used to inform intervention effectiveness: social cognitive, humanism, dual process, socioecological, action control, and combined (Rhodes et al., 2019). The remaining section of 2.5 will describe postpartum PA literature in relation to each theoretical framework.

2.5.1 Social Cognitive Framework

The dominant PA theoretical framework is the social cognitive framework which puts PA as a result of an individual's valued outcomes and expectancies (Rhodes et al., 2019). This can include both the expected results of a behaviour, for example the benefits or barriers of PA, as well as the individual's capability to perform PA, also known as self-efficacy. Self-efficacy can be influenced by personal or observed accomplishments and social encouragement. Examples of theories underlying the social cognitive framework include the theory of planned behaviour (Ajzen, 1991), protection motivation theory (Rogers & Prentice-Dunn, 1997), transtheoretical model (i.e., stages of change; Prochaska & DiClemente, 1982), and the social cognitive theory (Bandura, 1997).

Many observational studies have looked at social cognitive predictors of postpartum PA. The two most commonly reported barriers to postpartum PA are lack of time and childcare responsibilities (Alsobayel et al., 2020; Bauer et al., 2014; Burton et al., 2019; Cramp & Bray, 2011; Doran & Davis, 2011; Evenson et al., 2009; Pereira et al., 2007; Smith et al., 2005). Under the social cognitive framework, an individual with high barrier self-efficacy would be more likely to overcome such barriers to be active. The majority of studies have demonstrated barrier self-efficacy (Bauer et al., 2014; Cramp & Bray, 2011) and exercise self-efficacy as enablers to postpartum PA (Cramp & Bray, 2011; Hinton & Olson, 2001b; Koh et al., 2010; Lesser et al., 2023; Roozbahani et al., 2014; Smith et al., 2005). However, in one study, exercise self-efficacy was associated with lower PA (Vladutiu et al., 2015) and this may have been suggestive of reverse causality such that very active birth parents did not think they could participate in more PA beyond what they were already doing. Several outcome expectations that have predicted postpartum PA have been to feel better (Albright et al., 2006; Alsobayel et al., 2020; Doran & Davis, 2011; Evenson et al., 2009; Groth & David, 2008), to lose weight or look better (Alsobayel et al., 2020; Doran & Davis, 2011; Groth & David, 2008), to maintain fitness (Alsobayel et al., 2020), and to be a role model (Albright et al., 2006).

One of the most commonly reported enablers to postpartum PA in observational research is social support (Bennetter et al., 2023; Burton et al., 2019; Doran & Davis, 2011; Evenson et al., 2009; Groth & David, 2008; Koh et al., 2010; Smith et al., 2005) from either a family member or friends. One study found that overall family support and specific forms of support from family were associated with MVPA but not support from friends (Bennetter et al., 2023). Examples might be verbal encouragement, assistance with childcare, help with household chores, and having someone to exercise with (Smith et al., 2005). Health provider advice has also predicted higher levels of postpartum PA (Ferrari et al., 2010; Vladutiu et al., 2015).

There is some evidence that not enjoying PA might prevent postpartum individuals from being physically active (Doran & Davis, 2011; Smith et al., 2005) although there is also evidence that affective attitude doesn't predict postpartum PA (Pereira et al., 2007). Affective attitude might be more important for developing PA intentions rather than translating them into behaviours (Rhodes, Beauchamp, et al., 2021). One study that applied the transtheoretical model to postpartum PA reported stage of change, self-efficacy, processes of change, pros and cons (in relation to decisional balance), and past PA behaviours were all associated with postpartum MVPA (Roozbahani et al., 2014).

Similar to observational research, postpartum PA interventions have largely been informed by the social cognitive domain (Bashirian et al., 2020; Fjeldsoe et al., 2010; Gilinsky, 2014; Highton et al., 2026; Keller et al., 2014; Kernot et al., 2019; Khunti et al., 2023; Norman et al., 2010; Østbye et al., 2009). Intervention content has mainly been delivered via education either in-person or via pamphlet, text-message, or web page, either on an individual basis or group setting. Education targeted the benefits of postpartum PA, instruction on postpartum PA, local PA opportunities, social support, and goal-setting. Interventions have applied social cognitive theory, theory of planned behaviour, transtheoretical model, protection motivation theory, and the BASNEF (beliefs, attitudes, subjective norms, and enabling factors) model. Intervention effectiveness in the social cognitive domain has been mixed with some reporting significantly greater improved PA intensity (Bashirian et al., 2020), frequency (Fjeldsoe et al., 2010), and duration (Keller et al., 2014), while others reporting a null effect (Gilinsky, 2014; Highton et al., 2026; Kernot et al., 2019; Khunti et al., 2023; Norman et al., 2010; Østbye et al., 2009).

Although social support is a key predictor for postpartum PA (Edie et al., 2021), postpartum PA interventions that promote social support via group exercise have not consistently demonstrated success (Peralta et al., 2021). Between 23-52% of postpartum individuals report receiving advice on PA during the postpartum period from a healthcare provider (Doran & Davis, 2011; Evenson et al., 2009; Ferrari et al., 2010; van der Pligt et al., 2016b), yet the advice received is often arbitrary, insufficient, and inconsistent (Evenson et al., 2009; Murray-Davis et al., 2019; Tinius et al., 2021). In one study, a group PA program was delivered by a physiotherapist, however it did not result in significantly improved PA (Norman et al., 2010).

Several postpartum PA intervention studies have performed mediation analyses applying the social cognitive framework. In one study social support mediated the increase in MVPA following an intervention (Albright et al., 2019) however in another study, there was no evidence of mediation by the social cognitive outcomes (Fjeldsoe et al., 2013). To summarize, the social cognitive framework has dominated the postpartum PA literature and while it has been very helpful in identifying predictors of PA, experimental research has not consistently demonstrated causality of these predictors.

2.5.2 Humanistic Framework

The humanistic framework puts PA as a result of an individual's innate drive for growth, development, and realization of their potential. A major humanistic theory is the self-determination theory (Deci & Ryan, 2004, 2013) which is comprised of five mini-theories: causality orientations theory, goal contents theory, cognitive evaluation theory, basic psychological needs theory, and organismic integration theory. Together, these mini-theories inform an individual's motivation for PA through 1) individual tendencies towards motivation (causality orientations theory), 2) types of goals that individuals are driven towards (goal contents theory), 3) environmental conditions (cognitive evaluation theory), 4) psychological needs in relation to motivation (basic psychological needs), and 5) innate tendencies to participate in interesting activities and to refine their inner self (organismic integration theory). Basic psychological needs theory and organismic integration theory are most commonly applied to PA behaviour (Teixeira et al., 2012).

Little observational research has explored the humanistic framework with regards to postpartum physical activity. Motivation has predicted PA (Groth & David, 2008) while lack of motivation has been considered a barrier (Bauer et al., 2014). One study demonstrated that postpartum individuals who were classified as active (meeting ≥150min MVPA per week) reported significantly higher basic psychological needs for exercise and self-compassion (Lesser et al., 2023). Few postpartum PA interventions have been informed solely by the humanistic framework. One study reported a remote, group-based 8-week PA intervention that was grounded in self-determination and social cognitive theories was effective for improving postpartum MVPA, as well as self-efficacy for exercise and sense of coherence (Nomura et al., 2026). A second study reported a remote 6-month intervention that was also grounded in self-determination and social cognitive theories, however it did not find significant changes in MVPA from 36-weeks gestation to 12-weeks postpartum (Lewis et al., 2024). A third study compared a specific exercise program (i.e., couch to 5km run program) to a general exercise program and although it was hypothesized that the specific program would increase self-efficacy for PA (i.e., a social cognitive informed intervention), the general exercise program actually resulted in a greater increase in PA (Mailey & Hsu, 2019). This finding provided evidence that perhaps the general exercise program enabled participants to choose activities that they enjoyed more and therefore practiced more as a result of intrinsic motivation (Deci & Ryan, 2013).

2.5.3 Dual Process Framework

The dual process framework puts PA as a result of both conscious or reflective processes as well as non-conscious or automatic processes. The reflective processes include social cognitive variables such as intentions, values, and expectations, while the non-conscious processes include habits, automatic evaluations, automatic self-schemas, and automatic motivation (Rebar, 2017). The dual process framework also integrates hedonic motivational premises such that feelings people have during PA, for example hedonic or affectively charged motivation or frustration, can impact their future physical activity behaviour (Brand & Ekkekakis, 2018; Rhodes & Kates, 2015).

One cross-sectional study found that postpartum individuals classified as active (meeting ≥150min weekly MVPA) reported significantly higher PA identity (Lesser et al., 2023). Furthermore, identity and habit (both of which are reflexive constructs) have been shown to translate PA intentions into behaviour among postpartum individuals in an intervention study (Rhodes, Beauchamp, et al., 2021). Similar to the humanistic framework, few postpartum PA interventions have applied the dual process framework.

2.5.4 Socioecological Framework

The socioecological framework puts PA as a result of combined individual and social environment factors (McLeroy et al., 1988). Individual factors include intrapersonal characteristics such as age, sex, and cognitive processes as well as interpersonal factors such as formal or informal support systems through family, friends, and work. Social environment factors include institutional or organizational characteristics, community factors (e.g., built environment), and public policy. The application of the socioecological framework to PA generally focuses more on environmental factors since personal and social factors already receive attention from social cognitive and humanistic approaches (Rhodes et al., 2019).

Many articles have looked at sociodemographic factors in predicting postpartum PA. A few studies have demonstrated younger age of the birthing parent in predicting PA (Guardino et al., 2018; Smith et al., 2005) while others have shown no relationship (Albright et al., 2006; Alsobayel et al., 2020). Similarly, the relationship of race and ethnicity is inconsistent with white race or western ethnicity (North America or Western Europe) predicting more postpartum PA in some studies (Durham et al., 2011; Guardino et al., 2018; Hall et al., 2018; Richardsen et al., 2016) and not in others (Albright et al., 2006). In only one study, being a single parent was a barrier to postpartum PA (Vladutiu et al., 2014). More education is usually associated with PA (Hall et al., 2018; Mielke et al., 2021; Vernon et al., 2010; Vladutiu et al., 2014), however, in one study, it was not (Koh et al., 2010). Income and number of children do not consistently predict postpartum PA (Alsobayel et al., 2020; Guardino et al., 2018; Tornquist et al., 2023; Vladutiu et al., 2014). One study reported that plans to return to work at 6-months postpartum was associated with reduced MVPA (Durham et al., 2011).

There is more evidence for interpersonal factors such as social support, as previously mentioned under the social cognitive framework, for predicting postpartum PA (Burton et al., 2019; Doran & Davis, 2011; Evenson et al., 2009; Groth & David, 2008; Koh et al., 2010; Smith et al., 2005). Bad weather appears to be a barrier to postpartum PA (Cramp & Bray, 2011; Groth & David, 2008) while amenable weather enables PA (Albright et al., 2006; Vladutiu et al., 2014). As for the built environment, there is some evidence that neighbourhood walkability and access to recreational areas can facilitate postpartum PA (Doran & Davis, 2011; Porter et al., 2019; Richardsen et al., 2016) while a lack of built environment and living father away from recreational areas can act as barriers (Porter et al., 2019; Smith et al., 2005).

Social- and individual-level PA interventions technically fall under the umbrella of the socioecological framework and these interventions are reviewed under the social cognitive, humanistic, dual-process, and action-control sections. The main environmental feature to postpartum PA interventions that has been explored is access to childcare. Several interventions have included childcare and these interventions have been successful in resulting increased PA (Cramp & Brawley, 2006; Fjeldsoe et al., 2010; Keller et al., 2014). However, even with provided childcare, participants have reported a challenge in attending face-to-face intervention components (Fjeldsoe et al., 2010). In a pilot study where postpartum individuals were provided with home exercise equipment (i.e., treadmill or stationary bike based on personal preference), there was increased short-term (but not long-term) self-report PA, however accelerometry demonstrated a greater increase in PA in the control group (Teychenne et al., 2021).

2.5.6 Action Control Framework

Action control frameworks include processes that target translation PA intentions into behaviours (Kuhl, 1984). They go beyond the social cognitive construct of goal-setting and also include self-monitoring of behaviour, receiving feedback, and reviewing relevant goals in light of feedback to reinforce behavioural regulation (Carver & Scheier, 1998). Postpartum individuals have expressed that scheduling would be important for enhancing PA (Groth & David, 2008) and planning has in fact predicted the intention-behaviour gap in a cohort of postpartum individuals in an intervention study (Rhodes, Beauchamp, et al., 2021)

Several postpartum PA interventions have integrated action control processes (Badon et al., 2025; Bijlholt et al., 2021; Cramp & Brawley, 2006; Mailey & Hsu, 2019; Maturi et al., 2011; Rhodes, Blanchard, et al., 2021; Tinius et al., 2022) with some reporting significantly improved PA postpartum (Cramp & Bray, 2011; Mailey & Hsu, 2019; Maturi et al., 2011) and others not (Badon et al., 2025; Bijlholt et al., 2021; Rhodes, Blanchard, et al., 2021; Tinius et al., 2022). Interestingly, a systematic review of PA interventions among postpartum individuals found that more efficacious interventions included "goal-setting behaviour" and "prompt self-monitoring behaviour" behaviour change techniques while non-efficacious interventions included "provide information on consequences of the behaviour in general", "provide information on where and when to perform the behaviour", "provide information on where and when to perform the behaviour", "provide instruction on how to perform the behaviour", and "barrier identification/problem-solving" behaviour change techniques (Gilinsky et al., 2015). Although "barrier identification/problem-solving" may be tempting to address among postpartum individuals, given they have well known significant barriers, this might actually result in reduced self-efficacy for PA change (Gilinsky et al., 2015).

In the general adult population, meta-analyses have shown greater support for clusters of regulation strategies explaining behaviour change over individual strategies (Greaves et al., 2011; Michie et al., 2009; Rhodes, La, et al., 2021), however, a meta-analysis of postpartum PA behaviour change interventions found that neither an individual nor combination of behavioural regulation strategies was associated with postpartum PA change (Lim et al., 2020).

2.5.7 Combined Frameworks

Recent behavioural change theorists have recommended for theoretical frameworks to be integrated to account for the complexity and fluidity of human behaviours. For example, the multi-process action control (M-PAC) framework integrates social cognitive, humanistic, and socioecological constructs into a reflective base layer, with action control constructs in a middle regulatory layer, and unconscious constructs from the dual-process framework into an upper reflexive layer (Rhodes, 2021). Altogether, the M-PAC framework suggests that reflective processes mainly inform PA intentions while regulatory processes help to translate initial intentions into behaviours and then reflexive processes are in place to achieve maintenance of behaviour (Rhodes & Sui, 2021). When reflective, regulatory, and reflexive constructs were measured among postpartum individuals taking part in one of two PA interventions (i.e., 1) intervention informed by theory of planned behaviour or 2) the same intervention with the addition of self-regulatory approaches), only planning (regulatory), habit (reflexive), and identity (reflexive) were significant in predicting the translation from MVPA intentions to behaviour (Rhodes, Beauchamp, et al., 2021).

Another combined framework is the "Capability, Opportunity, Motivation and Behaviour" (COM-B) model which proposes that PA is a result of an individual's combined capability, including both psychological and physical components; motivation, including both conscious decision-making as well as underlying brain processes that direct behaviour; and opportunity, which involves all factors outside of the individual that make physical activity possible (Michie et al., 2011). One study applying the COM-B model found that postpartum individuals were more active if they had more time, felt less tired, had access to childcare, were part of a group, and were able to develop a habit (Ellis et al., 2019). Processes that were not important for PA were understanding why it's important, having the right clothes, feeling physically stronger, learning strategies, and knowing what to do (Ellis et al., 2019).

Research reporting the effectiveness of postpartum PA interventions informed by combined frameworks such as the M-PAC framework or the COM-B model are not yet available.

2.5.8 Antecedents of Muscle-Strengthening Exercise and Pelvic Floor Muscle Training

As mentioned previously, theoretical understanding of muscle-strengthening exercise in postpartum individuals is largely unknown. Emerging evidence of action control for muscle-strengthening exercise among adults in general has demonstrated that reflective, regulatory, and reflexive processes are all important predictors with perceived capability being particularly important for females (Rhodes & Lithopoulos, 2022). There is moderate evidence for social support, goal setting, instruction of behaviour, demonstration of behaviour, and practice rehearsal as effective for enhancing prescribed exercise in individuals with persistent musculoskeletal pain (Meade et al., 2019). Support for behaviour change theories predicting PFMT among postpartum individuals is limited, however, prompting practice seems to have a small effect among women of any age (Taut et al., 2016). Further observational and experimental research is needed to determine whether a combination of reflective, regulatory, and reflexive processes can predict MVPA, muscle-strengthening exercises, and/or PFMT in postpartum individuals and consideration of both clinical and non-clinical populations should be made.

2.5.9 Additional Considerations for Promoting Postpartum Physical Activity

Promoting postpartum PA is unique in that it must make consideration for the substantial physical, emotional, and social changes that the individual has undergone as a result of pregnancy and childbirth (Bø et al., 2017; Donnelly et al., 2022). As such behaviour change theories and frameworks described above may need to be expanded to account for this complex experience. A similar expanded framework that accounts for the links between clinical variables and PA has been proposed for individuals with cancer (Courneya, 2014). It has been recommended that return-to-exercise postpartum should follow a whole-systems biopsychosocial approach (Donnelly et al., 2022). The biopsychosocial model was originally conceptualized by a British psychiatrist, Dr. George L. Engel, proposing that human health is a result of interacting biological, psychological, social, and cultural factors (Engel, 1977). For the case of postpartum individuals, a biopsychosocial approach might make consideration of socioecological factors such age, socioeconomic status, parity, time since childbirth, and delivery mode; physical factors such as perineal tearing, symptoms of pelvic floor dysfunction (i.e., urinary incontinence, vaginal heaviness), musculoskeletal pain, abdominal muscle separation, physical deconditioning, changes to body mass, sleeping patterns, nursing, relative energy deficiency in sport, postpartum fatigue and thyroid autoimmunity; and psychological factors such as fear of movement and psychological well-being (Donnelly et al., 2022; Moore et al., 2021).

Many socioecological factors (e.g., age, race, education, income, social support) in relation to postpartum PA have been summarized earlier in section 2.5. As for physical contributors, Nomura et al. (2022) reported physical function, bodily pain, and role limitations due to physical health were associated with reduced postpartum PA; however, Moore et al. (2021) found that bodily pain was not associated with the likelihood of returning to running postpartum. The presence of urinary incontinence alone does not seem to be associated with PA, however, among postpartum people with urinary incontinence, greater symptom severity was associated with reduced PA and mixed urinary incontinence type was associated with reduced PA and muscle strengthening exercises (VanWiel et al., 2025). Moore et al. (2021) reported that not suffering vaginal heaviness, another symptom of pelvic flood dysfunction, increased the odds of returning to running postpartum. The association between LPP and postpartum PA will be explored in section 2.6 of this dissertation.

Considering additional psychological contributors, some studies have shown an association between depressive symptoms and lower postpartum PA (Lesser et al., 2023; Vernon et al., 2010) while others have not (Cramp & Bray, 2011; Nomura & Araki, 2022; Pereira et al., 2007; Vladutiu et al., 2015). Similarly, some studies have shown an association between anxiety and lower postpartum PA (Lesser et al., 2023; Nomura & Araki, 2022) while others have not (Vladutiu et al., 2015). Most studies have demonstrated an inverse relationship between fatigue/tiredness and PA (Almasaudi et al., 2024; Baattaiah et al., 2022; Lesser et al., 2023). One study reported lower fear of movement increased the odds of returning to running postpartum (Moore et al., 2021).

It is important to note that, in addition to having a direct impact on PA, sociodemographic factors or clinical conditions may also have an impact on the antecedents to postpartum PA (Courneya, 2014). The studies explored in section 2.5 are largely based on non-clinical populations and, given that a large percentage of postpartum individuals also suffer from certain clinical conditions, for example LPP (25%; Wu et al., 2004), more research is needed to determine whether antecedents to PA are unique among postpartum individuals experiencing these conditions. This information will be helpful in determining whether postpartum PA recommendations should be tailored to individuals who are experiencing clinical conditions. Identifying whether antecedents of PA are unique to postpartum individuals with LPP is a key research gap that this dissertation aims to fill.

2.5.10 Summary of Antecedents of Postpartum Physical Activity

To summarize, most postpartum PA observational and intervention research has been dominated by social cognitive frameworks. While constructs from the social cognitive domain have demonstrated associations with postpartum PA, interventions informed by social cognitive frameworks do not consistently demonstrate improvements in postpartum PA (Gilinsky et al., 2015). More research is needed to access determinants of postpartum PA informed by humanistic and dual process frameworks as well as combined frameworks that incorporate constructs from social cognitive, humanistic, socio-ecological, and dual process domains. Given the complexity of the postpartum experience in relation to available time, childcare, fatigue, recovery from pregnancy and childbirth and high rate of musculoskeletal impairments (e.g., LPP), traditional PA behaviour change theories and frameworks may need to be expanded and incorporate postpartum-relevant variables.

2.6 Postpartum Lumbopelvic Pain

A substantial limitation to postpartum PA research is that it has largely been conducted on non-clinical populations. A theoretical understanding of predictors and target variables among clinical postpartum populations is important, given the high prevalence of clinical conditions during this period. For example, between 0.3-67% of postpartum individuals report suffering from postpartum LPP, defined as pain in the low back and or pelvis (i.e., pelvic girdle pain) that developed initially either during pregnancy or postpartum (Gutke et al., 2011; Wu et al., 2004).

Postpartum LPP can present in the form of low back pain, pelvic girdle pain, or a combination of the two. Postpartum low back pain presents as pain between the 12th rib and the gluteal folds that can include painful and/or limited range of motion and pain with palpation of the lumbar spine musculature (Vleeming et al., 2008; Weis et al., 2021). The pain location can be confirmed by asking the individual to point to or draw their pain area on a diagram (Vleeming et al., 2008). Risk factors for postpartum low back pain include a history of low back pain prior to or during pregnancy, earlier onset and worse pain symptoms in a preceding pregnancy, and higher postpartum weight gain and weight retention (Weis et al., 2021).

Postpartum pelvic girdle pain presents as pain between the posterior iliac crests and gluteal folds, primarily near the sacroiliac joints, or surrounding the pubic symphysis. Postpartum pelvic girdle pain can radiate into the posterior thigh and is diagnosed upon exclusion of causes of pain related to the lumbar spine (Vleeming et al., 2008). Postpartum pelvic girdle pain encompasses pelvic musculoskeletal pain and excludes gynaecological and/or urological disorders. Risk factors can include higher pain during pregnancy, combined pain with low back pain during early pregnancy, pain with active straight leg raise (an objective orthopaedic test), low back pain prior to pregnancy, age ≥29 years, low endurance of back flexors, lower socioeconomic status, type of delivery (i.e., traumatic or forceps delivery), epidural or spinal injection, work dissatisfaction, and pelvic floor weakness (Weis et al., 2021).

Simonds et al. (2022) stated strong evidence was only available for a history of low back pain or pelvic girdle pain prior to or during pregnancy as a risk factor for postpartum pelvic girdle pain. Moderate evidence was available for pain located in the posterior pelvis, pain with rolling in bed and weight-bearing, multiparity, caesarean delivery, depressive symptoms, higher BMI prior to pregnancy, work factors, and nursing position (Simonds et al., 2022). Weak evidence was available for maternal age, maternal height, fetal weight, epidural, and duration of the second stage of labor for predicting postpartum pelvic girdle pain (Simonds et al., 2022).

Postpartum individuals can experience low back pain along with pelvic girdle pain however low back pain is generally more common postpartum (Sperstad et al., 2016; Weis et al., 2021). Although postpartum LPP often resolves within the first year postpartum, nearly 20% can experience pain up to 12-years postpartum (Bergström et al., 2017; Ostgaard et al., 1997).

Individuals with combined low back pain and pelvic girdle pain during pregnancy tend to have a longer recovery during the postpartum period (Weis et al., 2021). Risk factors for combined low back pain and pelvic girdle pain during postpartum include combined low back pain and pelvic girdle pain at 3-months postpartum or in early pregnancy, work dissatisfaction, age ≥29 years, low endurance of back flexors, type of delivery (i.e., traumatic or forceps delivery), and epidural or spinal injection (Weis et al., 2021).

2.6.1 Postpartum Lumbopelvic Pain and Physical Activity

Observational research has demonstrated an equally low rate of PA among postpartum individuals with LPP compared to those without and theoretically informed predictors have rarely been examined (Bergström et al., 2017; Gutke et al., 2011; Mogren, 2006; Mukkannavar et al., 2014; Robinson et al., 2024). Two cross-sectional studies compared postpartum individuals with LPP (either in the form of low back pain, pelvic girdle pain, or both) to those without pain and found no significant differences in PA between the groups (Gutke et al., 2011; Mukkannavar et al., 2014). Gutke et al. (2011) found no differences in PA among 3-month postpartum individuals between those with LPP and those without. They used a PA scale from 1 to 6, where 1-3 = managing all household gardening and light PA, and 4-6 = level 1 to 3 plus exercises at increasing intensity. In this study, the 3-month postpartum participants were asked to rate their PA over the last 6-months and only 20% reported a PA score between 4 and 6 while 80% reported a PA score between 1 and 3 (Gutke et al., 2011). In another cross-sectional study, there were no significant differences in PA of individuals 3- to 18-weeks postpartum between those with pelvic girdle pain and those without (Mukkannavar et al., 2014). Their PA was measured on a workload scale that combined ambulation activities, such as various intensities of walking, with various weights of lifting. In this study, 71.5% reported moderate workload, 15.1% reported heavy workload, and 13.4% reported very heavy workload. Workloads were defined as moderate = activities requiring standing or slow walking without sweating, heavy = activities requiring continuous walking and carrying loads (2-5kg), causing light sweating, and very heavy: activities requiring brisk walking and carrying heavy loads (>5kg) causing heavy sweating (Mukkannavar et al., 2014).

Two cross-sectional studies measured PA in 6-month and 14-month postpartum individuals that had a history of LPP in pregnancy (Bergström et al., 2014; Mogren, 2008). There were no significant differences in PA measured between the postpartum individuals who continued to experience pain and those who didn't at 6-months or 14-months. That said, only 45% with persistent LPP and 61% without pain reported current PA at 6-months and 14-months postpartum. Although there was no significant delay in resumption of PA following childbirth in participants with LPP, the mean starting time for resuming activity for all participants was 2.6-months postpartum (Mogren, 2008). In these two studies, PA was measured using a yes or no question as to whether participants exercise or do sports on a regular basis. They did not separate between measures of intensities of exercise. To summarize, although these studies did not find a difference in change in PA during the postpartum period between postpartum individuals with and without LPP, they found that regardless of pain status, PA participation is low.

Two longitudinal studies measured PA and sedentary behaviour in postpartum individuals with LPP. In a cohort of 3- to 12-month postpartum individuals with LPP, there were no significant differences in PA of any intensity between baseline, 3-month follow-up, or 6-month follow-up (Girard et al., 2020). In this study a Fitbit was used to track PA and the combined fairly and very active minutes per week were 107±88 at baseline, 113±107 at 3-months, and 104±87 at 6-months, which are all below the most recent postpartum PA guidelines of 120-min MVPA per week (Davenport, Ruchat, et al., 2025). In this study, PA was also measured as a dependent variable where greater levels of PA predicted lower levels of pain disability, as measured with the Oswestry Disability Index (Fairbank et al., 1980), at both 3-month and 6-month follow-ups; however, PA did not predict pelvic girdle pain disability nor lumbopelvic pain intensity or frequency. In the second study, postpartum individuals with LPP at 4-months were followed up at 10-months to measure persistence of LPP symptoms and whether PA or sedentary behaviour at 4-months predicted LPP symptom persistence (Aota et al., 2021). They found no significant differences of any intensity of PA (as practiced at 4-months) between postpartum individuals who continued to have LPP at 10-months compared to those who didn't (Aota et al., 2021). However, there was a significant difference in sedentary time whereby in first time birth parents, but not multiparous birth parents, being less sedentary at 4-months was a predictor of no pain at 10-months (Aota et al., 2021). In this study, sedentary time and physical activity were measured using the International Physical Activity Questionnaire short form (Craig et al., 2003; Rosenberg et al., 2008). To summarize, these studies demonstrated, again, that postpartum individuals both with and without LPP are not obtaining adequate PA and also that postpartum PA does not seem to predict persistent postpartum LPP. Upon reviewing this literature, it is important to note that few observational studies among postpartum individuals with LPP measured PA using validated or device-measured outcome measures to determine relationships between postpartum LPP and PA (particularly MVPA).

In summary, postpartum LPP is prevalent in the postpartum period and the majority of studies have shown that postpartum individuals with LPP are largely inactive. There are no PA participation studies that have looked at PA antecedents of postpartum individuals with LPP, indicating a research gap in this area. Furthermore, there are no studies that can confirm the relationship between postpartum LPP and MVPA due to a reliance on invalidated self-report PA outcome measures. In order to increase inclusivity and reach of postpartum PA promotion, more research is needed, using validated and device-measured PA outcome measures, to determine predictors of PA among postpartum individuals with LPP.

2.6.2 Postpartum Lumbopelvic Pain Exercise Intervention

Historically, exercise interventions for postpartum LPP have focused on muscle-strengthening exercises that target abdominal, back, gluteal, hip, and pelvic floor musculature. Several systematic reviews have concluded a significant effect of stabilizing exercises on pain and function in postpartum LPP (Moheboleslam et al., 2022; Özyurt et al., 2025; Ruchat et al., 2025; Tseng et al., 2015), while others have reported only low evidence to support stabilizing exercises or PFMT for the treatment of pelvic girdle pain (Almousa et al., 2018; Gutke et al., 2015; Vesentini et al., 2020; Weis et al., 2020). Exercise interventions for postpartum LPP have been initiated as early as the first week postpartum (Sakamoto et al., 2018), but more frequently begin at 6-, 8-, or 12-weeks (Bastiaenen et al., 2006; Gutke et al., 2010; Teymuri et al., 2018) and intervention duration ranges from two to 20 weeks (Ruchat et al., 2025; Simonds et al., 2022).

Resistance exercises were initially tested in interventions for LPP with the aim to improve core and/or lumbopelvic stability (Vleeming et al., 2008), however current literature does not support instability as a cause for postpartum LPP (Beales et al., 2019; Palsson et al., 2019; Simonds et al., 2022). Postpartum exercise intervention research has also demonstrated that improved muscular strength is not associated with changes in pain and/or disability outcomes in LPP following resistance exercise interventions (Ehsani et al., 2020; Gutke et al., 2010; Unsgaard-Tøndel et al., 2016). Additionally, there is no evidence to support greater levels of relaxin, the hormone produced during pregnancy to prepare the body for childbirth by relaxing ligaments of the pelvis and softening the cervix, in predicting LPP pain during pregnancy (Aldabe et al., 2012). As such mediators of the effects of exercise interventions for postpartum LPP may not be limited to the biomechanical domain.

Recently, management of postpartum LPP has shifted to a more biopsychosocial approach that integrates biological, psychological, and social factors (Beales et al., 2020; Gutke et al., 2021; Pulsifer et al., 2022). The most recent clinical practice guideline for pelvic girdle pain suggested that psychological measures of fear-avoidance and mental health be included in future research examining prognosis of postpartum LPP (Ruchat et al., 2025; Simonds et al., 2022). Research has shown that kinesiophobia, disturbed body perception, and sleep quality are associated with higher levels of disability in postpartum LPP (Beales et al., 2016; Gutke et al., 2011). Additionally, pregnant individuals who report high fear-avoidance during the third trimester of pregnancy are at higher risk of having persistent postpartum LPP at 6-months postpartum (Fernando et al., 2020). Finally, postpartum individuals with LPP have reported a three-fold increase in prevalence of depressive symptoms (Gutke et al., 2007) and one study of a self-management intervention for postpartum low back pain noted depression was a significant covariate of the intervention effects on pain disability and fear of movement (Bastiaenen et al., 2008). Given the strong evidence for PA in improving postpartum mental health (Deprato et al., 2025), it might be equally important to design an exercise intervention that targets psychological outcomes, such as fear avoidance and depression, of postpartum individuals with LPP.

Although many resistance exercise interventions have demonstrated improved pain and disability outcomes among postpartum individuals with LPP, few have had a significant effect on other measures, such as general health, quality of life, and fatigue (Gausel et al., 2019; Gutke et al., 2010; Mens et al., 2000; Özyurt et al., 2025). A systematic review reported “other” exercises (e.g., lower extremity strengthening exercises, dynamic neuromuscular stabilization) had a potential short-term (<3 months) benefit on quality of life while stabilization exercises had a potential mid-term (3-12 months) and long-term (>12 months) benefit; however, all were based on very low level of evidence (Özyurt et al., 2025). In one study, an intervention that included physical therapy with a focus on stabilizing exercise among postpartum people with pelvic girdle pain resulted in improved quality of life (Stuge, Laerum, et al., 2004; Stuge, Veierød, et al., 2004); however, upon further evaluation, there were only significant differences on the SF-36 subscales of physical functioning, role physical, and bodily pain with no significant differences on general health, vitality, social functioning, role emotional, and mental health (Stuge, Laerum, et al., 2004; Stuge, Veierød, et al., 2004). It is possible that changes in pain and disability are inadequate to result in improved mental health and quality of life and that the addition of PA promotion, beyond simply exercise to treat pain, could have greater impacts on these constructs.

Regular PA has been implemented in a few LPP intervention studies, often both in intervention and control groups (Ehsani et al., 2020; Stuge, Laerum, et al., 2004), however it is unknown whether the addition of regular PA to the intervention had an impact on the effect of the intervention where the focus was on resistance exercise. Clinical practice guidelines and recommendations for postpartum LPP consistently recommend regular PA (Pulsifer et al., 2022; Vleeming et al., 2008; Weis et al., 2021). They suggest for PA to be modified for pain symptoms but little is known how PA interventions should be delivered to postpartum individuals with LPP in a way to promote regular behaviour that is important both for pain and disability outcomes but also for mental and overall health outcomes.

Graded behavioural exposure is an intervention that can be used to overcome fear of movement by challenging unhelpful negative beliefs about behaviours and their consequences (Caneiro et al., 2022). The ultimate goal is to create a discrepancy between an individual's expected response to an activity compared to their actual pain response. Interestingly, in the PA literature, integrating graded tasks into behavioural interventions has been associated with negative consequence of decreased self-efficacy for PA (Ashford et al., 2010; Williams & French, 2011). Further, there does not appear to be support for including graded tasks in interventions to promote PA among postpartum individuals (Gilinsky et al., 2015; Lim et al., 2020). However, graded tasks have demonstrated effectiveness in PA interventions for healthy inactive adults for both behaviour change as well as maintenance (Howlett et al., 2019).

There is one intervention study of note that looked at the efficacy of an educational intervention that specifically integrated self-management and overcoming fear-avoidance techniques into an intervention for the management of postpartum LPP (Bastiaenen et al., 2006). In this study, they compared a time-based educational intervention with usual care where participants could seek physiotherapy guidance if desired and it was expected that the guidance would follow a more pain-based approach (i.e., avoid painful activities and perform stabilizing exercise) rather than the time-based educational approach. The time-based educational intervention was informed by interviews with postpartum individuals as well as physiotherapists experienced with postpartum LPP (Bastiaenen et al., 2004). In these interviews, postpartum individuals reported their dislike of the commonly provided pain-based interventions where they felt overly restricted in the activities they could do, often resulting in noncompliance.

In response to the discrepancy between the desires of postpartum individuals and the interventions currently recommended by health providers, the time-based educational intervention was developed. It included the following topics: back and pelvis anatomy, red flags to indicate serious medical condition, factors that contribute to pain fluctuations, education on pacing of exercise and activity, handling pain flare-ups, cognitive restructuring, graded exposure techniques, communication, and social persuasion. It included stabilizing exercises similar to the usual care group however a key difference was that activities of the intervention were not solely guided by pain. In the time-based intervention, physiotherapists worked with participants to set personal goals, develop action plans, review progress, and problem-solve to overcome presenting difficulties with implementing the plans. In this study, there was a statistically and clinically improved outcome of limitations in activities in the intervention group at 3-months (Bastiaenen et al., 2006). At one year, although the difference was still statistically significant, it was no longer clinically significant (Bastiaenen et al., 2008). At the one year follow-up, there were statistically greater improvements in the subscales autonomy in self-care and pain-related fear from the Impact on Participation and Autonomy questionnaire (Cardol et al., 2001), however these differences were not clinically significant (Bastiaenen et al., 2008). The other measurements of pain, severity of main complaints, global feeling of recovery, quality of life and costs did not demonstrate statistically significant nor clinically relevant differences.

To summarize, most exercise interventions for postpartum LPP have focused on muscle-strengthening exercises targeting the abdominal and back muscles (i.e., stabilization exercises), demonstrating moderate improvements in postpartum LPP intensity and associated disability. Mediators of muscle-strengthening exercises on LPP intensity and severity are still largely unknown and more research is needed to determine the types of exercise interventions that are effective for reducing kinesiophobia and depression among postpartum individuals with LPP.

2.6.3 Postpartum Lumbopelvic Pain Outcome Measures

A difficulty in the assessment of intervention effectiveness for postpartum LPP is the inconsistent use of outcome measures, which prevents the ability to perform meta-analyses and demonstrate pooled effects (Gutke et al., 2015; Liddle & Pennick, 2015). Recently, a Pelvic Girdle Pain-Core Outcome Set was developed to provide recommendations of outcomes that should be used in intervention studies among individuals with postpartum pelvic girdle pain (Remus et al., 2021). A systematic review identified 46 outcomes for postpartum pelvic girdle pain and LPP categorised into core domains of the OMERACT filter 2.0 framework: 'life impact', 'resource use/economic impact', 'pathophysiological manifestations', and 'death' (Wuytack & O'Donovan, 2019). Psychological outcomes and economic outcomes were more commonly measured in postpartum LPP. The largest percentage of outcomes were labeled under the 'life impact' domain, with most common being pain intensity followed by function and disability. Multiple measurement instruments were used for many outcomes and there was often inconsistency regarding terminology (i.e., function vs. disability) indicating a need for the Pelvic Girdle Pain-Core Outcome Set (Wuytack & O'Donovan, 2019).

A follow-up Delphi study suggested five outcome measures, which were all in the 'life impact' domain, to be included in the Pelvic Girdle Pain-Core Outcome Set: pain frequency, pain intensity/severity, function/disability/activity limitation, health related quality of life, and fear avoidance. Examples of commonly identified measurement instruments for pain intensity include the Visual Analogue Scale (Carlsson, 1983) and the Numerical Rating Scale (Ogollah et al., 2019); for pain frequency is a questionnaire ("always, day and night to several times per week, or occasionally to never") (Gutke et al., 2010)); for function/disability/activity limitation is the Oswestry Disability Index (Fairbank et al., 1980), Pelvic Girdle Questionnaire (Stuge et al., 2011), Disability Rating Index (Salen et al., 1994), Roland-Morris Disability Questionnaire (Roland & Fairbank, 2000), Patient Specific Functional Scale (Horn et al., 2012), and Quebec Back Pain Disability Scale (Kopec et al., 1995); for health related quality of life is the 36-Item Short Form Health Survey Instrument (SF-36) (McHorney et al., 1993) and the EuroQol/EQ-5D (Balestroni & Bertolotti, 2012); and for fear avoidance is the Fear-Avoidance Beliefs Questionnaire (Waddell et al., 1993) and the Tampa Scale for Kinesiophobia (Woby et al., 2005). The postpartum pelvic girdle pain clinical practice guideline from Simonds et al. (2022) reported moderate evidence validating the use of the Oswestry Disability Index and Pelvic Girdle Questionnaire, and weak evidence validating the use of the Quebec Back Pain Disability Scale for measuring disability. The postpartum LPP clinical practice guideline from Weis et al. (2021) suggested the Pregnancy Mobility Index (van de Pol et al., 2006) and Pelvic Girdle Questionnaire could be used however they haven't been validated in postpartum individuals yet. The next phase of the Pelvic Girdle Pain-Core Outcome Set development project will be to perform a robust systematic review of measurement properties of each of the measurement instruments used in the five COS outcomes (Wuytack et al., 2018).

2.7 Postpartum Physical Activity mHealth

In addition to sound theoretical consideration, mode of delivery is an important consideration for postpartum PA intervention success (Dombrowski et al., 2016). One of the most significant barriers to postpartum PA is time (Burton et al., 2019; Edie et al., 2021) and therefore the mode of delivery should be flexible and accessible. Digital health interventions are becoming increasingly available and have high potential for overcoming substantial time barriers that postpartum individuals often face. Digital health interventions are commonly referred to as mHealth or eHealth (electronic health) interventions and involve the delivery of information through mobile and digital technologies (World Health Organization, 2016). They can help users manage and monitor their own conditions and behaviours as well as deliver health care through interactive patient-clinician communications (Dicianno et al., 2015; Wei et al., 2020). Digital health interventions have high potential for reach to populations with demographic, socioeconomic, and geographic barriers, are easily modifiable, and can alleviate costs and resources on the healthcare system (Sherifali et al., 2017).

Postpartum individuals have expressed an overwhelmingly positive response to receiving healthy lifestyle information through digital health interventions (Lim et al., 2019) with an estimated 85% of postpartum individuals having access to a smartphone and 80% having a data plan (Fernandez et al., 2017). More recent data demonstrates that 95% of Canadian adults own a cellphone and of those, the majority (92%) own a smartphone (Summerfield, 2025). Postpartum individuals may be a particularly important population to reach through mHealth PA intervention given they are an at risk population (Mönninghoff et al., 2021). Not only are they at risk for low PA levels but many postpartum individuals are also concurrently facing challenges with weight retention, mood disorders, and/or musculoskeletal conditions such as LPP, urinary incontinence, and diastasis rectus abdominus (Bø et al., 2017). Given that varying forms of PA have proven beneficial for these commonly experienced physical and mental health conditions, postpartum individuals may have greater expectation of health outcomes from mHealth PA interventions, ultimately enhancing their potential for success.

2.7.1 Available Evidence for Postpartum Physical Activity mHealth

Aside from their immense potential, mHealth PA interventions for postpartum individuals do present several setbacks. A quality assessment of mHealth PA interventions for pregnant and postpartum individuals reported a MARS quality score of M = 3.06, SD = .94 on a scale from 1 = inadequate to 5 = excellent (Stoyanov et al., 2015) which was significantly lower than existing mHealth apps (M = 3.74, SD = .59) (Tinius et al., 2021). Since existing mHealth apps have been shown to have “moderate” quality, the authors felt it was appropriate to classify the apps targeting pregnant and postpartum individuals as low quality (Tinius et al., 2021). Free apps were of significantly lower quality than apps requiring in-app purchases and when authors reviewed three of the highest quality rated apps, they were between 100-300 times the cost of commonly used apps and none of the apps contained goal-setting that was in line with evidence-based PA guidelines. This is detrimental considering low-income mothers have reported cost as a major barrier to using mHealth in the postpartum period (Guerra-Reyes et al., 2016). Upon further review of the four MARS subscales, Functionality and Aesthetics had higher mean scores (3.32±1.03; 3.14±1.20 out of 5) while Information and Engagement had lower mean scores (3.01±0.91; 2.85±0.93). Overall perceived impact was also measured and took into account awareness, knowledge, attitudes, intention to change, help seeking, and behaviour change. All of these measures scored low, ranging from 1.57±0.66 for help seeking to 2.02±0.93 for intention to change (on a scale from 1 = strongly disagree to 5 = strongly agree) (Tinius et al., 2021). This implies that behaviour change theory has not been thoroughly integrated into the development and design of available postpartum PA apps. Behaviour change theory is important given that the number of behaviour change techniques has been associated with engagement in mHealth and engagement in mHealth can predict subsequent health outcomes (Hayman et al., 2021; Smith & Liu, 2020). A robust analysis of the effectiveness of mHealth postpartum PA interventions is still under evaluation however recent intervention studies have demonstrated limited efficacy/effectiveness and often low adherence and engagement (Kernot et al., 2019; Napolitano et al., 2021; Teychenne et al., 2018).

In a review of telehealth interventions for PA postpartum, out of 16 articles, five demonstrated significant improvements in PA (Turner et al., 2023). Most study interventions included at least 10 telehealth contacts with intervention delivery personnel. There haven't been any PA mHealth apps that have been tailored to postpartum LPP. However, research on mHealth for the self-management (including PA promotion) of low back pain in the general adult population has been growing and demonstrated positive indicators of success (Rintala et al., 2022). For example, one RCT compared the effect of a multidisciplinary mHealth app that included back pain education, physiotherapy/physical exercise, and mindfulness and relaxation techniques compared to a control intervention of six face-to-face sessions of standard physiotherapy once a week that comprised physical exercises tailored to the individual symptoms and fitness level and manual therapy, the recommendation to maintain an active lifestyle, and six emails with links to medically oriented websites (Toelle et al., 2019). After 12-weeks, the primary outcome of pain intensity was significantly lower in the intervention group compared to the control group. The control group had significant improvements in pain after 6-weeks but the pain reduction did not continue to 12-weeks and the authors suggested this may have been due to the fact that participants were no longer motivated to continue exercising upon the completion of the 6-week physiotherapy course. Exercise adherence data was not collected (Toelle et al., 2019).

In another RCT, the intervention group received advice on medication and PA from a health provider as well as an mHealth app while the control group only received advice from a health provider. The intention of the mHealth app was to motivate, promote, and guide users in increasing their level of PA and exercise adherence (Chhabra et al., 2018). In this study, both groups had a significant reduction in pain and improvement in disability over time. There was a significant difference between the groups in disability with the mHealth app group reporting less disability after the intervention however there was no significant difference between the groups with regard to pain (Chhabra et al., 2018). The mHealth group demonstrated significantly more distance walked at 12-weeks compared to baseline, however PA was not measured in the control group.

To summarize, postpartum individuals are an ideal population to target health behaviour change through mHealth apps, yet, available apps are of low quality, particularly with regard to evidence-based information, engagement, and application of behaviour change theory. Additionally, while mHealth apps appear to be effective for improving pain and disability among the general adult population with musculoskeletal pain, more research is needed to determine whether they have an impact on PA among postpartum individuals with LPP.

2.7.2 Physical Activity mHealth Development and Design

The reasoning for the low quality of available postpartum PA mHealth apps might be due to the historical lack of mHealth app regulation. Most countries have clear regulatory guidelines for drugs and medical devices however the guidance for mHealth apps is less distinct (Jogova et al., 2019). In order to build a safe and engaging product that effectively promotes healthy behaviours, it has been recommended that digital health interventions be grounded in behavioural theory, integrate in-depth qualitative understanding of the target population, be developed rapidly and iteratively based off of end-user feedback, be rigorously evaluated, and be widely disseminated (Bennett & Glasgow, 2009; Kumar et al., 2013; Mao et al., 2005; Mummah et al., 2016; Yardley et al., 2015). Many frameworks for digital health development are available however most are not inclusive of all of these elements (Carbonnel & Ninot, 2019). For example, a few of the earlier models, such as Stagewise, Waterfall, and Spiral, were the first to emphasize an iterative process that included multiple rounds of prototyping prior to dissemination (Boehm, 1988). In Agile Software Management, the focus moved towards the involvement of the end-user within the iterations of development (Fowler & Highsmith, 2001). Collectively, these models did not include grounding in behaviour change theory or formal testing.

On the other hand, the mHealth development and evaluation framework includes a stepwise user-centered design inclusive of pilot and effectiveness testing stages; however, it doesn't include rapid prototyping or specific guidance on behavioural strategies to inform design (Whittaker et al., 2012). Similarly, the user-centred design framework combines the Information Systems Research framework and design thinking (Hevner, 2007; Reaves, 2016) to provide a holistic framework that emphasizes both technical and social (i.e., user-specific) elements (Farao et al., 2020). However, the user-centered design is limited in that it does not include rigorous testing for efficacy or effectiveness.

The IDEAS (Integrate, Design, Assess, and Share) framework captures all of the elements of empathizing with the end-user, prototyping, design thinking, behaviour theory, rigorous testing, and dissemination (Mummah et al., 2016). It has been used to inform the development of many mHealth apps that promote several health behaviours such as PA, healthy eating, and reducing heavy alcohol consumption (Gabrielli et al., 2017; Hendrie et al., 2019; Kazemi et al., 2018; Lee et al., 2018). The TUDER (Targeting, Understanding, Designing, Evaluating, and Refining) framework is similar to the IDEAS framework however it emphasized that behavioural theory needs to be broken down into behavioural change techniques to inform strategies based off of key target constructs. It provides guidelines for Social Cognitive Theory, the Health Belief Model, Theory of Planned Behaviour, and the Health Action Process Approach (Wang et al., 2019).

2.7.3 Postpartum Physical Activity mHealth Features

In order for a postpartum PA mHealth intervention to be successful, user engagement must be considered and optimized, since user engagement is ultimately connected to outcomes (Smith & Liu, 2020). User engagement refers to the mHealth user's experience and is characterized by attributes of challenge, positive affect, endurability, aesthetic and sensory appeal, attention, feedback, variety, novelty, interactivity, and perceived user control (O'Brien & Toms, 2008). A systematic review of mHealth design features revealed seven key themes that influenced user engagement: 1) personalization, 2) reinforcement, 3) communication, 4) navigation, 5) credibility, 6) message presentation, and 7) interface aesthetics (Wei et al., 2020). There is overlap with some of the design features important for engagement with theoretical constructs that impact PA behaviour. Personalization, reinforcement, communication, and credibility translate to perceived outcomes and social support of the social cognitive framework. Although these elements, with the exception of social support, haven't demonstrated significant impact directly on behaviour, they might still be important for engaging individuals with mHealth apps. A review of observational and intervention research demonstrating the importance of these constructs on postpartum PA is already available in section 2.5 of this dissertation proposal. It is strongly suggested that behaviour change interventions be informed by user-feedback (Garad et al., 2020; Ma et al., 2021; Mummah et al., 2016). As such, several research groups have collected feedback from health providers and postpartum individuals regarding postpartum PA mHealth (Kernot et al., 2019; Napolitano et al., 2021; Nicklas et al., 2020; Teychenne et al., 2018; Tinius et al., 2021).

Health providers and postpartum individuals have suggested that a key feature for postpartum PA mHealth is a symptom-tracker to help guide users in customization of workouts as well as for flagging to contact a health provider (Tinius et al., 2021). As previously mentioned, the recent Canadian postpartum PA guideline provides a list of relative contraindications to MVPA (see Table 2), and also emphasizes that there are no absolute contraindications to MVPA (Davenport, Ruchat, et al., 2025). Postpartum PA mHealth could provide a reference to the GAQ for Postpartum to assist postpartum individuals in identifying whether they are experiencing any of these relative contraindications and should seek medical advice prior to engaging in MVPA (Davenport, Christopher, et al., 2025).

Postpartum individuals desire evidence-based and credible PA information that is structured, tailored to their postpartum stage, and takes into consideration the barriers they face (Nicklas et al., 2020; Teychenne et al., 2021; Tinius et al., 2021). mHealth should feature self-monitoring, both automated and manual, as well as goal-setting information that promotes self-efficacy (Napolitano et al., 2021). Postpartum individuals desire push notifications and if awards are provided, they should be tangible (e.g., monetary) (Napolitano et al., 2021; Nicklas et al., 2020). There is high desire for social support through an online forum with peers and this forum may be more effective on a platform familiar to users rather than the app itself (Finlayson et al., 2020; Kernot et al., 2019; Nicklas et al., 2020; Teychenne et al., 2018; Tinius et al., 2021). Given the significant time and fatigue barriers that postpartum individuals face it is essential that mHealth is simple with comprehendible vocabulary, and includes a home menu where users can choose where to navigate (Nicklas et al., 2020). Scalable mHealth in this population is possible but might consider including a symptom tracker to flag individuals when they should seek consultation with a health care provider (Tinius et al., 2021). Postpartum PA mHealth that has high effectiveness, engagement, and adherence is yet to exist and therefore it is absolutely essential that development continue to be iteratively informed by end-user (e.g., postpartum individuals and health provider) feedback.

2.8 Theoretical Framework

The purpose of this dissertation is to design and develop a PA mHealth app that is tailored to postpartum individuals with LPP. As such, the mHealth app development should follow a prespecified framework that integrates behaviour change theory for the selected behaviour of PA as well as considerations for intervening on a clinical population.

2.8.1 Digital Health Framework

As mentioned in section 2.7.1, there are currently many flaws to postpartum PA mHealth, such as lack of quality, evidence-based recommendations, engagement, behaviour change theory, and efficacy/effectiveness.

The digital health framework selected for this dissertation is the IDEAS (Integrate, Design, Assess, and Share) framework that has purposefully integrated the four key components of behaviour change theory, design thinking, evaluation, and dissemination (Mummah et al., 2016). The behaviour change theory can be applied to uncover important intervention characteristics when targeting specific populations and/or behaviours. Design thinking will have a focus on “what matters most” to the population rather than “what’s the matter” with them (Matheson et al., 2013). It will also integrate user-centered design whereby user feedback is gathered throughout various stages of the development process and is applied to refine the design (Draper & Norman, 1986; Hermawati & Lawson, 2014). Evaluation involves determining whether the intervention achieves its desired effect and dissemination is important for effective digital health interventions to reach individuals beyond the research setting.

The IDEAS framework includes 10 phases: 1) empathize with target users, 2) specify target behaviour, 3) ground in behavioural theory, 4) ideate implementation strategies, 5) prototype potential products, 6) gather user feedback, 7) build minimum viable product, 8) pilot potential efficacy and usability, 9) evaluate efficacy in RCT, and 10) share intervention and findings. Collectively, the phases are grouped into four overarching categories: 1) Integrate insights from users and theory (phases 1-4), 2) Design iteratively and rapidly with user feedback (phases 4-7), 3) Assess rigorously (phases 8,9), and 4) Share (phase 10) (Mummah et al., 2016). For the purpose of this research project, the focus will be on phases one through seven with the final step of tailoring the mHealth app to postpartum individuals with LPP using co-design methods and involving individuals who experienced postpartum LPP as well as healthcare providers who have experience in managing postpartum LPP. We will expand on the third phase of grounding in behavioural theory by identifying specific behavioural change techniques that are important when intervening with postpartum individuals, as seen in the TUDER framework (Wang et al., 2019).

2.8.2 Physical Activity Theory

Observational and intervention postpartum PA research have largely focused on social cognitive and action control frameworks with varying success (Gilinsky et al., 2015; Lim et al., 2020). In effort to explore humanistic and dual process factors among postpartum PA behaviour, a combined theoretical framework is selected for this dissertation. The M-PAC framework, as mentioned in section 2.5.7 proposes that reflective process are necessary for developing PA intentions while action control and reflexive processes are necessary for intention-translation and maintenance of longer term PA behaviour (Rhodes, La, et al., 2021; Rhodes & Sui, 2021). The M-PAC framework will be the selected behaviour theory framework to inform this dissertation.

Reflexive processes, such as habit and identity, are important considerations as they promote longer lasting behaviour change (Kwasnicka et al., 2016; Rhodes & Sui, 2021) which is often lacking in postpartum PA intervention studies (Cramp & Brawley, 2006; Keller et al., 2014; Mailey & Hsu, 2019). Habits are behavioural associations developed from specific cues that shield from automatic tendencies, preventing PA intention translation (Gardner, 2015). Past performance of a behaviour, consistency of practice, and affective judgments are important for forming exercise habits (Kaushal & Rhodes, 2015; Lally & Gardner, 2013; Rhodes, 2017). Postpartum individuals' schedules, particularly those who are nursing, is largely dependent on the sleeping and feeding schedule of their infants (Thomas & Foreman, 2005). This presents an opportunity to implement a regular PA habit that fits within this regular schedule. For example, a morning walk might fit after the morning feed and strengthening exercises could be performed several days a week during the afternoon nap.

Identity is someone's hierarchically organized categorization in a specific role. It activates reflexively on behaviour from triggers (environmental, social, individual) that challenges one's identity with their current behaviours (Burke, 2016). If a dissonance between an individual's identity and their observed behaviour is experienced, they will be motivated to reduce this discrepancy (Stryker & Burke, 2000). The concept of identity may be particularly relevant to postpartum individuals given their current state of life-stage transition and transforming identities (Finlayson et al., 2020; Rhodes, Wierts, et al., 2025). From a theoretical standpoint, there are several plausible direct and indirect routes by which identity change may occur (Strachan et al., 2025). The routes can be summarized under behavioural inputs (i.e., PA, self-regulation, investment), cognitive inputs (i.e., perceived ability, alignment with goals or values, imaginal experiences, and holding PA identity rules or standards), and social inputs (i.e., attachment ties, social appraisals) (see Strachan et al., 2025 for a full review of these inputs).

There are several examples of how behavioural, cognitive, and social influences could be leveraged to enhance postpartum PA identity. From a behavioural standpoint, a postpartum individual's experience in engaging in PA and how it does or does not meet their expectations (i.e., due to pain, fatigue, perceived change in gait (Moore et al., 2021)) may impact their perceived ability for PA and likelihood for imagining a physically active self. Additionally, postpartum individuals might invest in PA (and thereby strengthen PA identity) by choosing postpartum clothing (e.g., nursing sports bras) and baby equipment (e.g., a three-wheeled stroller to enable running or walking though nature) that support a physically active lifestyle. From a cognitive standpoint, postpartum PA identity might be strengthened by aligning it with other core identities and values such as role-modeling health-promoting behaviours for their children. Furthermore, for someone who has a core value of being a "good parent," reflecting on how PA may increase energy, mood, endurance, strength, and longevity might also encourage PA to become integrated with one's core value/identity. From a social standpoint, PA identity may be leveraged by attending exercise classes with other postpartum individuals who are also successfully engaging in PA (thus increasing perceived ability). However, caution should be made that the classes provide tailored options for postpartum individuals (accounting for factors such as time and recovery postpartum, musculoskeletal status, and fatigue), as a class might also motivate a postpartum person to do too much too fast, resulting in injury and possibly reduced perceived ability and/or increased fear of movement.

Research supports self-efficacy, planning, habit, and identity as predictors of intention-translation for MVPA among new mothers and mothers with young children (Grant et al., 2021;

Rhodes, Beauchamp, et al., 2021). A key limitation to these studies is that they may not comprehensively apply to clinical postpartum populations. The observational study by Grant et al. (2022) did not screen for clinical symptoms and the study by Rhodes et al. (2021) applied an intervention that necessitated healthy and motivated postpartum individuals and thus, there is a need for sustained research with broader sampling. As such, less is known about intention-translation in clinical postpartum populations such as postpartum LPP.

2.8.3 Postpartum-Relevant Variables

Identifying key barriers and enablers to PA among postpartum individuals with varying musculoskeletal conditions is essential given the high prevalence of musculoskeletal conditions, such as LPP described in section 2.6, during this period. Relatedly, PA behaviour theories and frameworks may need to be expanded to account for the complexity of the postpartum experience. Similar to a previously proposed framework for PA and cancer survivorship (Courneya, 2014), postpartum variables may interact with PA through several unique paths. One potential path is that postpartum-related variables may directly predict PA engagement. For example, postpartum-related variables such as fear of movement or perceived change in walking/running gait (Moore et al., 2021) may directly impede PA participation or disrupt intention-PA translation, independent of more generalized constructs in behavioural theories (e.g., general attitudes about PA, general perceived opportunity). Furthermore, postpartum LPP might decrease the intention-behaviour gap (i.e., a greater percentage of intenders will follow through with their intentions), as observed with other populations with health risks (e.g., cancer, cardiovascular risk factors) (Feil et al., 2023). This is potentially due to increased motivation for the physical and/mental consequences of PA. Another path is that postpartum-related variables may act as moderators of PA determinants. For example, the presence of LPP may reduce the relative impact of reflective, regulatory, and/or reflexive constructs on intention-PA translation. Further research is needed to determine whether pain moderates intention-PA in any population. Some speculations include a potential reduction in affective attitude towards PA and subsequent decrease in PA intentions (LaRowe & Williams, 2022), which in turn may impede on developing a PA habit (Kaushal & Rhodes, 2015) or identity (Rhodes et al., 2016). Finally, pain may also decrease instrumental attitude or perceived capability in relation to PA (Leveille et al., 2003)

2.9 Knowledge User Engagement

In addition to being grounded in theory-, up-to-date evidence, and following systematic, iterative development, there have been recent calls to incorporate knowledge user involvement in behavioural intervention design, delivery, and reporting (Bacon et al., 2020). Ultimately behavioural interventions need to be acceptable and engaging among knowledge users to result in intended health behaviours and outcomes. Postpartum PA intervention studies have reported notorious challenges in recruiting and retaining postpartum research participants in PA intervention studies (Haste et al., 2018; Lesser et al., 2024), speaking to the importance of including postpartum individuals in research and intervention design. As previously mentioned, the postpartum experience is complex and while it is recommended to apply an individualized approach to PA engagement, research is lacking on how to apply an individualized approach (Davenport, Ruchat, et al., 2025). Therefore, including postpartum individuals in the design and delivery of PA interventions is essential given they are the experts of their complex experiences.

There are many different ways that knowledge users can be involved in research and to date there is no gold standard method, but rather, the involvement should be based on the context (Greenhalgh et al., 2019). User-centered design is one approach that aims to create better interventions “for” users, placing the needs, wants and limitations of end-users at the center of the design process (Sanders & Stappers, 2008). A potential limitation to user-centered design is that it often involves researchers observing and/or interviewing largely passive users (Sanders & Stappers, 2008). Co-design is an alternative and potentially more optimal and comprehensive approach that involves active participation from knowledge users throughout the research process with an emphasis on improving applicability and acceptability (Greenhalgh et al., 2019; Sanders & Stappers, 2008). Co-design incorporates creativity of designers and people not trained in design working together in the design and development process. It is also known as participatory design where the user is the expert. Knowledge users play a large role in knowledge development, idea generation, concept development and are seen as research partners and the intention is to create a better solution "with" them (Greenhalgh et al., 2019). Potential benefits of co-design include minimizing power-imbalances between researchers and knowledge users, increasing accountability and transparency of research, increasing research relevance to knowledge users, improving recruitment and retention rates of knowledge users in research studies, and improving dissemination beyond academic audiences (Greenhalgh, 2019). It is important to also note that while there are many proposed benefits of co-design research, it is unknown whether research that involved co-design is more effective with regards to end user health outcomes or cost effectiveness (Slattery et al., 2020).

In order to optimally support, evaluate, improve, and report on knowledge users involved in co-design, ideally a framework can be used as a guide. Over 60 frameworks for co-design exist and while many have been developed using both theoretical principles and knowledge user involvement, the majority have seen little application beyond the groups that originally developed them (Greenhalgh et al., 2019). Ultimately this review concluded that a single one-size-fits-all framework for all co-design studies may be less useful than a range of resources that can be adapted and combined in a locally generate co-design activity (Greenhalgh et al., 2019). They suggest to either review available frameworks and decided whether one is fit for use, depending on context and intended use. Alternatively, research groups may choose to co-design a framework with knowledge users to develop a locally relevant and locally owned framework (Greenhalgh et al., 2019).

The Patient Engagement in Research (PEIR) Framework is an example of co-design framework that has an associated workbook consisting of eight components for fostering meaningful patient engagement and can be used to guide partnership between knowledge users and researchers (Hamilton et al., 2018). The workbook components include procedural requirements, convenience, contributions, support, team interaction, research environment, feel valued, and benefits (Hamilton et al., 2018). The intent of the workbook is to facilitate high quality partnerships between researchers and patient partners who are undertaking research projects together. The workbook is to be used flexibly amongst the research team, ideally initiated at the beginning of the research program, and ensures the perspectives of all members of the research team are heard and a research strategy can be agreed upon (Hamilton et al., 2018). It can be used throughout the program to critically reflect whether meaningful engagement is occurring through the research process (Hamilton et al., 2018).

Additionally, the PEIR Scale questionnaire (Hamilton et al., 2021) is available to systematically evaluate knowledge user engagement and to determine whether modifications are needed to enhance the partnership for subsequent phases of the research. The original PEIRS scale had 37-items with seven sections/subscales: procedural requirements (14-items), convenience (4-items), contributions (4-items), team environment and interaction (5-items), support (3-items), feel valued (3-items), and benefits (4-items). Each item uses a 5-point Likert scaled scored from 0 = strongly disagree to 4 = strongly agree (Hamilton et al., 2021). Informal conversations with researchers led the scale developers to shorten the scale as there was a perception that 37-items might hinder its implementation (Hamilton et al., 2021). The scale was ultimately shortened to 22-items, maintaining the seven sections/subscales, and has demonstrated acceptable internal consistency, structural validity, reliability, and interpretability among patients or family caregivers that had engaged in research projects with the PEIR scale developers in the three years prior to the study (Hamilton et al., 2021).

To date, it is unknown whether the use of the PEIR workbook results in more meaningful research team interactions and whether meaningful engagement, as scored by the PEIR scale is associated with more effective interventions. However, applying this framework and scale will help to inform future syntheses of co-design methodology and determine the impact of co-design methods on intervention effectiveness and how they may need to be modified or improved.

2.9.1 Knowledge User Engagement in Postpartum Physical Activity Intervention Development and Delivery

There have been very recent publication outputs demonstrating the involvement of knowledge users in the development and delivery of postpartum PA interventions. They include the co-design of an postpartum return-to-running intervention (James, 2025), a postpartum diabetes prevention program after gestational diabetes mellitus (Racey et al., 2025), and two lifestyle intervention programs to reduce postpartum weight retention (Makama et al., 2024; Wilkinson et al., 2023). Knowledge users have included postpartum (or recently within the last 5-years) people, program leadership staff, healthcare professionals, and researchers. The co-design methods applied have been diverse across the studies, including advisory group meetings, social media communication groups, workshops, focus groups, and semi-structured interviews.

One study was iterative whereby knowledge users provided feedback on updated versions of the intervention at three different time points (James, 2025) while another study involved several rounds of feedback with a focus on different phases of intervention development (i.e., intervention planning phase followed by conceptualizing program components phase) (Makama et al., 2024). Two studies involved the actual development of or tailoring of an intervention (James, 2025; Makama et al., 2024) while the other two studies involved gathering feedback from knowledge users on potential and preferred program components but the intervention was not developed as part of the study (Racey et al., 2025; Wilkinson et al., 2023). Of the two interventions that were developed, neither of them underwent experimental testing to determine whether they were effective in increasing postpartum PA (James, 2025; Makama et al., 2024).

Key postpartum-relevant feedback was collected from each study that may be beneficial to other postpartum PA interventions. Postpartum individuals from James (2025) expressed a desire for the program to target moms (and not "athletes") and to balance between providing enough content but not too much. Workshop attendees from Racey et al. (2025), who were primarily healthcare professionals, health coaches leadership staff, research and practice experts and two postpartum individuals, suggested integrating personalized information that is accessible (e.g., through digital delivery methods), comprehensive, inclusive and culturally sensitive, and includes resources such a PA videos, PA wearables, and exercise equipment. Mothers with young children from Makama et al. (2024) encouraged a consistent routine, breathing exercises, understanding that even small amounts of exercise are ok, incorporating exercising into usual routine, having someone or group to be accountable to, goal setting, and self-monitoring. Finally, women who had recently become mothers (< 24 months) from Wilkinson et al. (2023) emphasized a focus on the new normal of being a mother, having broad reach across a range of platforms, including digital delivery methods and coming from trusted sources such as healthcare providers. They preferred tailored supportive elements such as an encouraging and empathetic tone of communication and a focus on tangible benefits of health behaviours (i.e., less fatigue, breastfeeding) rather than aesthetic or chronic disease management. Furthermore, they requested instructions on safe exercise, goal setting, self-monitoring, and the ability to ask questions and seek professional support (Wilkinson et al., 2023).

2.10 Chapter 2 Summary and Structure of the Dissertation

The findings from the Chapter 2 literature review revealed that MVPA is associated with many physical and mental health benefits during the postpartum period, yet, most postpartum individuals are not engaging in adequate PA to reap such benefits. The majority of postpartum PA research has been dominated by social cognitive frameworks, however, PA interventions informed by this framework have not demonstrated meaningful change on postpartum MVPA. Future postpartum PA research that is informed by humanistic and dual process frameworks is needed to determine whether targeting reflexive constructs (e.g., habit, identity) are important when intervening on postpartum PA. Postpartum PA promotion may also need to account for the complexity of the postpartum experience. For example, up to two thirds of postpartum individuals experience LPP which might impact determinants of PA, such as their motivation for or capability to be active and fear of movement. Most PA interventions that have targeted postpartum LPP have applied muscle-strengthening exercises and while they have demonstrated a moderate effect on reducing LPP intensity and disability, more research is needed to determine the effects of meeting MVPA guidelines (inclusive of aerobic forms of MVPA) on postpartum LPP physical and mental health outcomes. Particularly given that muscle-strengthening exercise interventions don’t seem to be mediated by biomechanical changes or changes in muscle-strength.

Mobile apps are ideal for postpartum PA promotion as they can be scalable, low cost, and include up-to-date, evidenced based information. Available postpartum PA mobile apps have demonstrated overall low quality, particularly with regard to information and engagement, and have not been informed by behaviour change theory. mHealth app development should follow a systematic framework that includes grounding the intervention in behaviour change theory with input from knowledge users. Active involvement of knowledge users in intervention design is thought to increase acceptability and applicability of behavioural interventions. In order to avoid tokenism, the quality of knowledge user engagement should be considered throughout the research process. The PEIR scale can be used to determine the extent of meaningfulness that knowledge users perceived their experience throughout the research project. Measuring meaningfulness is important to inform future meta-syntheses of knowledge translation to determine whether meaningfulness is in fact associated with more effective behaviour change interventions.

The purpose of this dissertation is to develop an evidence-based, acceptable, usable feasible, scalable, and low-cost PA promotion mHealth app that is tailored to postpartum individuals with LPP using a behaviour change intervention development framework, behaviour change theory, and co-design methods. The mHealth app development is guided by the IDEAS framework (Mummah et al., 2016), the mHealth app is grounded in M-PAC theory (Rhodes, La, et al., 2021), and the development and design involves collaboration with knowledge users which is informed by the PEIR framework to promote a quality experience for all research partners (Hamilton et al., 2018). Each of the chapters 3-5 represent stand-alone papers: a version of chapter 3 has been published in *Health Psychology* (Hollman, Tran, et al., 2025), a version of chapter 4 has been published in the *International Journal of Sport and Exercise Psychology* (Hollman et al., 2026), and a version of chapter 5 will be submitted to a journal for peer-review in the near future. Each chapter represents a progression of research objectives that follow in line with the IDEAS framework and form a larger program of research with the objective to develop a PA promotion mHealth app that is tailored to postpartum individuals with LPP.

Chapter 3: A Systematic Review of Mediators of Physical Activity Behaviour Change Interventions Among Postpartum Individuals

A version of chapter 3 has been published in *Health Psychology* (Hollman, Tran, et al., 2025). Reproduced with permission from American Psychological Association. No further reproduction or distribution is permitted.

3.1 Abstract

Objective. Regular physical activity (PA) is associated with many health benefits; however, up to 94% of postpartum individuals do not meet PA guidelines. Understanding mediators of postpartum PA behaviour change interventions is essential to increase PA participation following childbirth. The purpose of this review was to identify putative mediators of postpartum PA interventions.

Methods. Six databases were searched for primary or grey literature from inception until December, 2023. Intervention studies of any language were included if they contained 1) individuals ≤12-months postpartum, 2) a PA intervention, 3) a no exercise or different exercise comparator, and 4) a change in PA and putative mediator outcome that could be classified with the Theoretical Domains Framework (TDF). Results were categorized by mediation path, mediator TDF domain, and PA outcome.

Results. Twenty-eight articles (3,328 participants) were eligible and summary effects for Paths AB, A, B, and C were calculated from two, 19, two, and 18 unique studies respectively. For the mediation Path AB, we found very small effects from the domains of beliefs about capabilities ($r = .08$), beliefs about consequences ($r = .02$), environmental context and resources ($r = .01$), and social influences ($r = .08$). We found a small total effect (Path C; $r = .12$) of postpartum PA interventions on PA.

Conclusion. Future postpartum PA interventions should integrate components that increase outcomes under the domains of beliefs about capabilities, beliefs about consequences, environmental context and resources, and social influences. Further research that tests non-conscious mediators (e.g., PA habit, identity) is needed.

Keywords: Postpartum Period; Exercise; Systematic Review; Mediation Analysis; Behavior and Behavior Mechanisms

Public Significance Statement: Physical activity has many health and social benefits; however, the majority of postpartum individuals are not meeting recommended physical activity guidelines. Available interventions have limited effectiveness for increasing postpartum physical activity. Future interventions, at a minimum, should incorporate components that target the following: 1) beliefs about the benefits of physical activity, 2) confidence in being physically active postpartum, 3) reducing barriers to postpartum physical activity, and 4) leveraging social support.

3.2 Introduction

Regular physical activity (PA) is established to be an essential tool to enhance postpartum health; with strong evidence in its capacity to reduce depressive symptoms (Dipietro et al., 2019), and growing evidence to improve cardiovascular disease risk factors (e.g., weight loss, plasma LDL-C; Davenport et al., 2011; Dodd et al., 2018) and other psychological constructs of well-being (e.g., anxiety, self-compassion; Bahadoran et al., 2007; Lesser et al., 2023). Postpartum PA can also influence the health of future pregnancies and the health behaviours of their children. For example, postpartum PA contributes to interpregnancy weight loss which is associated with a lower risk of delivering a large-for-gestational age neonate (Dodd et al., 2018; Teulings et al., 2019). Furthermore, maternal PA is strongly associated with infant PA and longer term child PA as mothers are established to be key role models for their children (Katzenelenbogen et al., 2024; Prioreschi et al., 2018). In order to reap these benefits, international postpartum PA guidelines generally recommend 150-minutes of moderate- to vigorous-intensity PA (MVPA) including two sessions of muscle-strengthening exercises (MSE) per week and regular pelvic floor muscle training (PFMT; Evenson et al., 2024); however, between 22-94% of postpartum individuals fail to meet these recommendations (Albright et al., 2019; Lesser et al., 2023; Mielke et al., 2021; Pereira et al., 2007). Despite extensive interventional studies demonstrating the health benefits of postpartum PA (Deprato et al., 2025; Jones, Moolyk, et al., 2025), an understanding of key mediators to support PA participation is lacking.

Several reviews have summarized the effectiveness of postpartum PA interventions on changing PA behaviour (Gilinsky et al., 2015; Lim et al., 2020; Peralta et al., 2021; Turner et al., 2023). Two meta-analyses reported a significant and moderate effect of postpartum PA interventions on increasing PA in general (Lim et al., 2020) and MVPA frequency (Gilinsky et al., 2015), however, their impact on MVPA volume (i.e., product of frequency and time spent in MVPA), which provides a more comprehensive understanding of one's MVPA behaviour, has been very small or inconclusive (Gilinsky et al., 2015; Lim et al., 2020; Peralta et al., 2021; Turner et al., 2023). Further, postpartum PA interventions have not been successful in resulting in a greater proportion of participants meeting PA guidelines of 150-min MVPA per week (Burkart et al., 2020; Sanda et al., 2017). Return to PA following childbirth may be particularly challenging among postpartum individuals given the unique barriers they face, such as guilt due to time taken away from their children, feelings of disconnection with their postpartum bodies, lack of available childcare support, and lack of guidance in returning to PA following childbirth (Ritondo et al., 2024).

Postpartum PA interventions have mainly been informed by social cognitive (Conner & Norman, 2015) and action control frameworks (Rhodes & Yao, 2015) (see Gilinski et al. 2015). In the review from Gilinsky et al. (2015), the findings were unable to specify which behavioural change techniques were more common in interventions that were efficacious for changing MVPA volume specifically. In the review from Lim and colleagues (2020), no behavioural strategies were found to be significantly associated with PA. Further, in another review of interventions (Peralta et al., 2021), three of the four interventions were informed by theory, yet the specific theoretical mechanisms of action differentiating change in PA were unclear. Altogether, there is a lack of sound theoretical underpinning of what is working in postpartum PA interventions with regards to increasing PA.

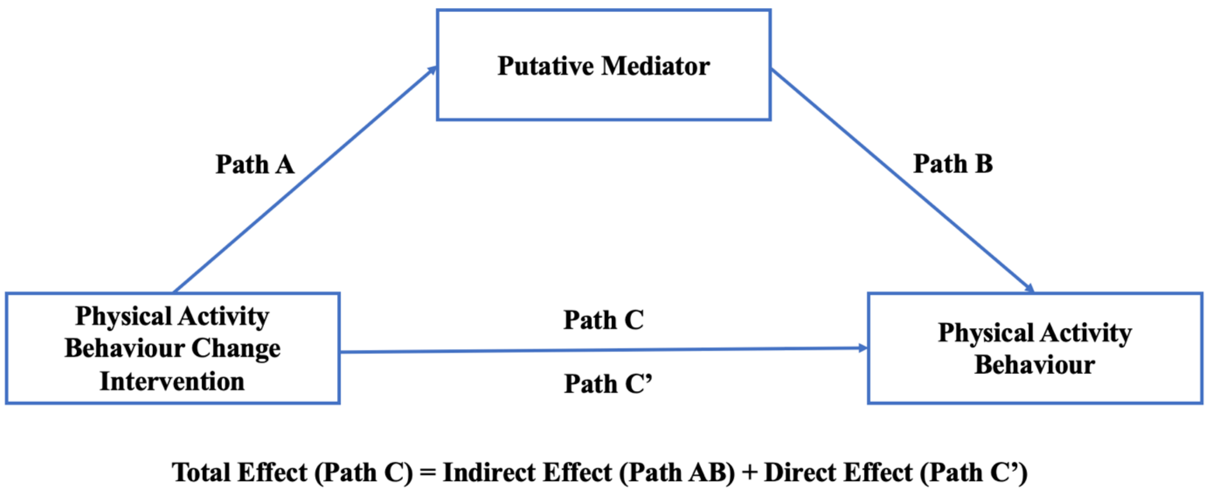
Other factors to consider when intervening on postpartum PA are clinical population and length of intervention. Gilinsky et al. (2015) identified two studies conducting PA interventions on postpartum clinical populations (i.e., gestational diabetes, postnatal depression) and found that neither were effective in changing PA. Peralta et al. (2021) reported that the majority of PA interventions were less than 3-months, suggesting a need for more postpartum PA interventions of "appropriate length" (at least three months duration). Research is needed to determine whether longer postpartum PA interventions are in fact more efficacious, particularly given the time burden amongst an already time-limited population.

To enhance the efficacy of interventions to increase postpartum PA (particularly MVPA volume), it is essential to understand the mediating pathways so that more targeted interventions can be developed (Baron & Kenny, 1986; Rhodes, Boudreau, et al., 2021). Mediation models explain whether the effect of an intervention on increasing PA is either partly (i.e., indirect mediation) or completely (i.e., direct mediation) due to a change in another intermediate variable, such as a psychological (e.g., self-efficacy) or environmental (e.g., childcare) construct (Baron & Kenny, 1986; See Figure 1 for a visual of a mediation model). For example, a group pram walking intervention that improves walking may be enacting its effect through increasing social support. Putative PA intervention mediators can be organized by the Theoretical Domains Framework (TDF) which represents an a priori classification of 14 domains of cognitive, affective, social, and environmental influences on behaviour (Cane et al., 2012). The TDF is ideal for this categorization because it integrates 33 theories of behaviour and behaviour change and includes the majority of major constructs applied in behaviour science (Atkins et al., 2017).

To date, there have not been any reviews that specifically explored putative mediators of postpartum PA interventions. Thus, the objective of this review was to determine the putative mediators of postpartum PA behaviour change interventions.

Figure 1

Mediation Diagram



3.3 Methods

We conducted a systematic review on putative mediators of PA, MSE, and PFMT interventions among postpartum individuals. The review was registered with PROSPERO (CRD #42020207107) and follows PRISMA reporting standards (Page et al., 2021). It was exempt from the institutional review board since it is a review of published literature. Deviations from the pre-registered protocol were the exclusion of abstracts where a full-text could not be retrieved and PA interventions that only involved stretching. We also did not calculate a relative risk or perform sub-analyses according to differing exercise variables (e.g., frequency, intensity, time, and type) because PA behaviour change intervention studies typically encourage increasing overall PA or focus on achieving PA guidelines rather than prescribing a specific exercise protocol for all participants to follow.

3.3.1 Eligibility Criteria

Study Design. All intervention studies with at least one intervention and control group were considered.

Population. Individuals who, at the beginning of the intervention, were up to 12-months following childbirth and ≥18 years of age. Postpartum was defined as 12-months postpartum in line with the 2016/2017 International Olympic Committee evidence summary of exercise in the postpartum period (Bø et al., 2017). The time period was also chosen because of the implications of early postpartum PA on immediate psychological and subsequent pregnancy health outcomes (Deprato et al., 2025; Dodd et al., 2018; Teulings et al., 2019).

Intervention. The intervention intended to increase postpartum PA, MSE, and/or PFMT behaviour and could be of any length. The intervention needed to begin following childbirth except for interventions that started during pregnancy and also included a separate intervention group that started following childbirth and could be independently assessed (as per Lim et al., 2020).

Control. The control group could be usual care, another type of intervention, or no intervention.

Outcome. The study measured both a change in PA outcome, either as a behaviour (either self-report or objective) or adherence (e.g., provided a measurement of intervention adherence, attendance, or compliance), as well as a change in at least one putative mediator, measured as a psychological or environmental outcome, inclusive of the 14 domains of the TDF (see Appendix A Supplemental Material 1; Cane et al., 2012).

3.3.2 Information Sources

Databases were searched from inception to December 13, 2023, including APA PsycINFO, CINAHL, SPORTDiscus, Scopus, Medline Ovid, and Web of Science. Gray literature was also searched using the Ovid Cochrane Central Register of Controlled Trials (inclusive of clinicaltrials.gov and WHO's International Clinical Trials Registry Platform). Search terms included synonyms of the following: "postpartum" AND "physical activity" AND "intervention" (see Appendix A Supplemental Material 2 for full search strategy). There were no limits on language or year. Subject headings were included in appropriate databases and Boolean searching was used to ensure retrieved articles included at least one term from each of the three groups. A manual search of reference lists from the retrieved eligible papers as well as relevant review papers was also conducted.

3.3.3 Study Selection

The Covidence systematic review software was used for title, abstract, and full-text screening (Veritas Health Innovation, Australia; Veritas Health Innovation, 2023). The initial search was conducted in March, 2022 and it was updated in December, 2023. During the search, two researchers (HH and one of ST, WS, AR, or EH) independently screened the titles and abstracts of all retrieved articles. If at least one reviewer deemed an article as meeting the initial screening criteria, the full-text was retrieved. Full-text articles were then independently screened by two reviewers. During the full-text screening, disagreements between individual judgements were resolved by meeting for consensus, and if still not resolved they consulted a third researcher (RER).

Data Collection

Data extraction and management were conducted in Microsoft Excel (Microsoft Corporation, 2024). Data were extracted from the selected papers from one researcher and a second researcher checked the extracted data. Researchers met to resolve disagreements and a third researcher was called upon when needed. Missing data was reported and authors were contacted for unreported data or additional details. Data to be extracted included 1) study characteristics (i.e., authors, year, study design, sample size, country), 2) participant characteristics (i.e., age, time postpartum, baseline activity status, parity, concomitant health issue) 3) intervention characteristics, (i.e., theory, duration and quality, setting, medium of dissemination, frequency, intensity, time, and type [FITT] of prescribed PA, and behavioural change techniques), 4) measurement characteristics of the objective or self-report of PA and mediating variable, coded as per the 14 domains of the TDF (Cane et al., 2012), revised as per Rhodes and colleagues (2021), to separate instrumental and affective beliefs, and the addition of fear of movement into the beliefs about consequences domain, 5) results of the PA behaviour and putative psychological mediator outcomes and, if available, the mediation analysis. See Appendix A Supplemental Table 1 for the extraction table and the extraction criteria.

3.3.4 Risk of Bias

Risk of bias (ROB) assessment was conducted using the Joanna Briggs Institute critical appraisal tools (Tufanaru et al., 2020). For more detailed informed of how ROB was assessed please see Appendix A Supplemental Material 4.

3.3.5 Analysis

Results were categorized by mediator TDF domain (Cane et al., 2012; Rhodes, Boudreau, et al., 2021), PA outcome (i.e., MVPA, total PA, walking, light PA, MSE, PFMT), and mediation path (see Figure 1). Four mediation paths were explored (Figure 1): 1) Path A is the effect of the PA intervention on the putative mediator, 2) Path B is the effect of the putative mediator on PA, controlling for the PA intervention, 3) Path C is the total effect of the PA intervention on PA without controlling for the mediator, 4) Path AB is the effect of the PA intervention on PA behaviour through the mediator and is the product of Path A and Path B. Due to methodological diversity including heterogeneity across interventions (e.g., length and mode of delivery) and outcome measure instruments for each domain, we decided not to conduct a meta-analysis (Deeks et al., 2019). Instead, as per the recommendation of the Cochrane Handbook for Systematic Reviews of Interventions (McKenzie & Brennan, 2019), we provided summaries of the effect estimates for each theme that included at least two studies with the same TDF domain, mediation path, and PA outcome (see Appendix A Supplemental Material 4 for more detailed information; Rhodes et al., 2020). When multiple PA outcomes were present in the same study, we prioritized device measured (i.e., accelerometer) PA outcomes over self-report PA outcomes and PA volume (e.g., minutes per week) over frequency (e.g., times per week), duration (e.g., minutes per session) and percentage of PA time (e.g., percentage of PA time spent in MVPA). PA outcomes were coded as only one of the six potential outcomes (i.e., MVPA, total PA, walking, light PA, MSE, or PFMT) from each study. We also included an Omnibus PA category which included data from papers that did not report MVPA but did report total PA.

For each theme, the mean differences of change in continuous outcomes between the intervention group and the control group were examined. The difference in change scores were used to account for interventions that started during pregnancy but a change in outcomes could be measured during the postpartum period. In calculating the mean differences of change, the baseline standard deviations were used for the pooled standard deviation. We used RStudio (RStudio Team, 2021) to calculate the mean differences of change and subsequently converted them to Pearson correlation r with an online ES conversion calculator (https://www.escal.site/). If multiple measurements were taken of the same domain in one article, we coded the one with the largest ES (see Appendix A Supplemental Material 4 for a more detailed explanation). The median effect size (ES; Pearson correlation r) and interquartile range (IQR) for each theme were presented. The ES were deemed very small if $r < .10$ (as per Rhodes, Boudreau, et al., 2021) small if $r \geq .10$, medium if $r \geq .30$, and large if $r \geq .50$ (Cohen, 1992).

3.3.6 Secondary Analyses

In order to assess the articles that did not provide sufficient data to calculate an ES (e.g., they only reported medians and IQR for continuous outcomes), we also summarized the overall significance across each theme. A statistically significant difference in change of a continuous outcome was indicated if either $p <.05$, the 95% confidence interval did not cross 0, or the narrative summary provided a statement of statistical significance (see more information in Appendix A Supplemental Material 4). As per the Sallis and colleagues (2000) rubric for determining the impact and consistency of findings, themes were considered to a) have a positive pathway (+) if more than 59% of studies report a positive significant effect, b) have a negative pathway (-) if more than 59% of studies report a negative significant effect, c) be inconclusive (?) if 34%-59% of studies find a significant effect, d) are non-significant (ns) if less than 34% of studies showed a significant effect. If fewer than two studies examined a path, the evidence strength was not assessed but the results were represented in Appendix A Supplemental Table 1. In studies where multiple measurements were taken of the same domain, if 50% or more of the tests in a given category were significant, the paper was deemed significant (Rhodes, Zhang, et al., 2020).

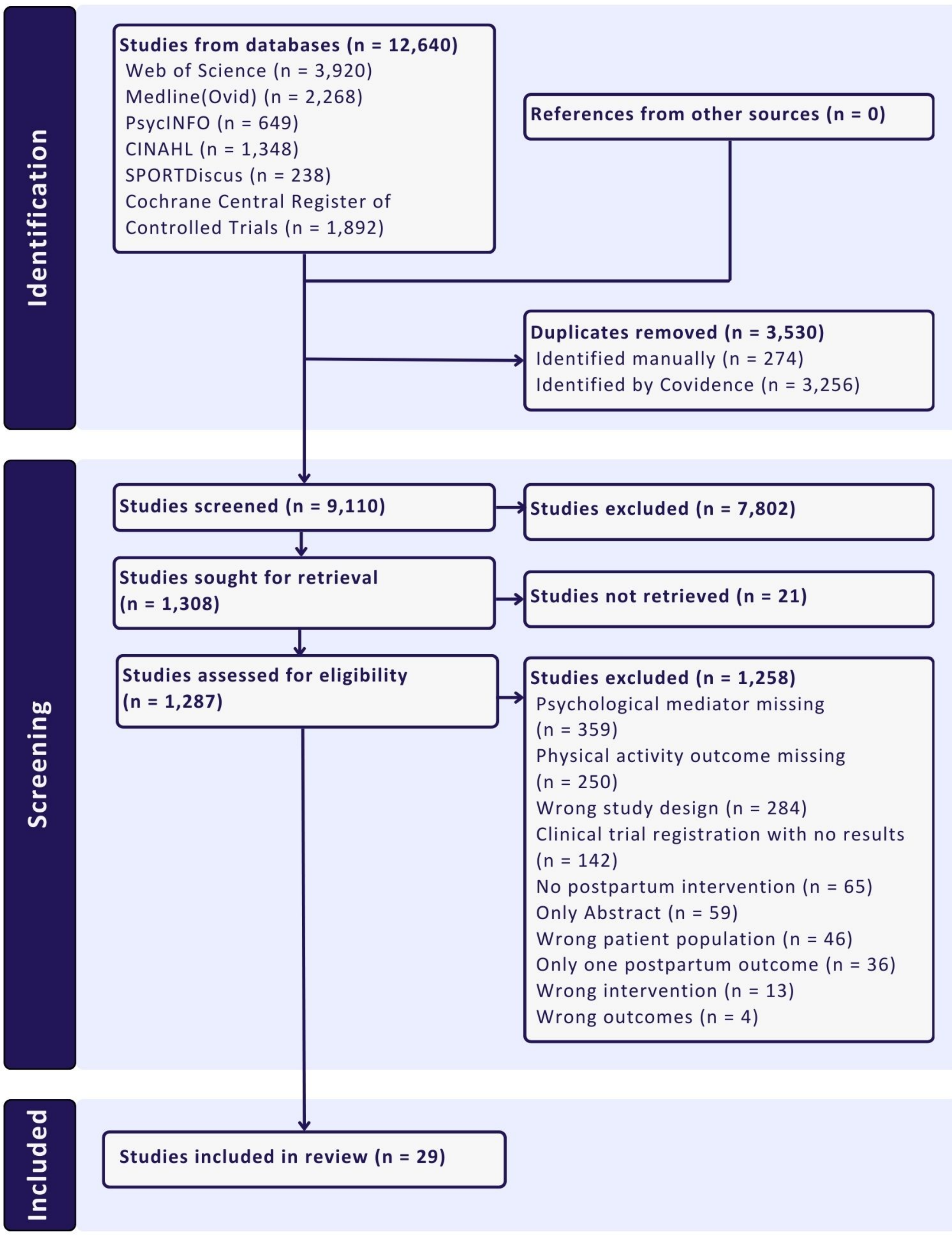
Additionally, for Path C, (see Figure 1), the following moderators were assessed for Omnibus PA: clinical population, 2) intervention theory, 3) intervention duration, and 4) ROB. We did this by creating summary ES for each group across each moderator.

3.4 Results

Our search retrieved 12,640 results and after removing 3,530 duplicates; we screened 9,110 by title and abstract and excluded 7,802 articles. Inter-rater reviewer reliability ranged from 83-89% agreement, indicating overall acceptable agreement (McHugh, 2012). All articles with at least one “agree” were sought for retrieval and 21 (1.6%) could not be retrieved (e.g., through the university interlibrary loan service). Full-text screening was assessed for 1,287 articles and inter-rater reviewer reliability ranged from 79-86% agreement, indicating an overall acceptable agreement of at least 80% (McHugh, 2012). All articles with at least one “agree” was extracted and additional articles were excluded during this phase, requiring agreement from two authors. The most common reasons for exclusion were missing outcomes of putative mediators and/or PA and study design. Twenty-nine articles met our inclusion criteria and were included in our analysis (see Figure 2). We were able to calculate ES (Pearson correlation r) for Paths AB, A, B, and C from two, 19, two, and 18 unique studies respectively. The remaining articles were included in the secondary analysis summary of statistical significance.

Figure 2

PRISMA Diagram



Study Characteristics

Data extraction can be found in Appendix A Supplemental Table 1 and study characteristics are presented in Table 3. Of the 29 articles, most were conducted in the United States (*n* = 10), Australia (*n* = 7), and the United Kingdom (*n* = 6). Half of the study designs were randomised controlled trials (RCTs; 50%), three were quasi-experimental, one was a cluster RCT, and 10 were pilot/feasibility studies. Half of the studies examined clinical populations, including individuals who were overweight or obese (n = 6), individuals with gestational diabetes mellitus (n = 4), depressive symptomatology (n = 3), and urinary incontinence (n = 1) .

Table 3

Study Characteristics

(n = 29 studies; 28 unique samples)	Number of studies	Percent (%)
Country		
United States	10	35.71
Australia	7	25.00
United Kingdom	6	21.43
Canada	2	7.14
Korea	1	3.57
Iran	1	3.57
Malaysia	1	3.57
Study Design		
Randomized Controlled Trial	14	50.00
Quasi-experimental study	3	10.71
Pilot/Feasibility RCT	7	25.00
Pilot Quasi-experimental study	1	3.57
Cluster RCT	1	3.57
Pilot/Feasibility Cluster RCT	2	7.14
Clinical Population		
Gestational Diabetes Mellitus	4	14.29
Depressive Symptomatology	3	10.71
Overweight/Obese	6	21.43
Urinary Incontinence	1	3.57
Not an inclusion criterion	14	50.00
Theoretical Domain		
Knowledge	2	7.14
Skills	0	0

Social/professional role and identity	1	3.57
Beliefs about capabilities	18	64.29
Optimism	0	0
Beliefs about consequences	6	21.43
Reinforcement	0	0
Intentions	3	10.71
Goals	2	7.14
Memory, attention and decision processes	0	0
Environmental context and resources	6	21.43
Social influences	8	28.57
Emotion	13	46.43
Behavioural regulation	8	28.57
Physical Activity Measure		
Self-report	27	96.43
Active Australia Survey	5	17.86
Australian Women's Activity Survey	1	3.57
Godin-Leisure Exercise Questionnaire	3	10.71
Health-Promoting Lifestyle Profile	3	10.71
International Physical Activity Questionnaire	4	14.29
Pregnancy Physical Activity Questionnaire	4	14.29
Stanford Brief Activity Survey	1	3.57
7-day Physical Activity Recall	2	7.14
1999 National Physical Activity Survey	1	3.57
Type, duration, frequency	2	7.14
Device-measured	10	3.57
Accelerometers	8	28.57
Actiheart device	1	3.57
Pedometers	2	7.14
Intervention Focus		
MVPA (150min/week)	18	64.29
General physical activity	6	21.43
Steps	1	3.57
Muscle strengthening exercises	5	17.86
Pelvic floor muscle training	1	3.57
Flexibility	2	7.14
Intervention Theory		
Social cognitive theory	12	42.86
Transtheoretical model	3	10.71
Theory of planned behaviour	2	7.14
Fun theory	1	3.57
Relapse prevention theory	1	3.57
Self-regulation theory	1	7.14
Health action process approach	3	10.71
Socio-ecological model	1	3.57

BASNEF (Beliefs, Attitude, Subjective norms, Enabling factors) model	1	3.57
No theory	10	35.71
Intervention Medium		
Telephone calls	13	46.43
Educational classes	10	35.71
Educational leaflet	10	35.71
Pedometer	10	35.71
Face-to-face consultations	9	32.14
Exercise supervision (either one-on-one or in group)	8	28.57
Exercise classes	7	25.00
Logbook	5	17.86
Online social group	4	14.29
Text messages	3	10.71
Website	3	10.71
Online Intervention	3	10.71
Complementary gym membership	2	7.14
Smartphone app	2	7.14
Emails	2	7.14
Mobile Virtual Reality program	1	3.57
Provided home exercise equipment	1	3.57
Commercial weight management program	1	3.57
Intervention duration		
3-months or shorter	16	57.14
Over 3-months	12	42.86
Type of PA measured		
MVPA	24	85.71
Total PA	10	35.71
Walking	8	28.57
Light PA	6	21.43
Pelvic floor muscle training	1	3.57

3.4.1 Risk of Bias

Of the randomized trials (*n* = 25; including the pilot/feasibility RCTs, cluster RCTs, and pilot/feasibility cluster RCTs), the overall risk of bias was low in seven studies and high in 18 (see Appendix A Supplemental Table 2). The most common reasons for bias were a lack of blinding of individuals delivering the intervention to treatment assignment (*n* = 25), a lack of blinding of participants to treatment assignment (*n* = 24), a lack of blinding of outcome assessors to treatment assignment (*n* = 18), a lack of adequate description and analysis of drop-outs (*n* = 16), a unclear difference in groups at baseline (*n* = 11), and participants were not analyzed in the groups to which they were randomized (*n* = 10). The overall risk of bias was low for the four quasi-experimental trials (see Appendix A Supplemental Table 3; including the pilot quasi-experimental study).

3.4.2 Physical Activity Interventions

The most common intervention mediums were individual telephone calls (*n* = 13), educational classes (*n* = 10), and educational leaflets (*n* = 10). Participants were provided at least one supervised exercise session, either individually or in a group, in eight studies. In some interventions, participants were given a pedometer (*n* = 10) or logbook (*n* = 5) to support the intervention. Duration of intervention delivery ranged from 4-weeks to 12-months; 16 (57%) interventions were 3-months or shorter and 12 (43%) interventions lasted longer than 3-months. Interventions were most commonly informed by social cognitive theory (*n* = 12), followed by the transtheoretical model (*n* = 3), the health action process approach (*n* = 3), and the theory of planned behaviour (*n* = 2). Ten studies were not described as being informed by a theory.

3.4.3 Physical Activity Outcomes

All but one study utilized self-reported PA while 10 articles also reported a device-measured outcome. PA was measured in the forms of MVPA (*n* = 24), total PA (*n* = 10), walking (*n* = 8), light PA (*n* = 6), and PFMT (*n* = 1). None of the studies measured a change in MSE. If it was clear that the walking outcome pertained to light or MVPA, it was coded as such and if not, it was coded as "walking".

3.4.4 Putative Mediators

Out of the 14 domains of the TDF, the most commonly measured putative mediators fell under the domains of beliefs about capabilities (*n* = 18; e.g., self-confidence to overcome barriers to PA), emotion (*n* = 13; e.g., depression, anxiety), social influences (*n* = 8; e.g., social support for exercise), behavioural regulation (*n* = 8; e.g., PA planning and scheduling), and beliefs about consequences (*n* = 6; e.g., perceived benefits to postpartum PA). Putative mediators from four domains (skills, optimism, reinforcement, and memory, attention and decision processes) were not identified.

Three studies conducted formal mediation analyses. Albright and colleagues (2019) used longitudinal autoregressive mediation path models (MacKinnon, 2008), Fjeldsoe and colleagues (2013) used a simple product-of-coefficient approach using Sobel tests (Preacher & Hayes, 2004) to examine concurrent mediation (change in mediators and behavioural outcomes from baseline to 6-weeks or baseline to 13-weeks) and longitudinal mediation (change in mediators from baseline to 6-weeks and changes in behavioural outcomes from 6-weeks to 13-weeks), and Cramp and Brawley (2009) applied the prospective hierarchical multiple regressions using the Sobel test (Baron & Kenny, 1986; Sobel, 1982).

Omnibus (any) Physical Activity

Path C. Based on effect sizes provided from 18 independent samples, the overall Path C effect size on Omnibus PA was small (Median *r* = .12; IQR: .03, .28) and the pathway was non-significant. The summary effects for Paths A, B, and AB can be found in Table 4.

Path A. Nineteen articles reported Path A and the median effect sizes were small for beliefs about capabilities (Median *r* = .11; IQR: .01, .21), beliefs about consequences (Median *r* = .14; IQR: .01, .32), intentions (Median *r* = -.24; IQR: -.27, .01), and behavioural regulation

(Median r = .25, IQR: .22, .31); and very small for knowledge (Median r = .09; IQR: -.14, .32), environmental context and resources (Median r = .02; IQR: -.07, 14), social influences (Median r = .04; IQR: -.06, .30), and emotions (Median r = -.06; IQR: -.17, .03).

There was a significant positive pathway for behavioural regulation and inconclusive pathways for knowledge, beliefs about capabilities, beliefs about consequences, and intentions. The following pathways were non-significant: environmental context and resources, social influences, and emotions.

Path B. Two articles reported Path B and the median effect sizes were small for beliefs about capabilities (Median r = .23; IQR: .16, .29), beliefs about consequences (Median r = .24; IQR: .12, .35), social influences (Median r = .22; IQR: .21, .24), and environmental context and resources (Median r = -.16; IQR: -.25, -.08). The significance of all pathways were inconclusive.

Path AB. Two articles reported Path AB and the median effect sizes were very small for beliefs about capabilities (Median r = .08; IQR: .04, .11), beliefs about consequences (Median r = .02; IQR: .01, .02), environmental context and resources (Median r = .01, IQR: .01, .01), and social influences (Median r = .08, IQR: .07, .10). All pathways were non-significant.

Table 4

Mediation Paths A, B, and AB for Omnibus PA

	Path A effect size r Median(IQR) (n = 19)	Path A overall significance (n = 26)	Path B (effect size r) Median (IQR) (n = 2)	Path B (p-value) (n = 2)	Path AB (effect size r) Median (IQR) (n = 2)	Path AB (p-value) (n = 2)
Knowledge	.09(-.14, .32)[1,2]	(?)[1,2]	NA	NA	NA	NA
Skills	NA	NA	NA	NA	NA	NA
Social/professional role and identity	NA	NA	NA	NA	NA	NA
Beliefs about capabilities	.11(.01, .21)[1,3–12]	(?)[1,3,5–17]	.23(.16, .29)[3,9]	(?)[3,9]	.08(.04, .11)[3,9]	(ns)[3,9]
Optimism	NA	NA	NA	NA	NA	NA
Beliefs about consequences	.14(.01, .32)[2,3,5,7,9,18]	(?)[2,3,5,7,9,13,18]	.24(.12, .35)[3,9]	(?)[3,9]	.02(.01, .02)[3,9]	(ns)[3,9]
Reinforcement	NA	NA	NA	NA	NA	NA
Intentions	-.24(-.27, .01)[1,2,7]	(?)[1,2,8,17]	NA	NA	NA	NA
Goals	NA	NA	NA	NA	NA	NA
Memory, attention and decision processes	NA	NA	NA	NA	NA	NA
Environmental context and resources	.02(-.07, .14)[1–3,6,9]	(ns)[1–3,6,9,13]	-.16(-.25, -.08)[3,9]	(?) [3,9]	.01(.01, .01)[3,9]	(ns) [3,9]
Social influences	.04(-.06, .30)[1–3,9,10,19,20]	(ns)[1–3,9,10,13,16,19–21]	.22(.21, .24)[3,9]	(?) [3,9]	.08(.07, .10) [3,9]	(ns)[3,9]
Emotion	-.06(-.17, .03)[1,8,10,11,19,20,22–24]	(ns)[1,8,10,11,15,16,19,20,22–26]	NA	NA	NA	NA
Behavioural regulation	.25(.22, .31)[1,6,7,18,20,24,27]	(+)[1,6,7,16,18,24,27]	NA	NA	NA	NA

Note:
(+) = more than 59% of studies report a significant positive effect ($p < .05$).

(-) = more than 59% of studies report a significant negative effect (p <.05).
(?) = 34%-59% of studies find a significant effect in each direction (inconclusive)
(ns) = less than 34% of studies showed an effect in each direction (no effect)
NA = not applicable due to inadequate studies available to assess the summary effect
See Appendix A Supplemental Material 7 for a reference list of all included articles

Specific Types of Physical Activity

For Path C, there were small effects on MVPA (Median r = .10; IQR: .03, .25; n = 17) and on total PA (Median r = .16, IQR: -.01, .27; n = 9) and very small effects on walking (Median r = .03, IQR: -.02, .09; n = 5) and on light PA (Median r = .09; IQR: .04, .17; n = 4). The pathway was overall non-significant across all types of PA. The summary effects for Path A, B, and AB for MVPA, total PA, walking, and light PA can be found in Appendix A Supplemental Tables 4, 5, 6, and 7 respectively.

3.4.5 Sub-Analyses

We explored the following moderators for Path C on Omnibus PA: clinical population, intervention theory, intervention duration, and risk of bias (see Table 5).

Clinical Population

The median effect was small and negative for the studies that included individuals with symptoms of *depression* (Median r = -.28; IQR: -.49, -.08; n = 2); small for the studies that included individuals with a history of *gestational diabetes mellitus* (Median r = .16; IQR: .10, .23; n = 2) as well as the studies that *did not have clinical inclusion criteria* (Median r = .18; IQR: .06, .42; n = 11); and very small for the studies that included individuals who were *overweight or obese* (Median r = .09; IQR: -.23, .17; n = 3).

Intervention Length

The median effect was small for the studies that included interventions that were 3-months or less (Median *r* = .18; IQR: .03, .42; *n* = 12) and very small for the studies included interventions that were over 3-months (Median *r* = .09: IQR: .05, .17; *n* = 6).

Intervention Theory

The median effects were small for the studies that had interventions that were primarily informed by a cognitive behavioural theory (e.g., social cognitive theory, transtheoretical model, theory of planned behaviour, or BASNEF; Median *r* = .10; IQR: .03, .29; *n* = 9), an action control theory (e.g., self-regulation theory, HAPA; Median *r* = .13; IQR: .08, .18; *n* = 2), and no theory (Median *r* = .19; IQR: .10, .37; *n* = 6).

Risk of Bias

The median effects were small for the studies that were deemed high ROB (Median *r* = .11, IQR: .03, .33; *n* = 12) and those that were deemed low ROB (Median *r* = .14, IQR: .09, .22; *n* = 6).

Table 5

Path C Moderators for Omnibus PA

(n = 29; 28 independent samples)

		Depression	*Overweight*	*GDM*	*No Clinical Pop*
Clinical Population	ES median(IQR)	-.28(-.49, .08) [1,8]	.09(-.23, .17) [4,11,15]	.16(.10, .23) [12,14]	.18(.06, .42) [3,5–7,9,19,20,22,24,27,28]
	p-value	(ns) [1,8,10]	(ns) [11,15–17,25]	(ns) [12,14,23,26]	(?) [2,3,5–7,9,13,19–22,24,27,28]
		Cognitive Behavioural	*Socio-ecological model*	*Action Control*	*N/A*
Intervention Theory	ES	.10(.03, .29) [3–5,7,9,12,14,22,28]	NA	.13(.08, .18) [6,27]	.19(.10, .37) [8,11,15,19,20,24]

	median(IQR)				
	p-value	(ns) [2,3,5,7,9,12–14,16,17,22,28]	NA	(ns) [6,23,27]	(ns) [8,10,11,15,19–21,24–26]
		3-months or under	*Over 3-months*		
Intervention Duration	ES median(IQR)	.18(.03, .42) [1,5–9,11,19,20,22,24,27]	.09(.05, .17) [3,4,12,14,15,28]		
	p-value	(?) [1,2,5–9,11,16,17,19,20,22,24,27]	(ns) [3,10,12–15,23,25,26,28]		
ROB	ES	High Risk	Low Risk		
	Median (IQR)	.11(.03, .33) [1,5,6,8,9,11,12,14,15,19,22,24,28]	.14(.09, .22) [3,4,7,20,27]		
	p-value	(ns) [1,5,6,8–17,19,22–24,28]	(ns) [2,3,7,20,21,25–27]		

Notes:
(+) = more than 59% of studies report a significant positive effect (p <.05).
(-) = more than 59% of studies report a significant negative effect (p <.05).
(?) = 34%-59% of studies find a significant effect in each direction (inconclusive)
(ns) = less than 34% of studies showed an effect in each direction (nonsignificant)
NA = not applicable due to inadequate studies available to assess the summary effect
See Appendix A Supplemental Material 7 for a reference list of all included articles

3.5 Discussion

The purpose of this review was to identity putative mediators of postpartum PA interventions to better understand how interventions are working and how future interventions can be improved. Our systematic search retrieved 29 postpartum PA intervention studies of which we could calculate effect sizes on Omnibus PA (which prioritized MVPA volume) for Paths AB, A, B, and C from two, 19, two, and 18 unique studies respectively (See Figure 1). We found an overall small effect of postpartum PA interventions improving Omnibus PA (Path C) and that interventions were indirectly mediated (Path AB) with a very small effect by putative mediators from the TDF domains of beliefs about capabilities, beliefs about consequences, environmental context and resources, and social influences. Our ROB moderation analysis demonstrated that studies with high ROB had slightly higher Path C median effects compared to studies with low ROB.

Our Path AB indirect mediation findings were similar to a meta-analysis of PA intervention mediators targeting non-clinical adults (Rhodes, Boudreau, et al., 2021). They inform us that in order to optimally promote postpartum PA, it may be beneficial to provide information on 1) why postpartum PA is beneficial (i.e., beliefs about consequences domain), 2) how to improve PA self-efficacy (i.e., beliefs about capabilities domain), 3) how to identify barriers to PA participation (i.e., environmental context and resources domain), and 4) how to leverage social support to meet PA goals and intentions (i.e., social influences domain).

Based on these findings, we recommend postpartum PA interventions target outcomes that can be classified under the TDF domains of beliefs about consequences, beliefs about capabilities, environmental context and resources, and social influences. For example, researchers should work with postpartum subgroups (e.g., postpartum individuals with pregnancy-related low back pain, pelvic girdle pain, urinary incontinence, or depression) to identify PA health and wellness outcomes that are directly relevant to each subgroup (Finlayson et al., 2020; Slattery et al., 2020). PA self-efficacy could be improved by providing specific examples of progressive exercises that are appropriate for individuals who have just experienced pregnancy and childbirth. For example, the Fit for the Future booklet from Pelvic, Obstetric and Gynaecological Physiotherapy includes advice on exercise progressions for individuals following childbirth (Pelvic, Obstetric and Gynaecological Physiotherapy, 2024). The most common barriers to postpartum PA are lack of time and available childcare (Burton et al., 2019) and, therefore, PA interventions should also incorporate suggestions around exercising with an infant. For example, stroller running should commence at least 6-months postpartum, slowly and graded, with an initial two-handed technique to reflect the speed and stride length of non-stroller running (Goom et al., 2019). Moreover, postpartum individuals should seek a proper fit for their babywearing garment to prevent musculoskeletal pain (Havens et al., 2022). Time sensitive recommendations could include brief home exercise videos or accumulating PA across the day (e.g., by parking farther away from the store). Finally, social support should be promoted, particularly social support from family in the forms of discussion about PA, co-participation in PA, and taking over chores (Bennetter et al., 2023).

In addition to the domains already identified in Path AB, we observed summary effects for Path A (i.e., the association between the PA intervention and putative mediator), in the domains of behavioural regulation (small positive effect), knowledge (very small positive effect), and emotions (small negative effect implying reduced negative emotions). However, there were not any studies that measured Path B or Path AB for these domains. Therefore, it is possible that interventions aiming to enhance action planning (i.e., behavioural regulation), structured information on how to exercise postpartum (i.e., knowledge), and reduce symptoms of anxiety (i.e., emotions) may be influencing their effect on PA behaviour through these mediating variables. Our Path C summary effect, which was based on 18 studies and prioritized MVPA volume, is slightly greater than Gilinski and colleagues' (2015) summary effect on MVPA volume (SMD = .15). When comparing this summary effect to benchmarked PA intervention effects (using a Cohen's *d* of .20 from Pearson *r* of .10), it fell near the top of the 45th percentile which corresponds to an additional 14.1 minutes per day of MVPA or an additional 3.9% meeting PA guidelines (Wright et al., 2021).

We had inadequate studies to assess the TDF domains of skills, optimism, reinforcement, goals, memory, attention and decision processes, and social/professional role and identity. Constructs that fall under these domains may be of particular importance to postpartum individuals. For example, outcomes from the behavioural regulation domain may be impacted by increased cognitive overload/tiredness (i.e., memory, attention and decision processes domain) amongst a population who is already facing a high rate of fatigue (64%; Badr & Zauszniewski, 2017). Further, non-conscious psychological constructs, such as habits (i.e., reinforcement domain) or PA identity (i.e., optimism, social/professional role and identity domain) may be particularly relevant since postpartum individuals are facing a period of developing new routines, usually revolving around the schedules of their infants, and new identity as a mother or parent (Laney et al., 2015). PA identity (e.g., "exercising within or around motherhood") may contribute to increased PA engagement despite the barriers (Bean et al., 2023). In fact habit and PA identity have predicted translation of the PA intention-behaviour gap, which is the conceptualization of the commonly observed lack of behavioural follow-through from PA intentions, in postpartum individuals (Rhodes, Beauchamp, et al., 2021; Sheeran & Webb, 2016).

We explored sub-analyses by clinical population, intervention length, and intervention theory as moderators of Path C. For clinical population, studies that recruited individuals with a history of gestational diabetes mellitus or no clinical condition had a small effect, studies that recruited individuals who were overweight or obese had a very small effect, and studies that recruited individuals with depressive symptoms had a small negative effect. The observed differences in effect sizes could be the consequence of clinical and non-clinical postpartum populations having unique predictors for PA behaviour and as such needing tailored interventions. For intervention length, studies with shorter interventions (3-months or less) had a small effect while those with longer interventions (over 3-months) had a very small effect. This finding is contradictory to the recommendation from Peralta (2021) that future postpartum PA interventions should be longer (i.e., >3-months) in length. For intervention theory, the effect was small regardless of whether the interventions were informed by a social cognitive model, an action control model, or no theory. We would usually expect to see a larger effect from interventions informed by action control models since they are proposed to assist individuals in overcoming the PA intention-behaviour gap, resulting in more consistent PA behaviour (Feil et al., 2023; Howlett et al., 2019). It may be that since the postpartum population has so little available leisure time, PA interventions incorporating action planning may not be assisting in overcoming this barrier (Rhodes, Beauchamp, et al., 2021). Altogether these findings suggest that interventions might need to be shorter (< 3-months) while still focusing on long-term PA changes. Additionally, interventions may need to target PA predictors that are unique to non-clinical and clinical sub-populations and they should be informed by theories beyond those that have already been tested.

3.5.1 Limitations

Despite the strengths of this review, there are several limitations worth noting. First, the effect sizes were all small or very small which limits the interpretability or potential effectiveness of the findings. Second, we were unable to perform a meta-analysis due to heterogeneity amongst the intervention characteristics and outcome measures across the TDF domains. Future reviews may revisit these outcomes when higher quality research is available. Third, we were only able to identify one study that measured a change in PFMT and none that measured a change in MSE in combination with a putative mediator. Thus, future research on interventions targeting MSE and PFMT with mediation analyses is needed. Fourth, no studies reported postpartum PA interventions for populations with musculoskeletal conditions (e.g., pregnancy-related low back pain, pelvic girdle pain, urinary incontinence, diastasis rectus abdominus, etc.). These are essential considerations since an extensive proportion of postpartum individuals suffer from at least one of these conditions (Sperstad et al., 2016; Thom & Rortveit, 2010; Wu et al., 2004) and they can have substantial negative consequences on PA behaviour (Clark & Thorpe, 2023; Dakic et al., 2022).

3.6 Conclusion

This is the first review to assess putative mediators of postpartum PA interventions. We found few articles in the postpartum PA intervention literature that conducted formal mediation analyses. For the mediation Path AB, we found very small effects for beliefs about capabilities, beliefs about consequences, environmental context and resources, and social influences which implies that integrating intervention components that aim to enhance outcomes of these domains may be beneficial for future postpartum PA interventions. For Path C, we found an overall small effect of postpartum PA interventions on PA. Mediators of postpartum MSE and PFMT interventions are still largely unknown. Further research is needed that tests mediating variables of postpartum PA interventions, particularly those that promote post-intentional and non-conscious of processes of building PA habits and identity.

3.7 Acknowledgements

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Chapter 4: Postpartum Physical Activity Action Control — Is it Impacted by the Presence of Pregnancy-Related Lumbopelvic Pain?

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4.1 Abstract

Background: Most postpartum physical activity (PA) research is informed by social cognitive frameworks which do not account for the commonly observed PA intention-behaviour gap. The multi-process action control (M-PAC) framework includes post-intentional constructs (e.g., behaviour regulation, habit, identity) that target intention-behaviour translation. The M-PAC framework may need to be expanded to account for postpartum PA-relevant variables such as lumbopelvic pain (LPP), fear of movement, and perceived change in walking/running gait. This study sought to determine 1) the postpartum PA intention-behaviour gap, 2) predictors of intention-PA translation using M-PAC constructs and postpartum PA-relevant variables, and 3) whether the findings are moderated by the presence LPP.

Methods: A sample of n = 224 individuals <12-months postpartum (mean age = 33.18; SD = 3.91; 58.9% with LPP) completed 1) M-PAC measures, 2) postpartum-relevant variables, 3) intention to engage in PA, and 4) PA participation (meeting 150 minutes/week of moderate-to-vigorous PA [MVPA]). Multivariate analysis of variance (ANOVA) with follow-up discriminant function analysis were conducted to compare the groups across each predictor variable and one-way ANOVAs determined which variables predicted successful from unsuccessful intenders.

Results: The intention-behaviour gap was 25.5% and it was predicted by identity (d = .88), habit (d = .84), affective attitude (d = .74), fear of movement (d = -.66), perceived opportunity (d = .58), and reactive regulation (d = .46). LPP attenuated the effect of perceived opportunity on intention-PA translation.

Conclusion: Future postpartum PA interventions should target PA identity, habit, affective attitude, fear of movement, perceived opportunity, and reactive regulation.

Keywords: postpartum period; exercise; pelvic girdle pain; low back pain; intention-behaviour gap

4.2 Introduction

Postpartum physical activity (PA) provides both short- and long-term health and wellness benefits to both the birth parent as well as their children. Specifically, postpartum PA decreases the risk of developing type 2 diabetes by 28% and lowers cardiometabolic risk factors such as triglycerides, VLDL-c, and systolic blood pressure (Jones, Moolyk, et al., 2025). Furthermore, postpartum PA reduces the odds of developing postpartum depression by 45% with moderate evidence that it reduces the severity of depression and anxiety symptoms (Deprato et al., 2025). An additional social benefit of postpartum PA is its positive influence on future child PA, which is ultimately associated with health and wellness benefits to their children as well (Cliff et al., 2017; Prioreschi et al., 2018; Rhodes, Guerrero, et al., 2020; Yao & Rhodes, 2015). Thus, promoting postpartum PA should be a public health priority.

Recent PA guidelines recommend that postpartum individuals accumulate at least 120 minutes of moderate-to-vigorous PA (MVPA) per week (Davenport, Ruchat, et al., 2025). Given the recency of these guidelines, surveillance data for meeting these guidelines is not yet available. However, prior postpartum PA participation research applying the historically recommended 150 min/week MVPA cut-point (Bull et al., 2020; Evenson et al., 2024b) demonstrated over 55% of postpartum individuals were not meeting those guidelines (Coll et al., 2015; Evenson et al., 2012, 2013; Lesser et al., 2023). To date, interventions designed to increase accumulated PA postpartum have exhibited moderate effects on PA overall (inclusive of all intensities) and MVPA frequency, however their impact on MVPA volume or meeting MVPA guidelines is inconclusive (Gilinsky et al., 2015; Lim et al., 2020; Turner et al., 2023). Given that available interventions have not demonstrated a meaningful impact on MVPA volume, the PA outcome that is associated with most health benefits (Davenport, Ruchat, et al., 2025), a sound theoretical understanding of postpartum PA behaviour is needed to determine more effective PA promotion (Michie et al., 2018).

Currently, the research evidence is either mixed or unsubstantiated for postulated contributors to postpartum PA. Common barriers to postpartum PA cited in observational research are lack of time and childcare (Cramp & Bray, 2011; Evenson et al., 2009), yet, interventions that attempt to overcome these barriers by incorporating the behaviour change technique (BCT) "barrier identification/problem-solving" have not been overall efficacious (Gilinsky et al., 2015). Similarly, a common postpartum PA predictor in observational research is social support (Bennetter et al., 2023; Evenson et al., 2009), yet, group-based postpartum PA interventions (which aim to promote PA through social support) do not reliably lead to improved PA levels (Peralta et al., 2021). The evidence is either mixed or unsubstantiated for other postulated contributors to postpartum PA, including education targeting instrumental attitudes (e.g., information on consequences of postpartum PA), self-efficacy (e.g., instruction on how to perform postpartum PA), and proactive behavioural regulation (e.g., goal setting, self-monitoring

Gilinsky et al., 2015; Lesser et al., 2023; Lim et al., 2020). As such, there is still room for improvement regarding theoretical underpinnings of postpartum PA.

Much of both the postpartum PA observational and intervention research (see a summary described above) has been dominated by social cognitive frameworks. These frameworks place PA as the direct result of intentions that are formulated primarily by outcome expectations (e.g., expected health outcomes) and self-efficacy (Gilinsky, 2014; Hollman, Tran, et al., 2025). Social cognitive frameworks may not fully account for the commonly observed gap between PA intentions and behaviours (i.e., nearly half of individuals intending to be physically active are not enacting these intentions; Feil et al., 2023; Rhodes, La, et al., 2021). The intention-behaviour gap and predictors of its translation can be examined using a 2 x 2 intention-behaviour profiling method (Feil et al., 2023; Sheeran, 2002). This method typically includes four quadrants: two congruent profiles (i.e., non-intenders who are subsequently not meeting PA guidelines; successful intenders who are meeting PA guidelines) and two incongruent profiles (i.e., non-intenders who are subsequently meeting PA guidelines; unsuccessful intenders who are not meeting PA guidelines) (Feil et al., 2023; Sheeran, 2002). Successful intenders can then be compared to unsuccessful intenders to determine whether there are unique predictors that differentiate successful from unsuccessful intenders.

One approach that can be applied to the 2 x 2 intention-behaviour profiling method and targets sustained PA intention-behaviour translation is the multi-process action control (M-PAC) framework (Rhodes, 2017; Rhodes & de Bruijn, 2013). The M-PAC framework integrates pre-intentional *reflective constructs* from the traditional social cognitive approach, with volitional *regulatory* and *reflexive constructs* that altogether and independently facilitate intention development and translation into successful ongoing PA (Rhodes, 2017). *Reflective constructs* include instrumental attitude, affective attitude, perceived capability, and perceived opportunity and are necessary for developing PA intentions. The initial translation of intentions into regular PA is then marked by the enactment of *regulatory constructs*, including behaviour and emotion regulation strategies (e.g., planning, self-monitoring, attention focus). Finally, *reflexive constructs*, including habit (i.e., automatic cue-behaviour associations) and identity (i.e., role self-categorization) develop as a result of repeated successful PA over time. These reflexive processes of the M-PAC framework are likely the critical drivers of sustained PA (Rhodes, La, et al., 2021).

Research on reflexive processes on their own and the M-PAC framework as a whole in relation to postpartum PA is limited. To our knowledge, there is only one study looking at the association between PA identity and postpartum PA, demonstrating a positive and moderate-size association (Lesser et al., 2023). Similarly, there is only one study applying M-PAC to a postpartum population which found that intention-PA translation was predicted by regulatory (i.e., planning) and reflexive constructs (Rhodes, Beauchamp, et al., 2021). This latter study applied an intervention that necessitated healthy and motivated postpartum individuals and thus, there is a need for sustained research with broader sampling. Identifying key barriers and enablers to PA among postpartum individuals with varying musculoskeletal (MSK) conditions is essential given the high prevalence of MSK conditions during this period. For example, upwards of two thirds of postpartum individuals suffer from lumbopelvic pain (LPP; Wu et al., 2004), warranting the need for further evaluation of predictors of PA and intention-PA translation in this population. Relatedly, PA behaviour theories and frameworks may need to be expanded to account for the complexity of the postpartum experience. Similar to a previously proposed framework for PA and cancer survivorship (Courneya, 2014), postpartum variables may interact with PA through several unique paths. One potential path is that postpartum-related variables may be determinants of PA. For example, postpartum-related variables such as fear of movement or perceived change in walking/running gait (Moore et al., 2021) may decrease PA participation or intention-PA translation, independent of more generalized constructs in behavioural theories (e.g., general attitudes about PA, general perceived opportunity). Furthermore, postpartum LPP might decrease the intention-behaviour gap, as observed with other populations with health risks (e.g., cancer, cardiovascular risk factors), possibly due to increased motivation for the physical and/mental consequences of PA (Feil et al., 2023). Another path is that postpartum-related variables may be moderators of PA determinants. For example, the presence of LPP may reduce the effect of some reflective, regulatory, and/or reflexive constructs on intention-PA translation. Prior research has not specifically explored pain as a moderator of intention-PA in any population, however, pain could potentially reduce affective attitude towards PA and subsequently decrease PA intentions (LaRowe & Williams, 2022). These interactions may ultimately impede on PA habit (Kaushal & Rhodes, 2015) or identity (Rhodes et al., 2016). Furthermore, pain may decrease instrumental attitude and perceived capability (Leveille et al., 2003) leading to a similar reduction in PA intentions (Bandura, 1997).

As such, the first objective of this research is to determine the proportion of postpartum (i.e., up to one year following childbirth) individuals with intentions in meeting postpartum MVPA guidelines who are not following through with those intentions (i.e., the PA intention-behaviour gap). The second objective is to determine which reflective, regulatory, and reflexive constructs and postpartum-related variables (i.e., LPP, fear of movement, perceived change in walking/running gait) predict the translation of intentions in meeting postpartum MVPA guidelines to actual behaviour (i.e., intention-behaviour translation). Finally, the third objective is to determine whether the intention-behaviour gap and predictors of PA intention-behaviour translation are moderated by the presence of LPP. We hypothesize that the postpartum PA intention-behaviour gap is between 43.8 and 51.3%, as per a recent systematic review on the PA intention-behaviour gap among the general population (Feil et al., 2023) and that translation of this gap is predicted by regulatory behaviours, habit, and identity, as per M-PAC theory and a prior postpartum PA study (Rhodes, Beauchamp, et al., 2021). The impact of postpartum-related variables (i.e., LPP, fear of movement, and perceived change in walking/running gait) on the PA intention-behaviour gap and LPP moderation of intention-PA predictors are exploratory tests of several paths outlined by Courneya (2014).

4.3 Materials and Methods

This study received ethical approval from the Human Research Ethics Board at the University of Victoria (ID: 22-0722). Participants were provided details of the study and asked for their informed consent online before proceeding to answer the questionnaire, which was published online via SurveyMonkey (*SurveyMonkey Inc.*, 2025) between April 2023 and July 2024. This study featured an international cross-sectional survey of postpartum individuals.

4.3.1 Participants and Recruitment

Eligibility was restricted to respondents who were English-speaking adults (at least 18 years of age) who had given birth within the last 12-months. They could reside anywhere in the world. The primary means of recruitment was through online social media, such as X (formerly Twitter), Instagram, Facebook groups for new mothers and paid Facebook advertisements. Participants had the option to donate $2 to a charitable organization that supports mothers and birth parents.[1]

Of the 419 individuals who started the updated questionnaire, 224 participants were included in the analysis.[1] An overall response rate calculation was not possible due to the high proportion of fraudulent respondents (>1000 fraudulent responses).

4.3.2 Instrumentation

Demographics were asked including questions on age, country, gender identity, weight, height, time postpartum, mode of delivery, number of children, number of pregnancies, race, education, employment status, and household income.

***PA* volume** was assessed using a modified version of the Godin Leisure-Time Exercise Questionnaire which has demonstrated acceptable validity and reliability (Godin & Shephard, 1997). Additionally, open-ended questions assessed the types of PA practiced for each intensity of PA (see Appendix B Supplemental Material 1 for further descriptions of PA measurements).

M-PAC constructs (see Appendix B Supplemental Material 1 for further descriptions of M-PAC construct measurements) were framed for PA and defined as "achieving at least 150-min of MVPA per week," corresponding with PA guidelines at the time of the survey (Bull et al., 2020; Evenson et al., 2024).

Attitudes towards engaging in MVPA were measured using six items that assessed both instrumental (e.g., "In a typical week, it is wise for me to engage in PA on a regular basis") and affective components (e.g., "In a typical week, it is enjoyable for me to engage in PA on a regular basis; Ajzen, 2002; Rhodes & Courneya, 2003; affective $\alpha = .89$; instrumental $\alpha = .85$). Scores ranged from 1 (strongly disagree) to 5 (strongly agree).

Perceived capability was assessed with 8-items ($\alpha = .90$) from the Barrier Self-efficacy scale, asking participants how confident they were in engaging in 150-min of MVPA per week despite various barriers (Resnick & Jenkins, 2000). Key barriers were applied from previous research on PA postpartum and mothers with young children (Grant et al., 2022; Moore et al., 2021) and included low back and/or pelvic pain; hip pain; lower extremity pain (e.g., thigh, knee, leg, ankle, foot); upper extremity pain (e.g., shoulder, arm, elbow, wrist, hand); upper back and/or neck pain; urinary leakage; vaginal heaviness; and fatigue. Scores ranged from 1 = extremely unconfident to 5 = extremely confident.

Perceived opportunity was assessed with 2-items (e.g., "If I really wanted to, I would have the chance to engage in physical activity on a regular basis"; $\alpha = .67$; Rhodes et al., 2006). Perceived opportunity encompasses perceptions of both the physical and social environment that affect access to PA enactment, independent of motivation to perform PA (Lithopoulos et al., 2023; Rhodes, 2017). Scores ranged from 1 = strongly disagree to 5 = strongly agree.

Decisional intention to be physically active was measured using one item: "In a typical week I intend to engage in at least 150-minutes of MVPA per week" (Plotnikoff et al., 2001; Rhodes & Rebar, 2017). Participants either agreed with this statement or not. A dichotomized item was selected to establish intention-behaviour profiles which would enable the analysis of theoretical constructs in predicting intention-behaviour translation.

Behavioural regulation was assessed with 14-items ($\alpha = .90$) using the Physical Activity Regulation Scale (Rhodes & Lithopoulos, 2023). It includes four subscales for proactive regulation (e.g., action planning; $\alpha = .90$), reactive regulation (e.g., emotional regulation; $\alpha = .88$), social monitoring ($\alpha = .69$), and self-monitoring ($\alpha = .88$). Scores ranged from 1 = strongly disagree to 7 = strongly agree.

Habit was assessed with 4-items (e.g., "I do the regular PA automatically"; α = .91) from the self-reported automaticity subscale (Gardner et al., 2012) of the Self-Report Habit Index (Verplanken & Orbell, 2003). Scores ranged from 1 = strongly disagree to 5 = strongly agree.

Identity was measured using 3-items (e.g., "I consider myself someone who does regular PA"; α = .90) adapted from the role identity subscale (Wilson & Muon, 2008) of the exercise identity scale (Anderson & Cychosz, 1994). Scores ranged from 1 = strongly disagree to 5 = strongly agree.

Postpartum-relevant variables measured were fear of movement and perceived change in running/walking gait.

Fear of movement was measured with the 11-item (α = .85), modified Tampa Scale for Kinesiophobia (Woby et al., 2005). It has found to be reliable and valid amongst a sample of adults with chronic pain (Tkachuk & Harris, 2012).

Perceived change in running/walking gait was asked similar to the questionnaire used by Moore and colleagues (2021). The question was "Since you gave birth, do you think you changed how you walk and/or run?" with responses yes/no.

LPP was assessed with questions similar to Gutke et al. (2018; see Appendix B Supplemental Material 1 for further descriptions of LPP measurements). *Pain intensity* of the low back, posterior pelvic girdle, and anterior pelvic girdle were measured using the Visual Analogue Scale scored from 0 = no pain to 10 = worst pain (Carlsson, 1983). Pain was classified as mild (≤ 3.4), moderate (3.5 to 7.4), or severe (≥ 7.5; Boonstra et al., 2014). *Pain disability* was measured with the Oswestry Disability Index (ODI; Fairbank et al., 1980; α = .88) with the total score ranging from 0 to 100 and higher scores indicating worse function (i.e., 0-20 = minimal disability, 20-40 = moderate disability, 40-60 = severe disability, 60-80 = crippled, 80-

100 = bedbound or exaggerating) and the Pelvic Girdle Questionnaire (PGQ; Stuge et al., 2011; $\alpha = .93$) with a total score ranging from 0 to 100 and higher scores indicating worse function. Both of these scales show good internal consistency, reliability, and construct validity among postpartum individuals (Grotle et al., 2012).

4.3.3 Analysis Plan

The data were first examined for validity and completeness. Fraudulent responses were identified by examining the open-ended responses and observing common patterns of responses (e.g., the same duplicated pattern of email address to receive the honorarium). Additionally, if multiple responses were being conducted at the same time or if the survey was completed in less than 3 minutes, responses were removed. Individuals were included in analyses if they completed the PA, M-PAC constructs, and postpartum-relevant variable measures. Next, the scores for the PA, M-PAC constructs, and postpartum-relevant variable measures were examined for missingness, outliers, and normality. Outliers were defined as values more than three times greater or less than the middle 50% (25th to 75th percentiles) of the distribution (Pallant, 2020). Outliers were recoded as the highest or lowest value that was not an outlier (i.e., a value three times greater or less than the middle 25^{th} and 75^{th} percentiles; Tabachnick & Fidell, 2007).

The creation of intention-behaviour profiles included the following (as per Grant et al., 2022): 1) non-intenders who are not active (low intentions, <150 min of weekly MVPA), 2) unsuccessful intenders who failed to enact positive intentions (high intentions, <150 min weekly MVPA), and 3) successful intenders who were active (high intentions, ≥150 min weekly MVPA). The intention behaviour gap is the proportion of unsuccessful intenders in relation to the total number of intenders (unsuccessful intenders plus successful intenders).

Multivariate analysis of variance (MANOVA) with follow-up discriminant function analysis and one-way ANOVAs were conducted to compare the groups across each predictor variable and to determine which variables contributed significantly to each discriminant function. Constructs predicting translation of the intention-behaviour gap were the ones that predicted successful intenders from unsuccessful intenders (Grant et al., 2022). To explore the relative contribution of reflective (instrumental and affective attitude, perceived capability and opportunity), regulatory (behavioural regulation), and reflexive processes (habit, identity) hierarchical blocks of predictors were applied to the discriminant function analysis.

A sub-analysis was performed between those with LPP and those without using two-way ANOVAs, where the independent variables were successful/non-successful intenders and LPP/no LPP and the dependent variables were the M-PAC constructs, fear of movement, and perceived change in walking/running gait. This analysis was run twice, first comparing individuals with LPP that started during pregnancy or within the first three-weeks postpartum (P-LPP) to individuals who did not report LPP (N-LPP) and second comparing individuals with LPP, regardless of onset (P-LPP + NP-LPP), to individuals who did not report LPP.

Effect sizes for each predictor were evaluated as n_p^2 = 0.01 for small, n_p^2 = 0.06 for medium, and n_p^2 = 0.14 for large (Cohen, 1992). Post hoc tests were corrected for multiple comparisons using the family-wide error rate using the Tukey HSD test. For predictor associations with the discriminant function, r = .15 was used as the minimum recommended effect size because this estimate is between Cohen's (1992) r = .10 and Ferguson's (2009) r = .20 recommendations. Similarly, for post hoc mean differences, d = .30 was used as the minimum recommended effect size because this estimate is between Cohen's (1992) d = .20 and Ferguson's (2009) d = .41 recommendations.

4.3.4 Sample Size

The proposed minimum sample size was 183 based on a power analysis with $\alpha = 0.05$, power of 0.80, and effect size of $f^2(V) = 0.06$ for a medium effect size (Cohen, 1988) for the association between the three theory-driven groups expected to capture the majority of the participants (i.e., successful intenders, unsuccessful intenders, and successful non-intenders; Feil et al., 2023) and the 10 predictors (i.e., instrumental attitude, affective attitude, perceived capability, perceived opportunity, regulatory behaviours, habit, identity, fear of movement, perceived change in walking/running gait, and postpartum LPP; Faul et al., 2007). For the two-way factorial ANOVA that was conducted to assess LPP as a moderator, a total sample size of 128 was required with at least 64 participants with and without LPP and 64 participants who were successful and non-successful intenders.

4.3.5 Secondary Analyses

First, due to the recent change in MVPA guidelines for postpartum individuals, a sensitivity analysis was conducted using the 120 min/week cut-off (Davenport, Ruchat, et al., 2025). This analysis was performed to assess the dichotomisation of the PA profile variable and to ensure minor lapses in PA (resulting in "unsuccessful intender" coding) did not greatly impact the results.

Second, since the PA Regulation Scale has only received general population validation (Rhodes & Lithopoulos, 2023) and the effectiveness of the subscales (i.e., proactive regulation, reactive regulation, social monitoring, and self-monitoring) has received limited attention, a sensitivity analysis of the behavioural regulation score was performed. Follow-up one-way ANOVAs were conducted with the four subscales to determine whether the behavioural regulation score was resulting from specific subscales.

4.4 Results

4.4.1 Data Management

Vigorous-intensity PA had three missing scores and fear of movement had eight missing scores which were recoded to the mean of each variable respectively. PA intention had one missing outcome which was not recoded. Nineteen participants were classified as non-intenders meeting PA guidelines and were only included in descriptive analyses due to the small cell size. Instrumental attitude was highly and negatively skewed (-1.19), however neither logarithmic nor square root transformations resulted in improved skewness and therefore it remained unadjusted. All other continuous variables were normally distributed.

Prior to running the MANOVA, sample sizes were moderately different across the groups (n = 47 non-intenders, n = 40 unsuccessful intenders, and n = 117 successful intenders; Appendix B Supplemental Table 1), however there were far more cases than DVs in each cell. Homogeneity of variance-covariance was violated ($p < .05$) and, therefore, Pillai's trace was used to calculate effect size n_p^2 (Tabachnick & Fidell, 2007). The continuous variables were free of multicollinearity (see Appendix B Supplemental Table 2 for a correlation matrix).

4.4.2 Participant Characteristics

Participant characteristics are summarized in Table 6. The mean age was 33.2 ($\pm$3.9) years, with the majority (81.7%) residing in Canada, the majority reporting woman gender-identity (n = 223) and one who reported non-binary. Seven reported queer in combination with woman gender-identity. The mean time postpartum of participants was 27.23 ($\pm$13.87) weeks, mean BMI was 26.07 ($\pm$5.47) kg/m^2, and mean number of children was 1.62 (.82). Most participants were white (88.0%), had at least a bachelor's degree (79.5%), the majority were caring for young children full-time or on full-time parental leave (69.2%), and most (88.8%) had a household income above $75,000 CAD.

Over half (58.9%) of the participants reported LPP within the past 4-weeks and of those, 68.9% reported that the pain started either during pregnancy or within the first three weeks postpartum (Appendix B Supplemental Table 4). As such, 40.6% were experiencing previously defined postpartum-LPP (P-LPP). Of those with P-LPP, 75.6% believed their pain was from their low back and 78.0% believed their pain was from the pelvic girdle (specifically, 42.9% from the front and 36.6% from the back right side and 34.6% from the back left side of the pelvic girdle). The mean pain intensity on a scale from 0 to 10 was 3.45 (±2.09; moderate pain) in the low back, 3.19 (±2.08; mild pain) from the posterior pelvic girdle, and 2.31(±2.06; mild pain) from the anterior pelvic girdle. The mean low back pain disability (as measured by the ODI) was 13.05 (±10.46; minimal disability) and pelvic girdle pain disability (as measured by the PGQ) was 24.69 (±18.42).

Over half of participants were meeting 150-min of MVPA per week (61.1%). There was a significantly lower proportion of individuals with LPP meeting the guidelines (46.2%) compared to individuals without LPP (70.7%). The most common type of PA according to intensity was as follows: light intensity PA = walking (n = 172), yoga (n = 49), housework (n = 23), and stretching (n = 22); moderate-intensity PA = walking (n = 123), housework (n = 66), gardening (n = 26), and weight training (n = 22); vigorous-intensity PA = running (n = 49), weight training (n = 23), fitness class (n = 16), and cycling (n = 14) (Appendix B Supplemental Table 3).

4.4.3 Physical Activity and Intention-Behaviour Profiles

Just over half of the participants were successful intenders (52.5%), followed by non-intenders (21.1%), unsuccessful intenders (17.9%), and non-intenders who were meeting MVPA guidelines (8.5%) (Table 6). The intention-behaviour gap was 25.5%.

Table 6

Participant Characteristics

	All (n = 224)	**%**	P-LPP (n = 91)	**%**	NP-LPP (n = 41)	%	N-LPP (n = 92)	%
***M*Age**	33.18 (3.91) years		32.46 (4.03)		33.68 (3.82)		33.73 (3.40)	
Country								
Canada	183		73		37		73	
United States	30		16		2		12	
Europe	6		0		1		5	
UK	3		1		1		1	
Mexico	1		0		0		1	
Australia	1		1		0		0	
Gender Identity								
Woman	223		91		40		92	
Man	0		0		0		0	
Non-binary	1		0		1		0	
Two Spirit	0		0		0		0	
Transgender	0		0		0		0	
Queer	7		0		3		4	
Questioning	0		0		0		0	
Prefer not to say	0		0		0		0	
***M*BMI**	26.07 (5.47)		26.25 (5.12)		26.25 (5.12)		24.93 (3.93)	
***M*Time postpartum**	27.23 (13.87) weeks		25.50 (13.92) weeks		27.55 (10.76)weeks		28.79 (14.95)	
Mode of Delivery								
Vaginal	136	60.71	54	59.34	22	53.66	60	65.22
C-section	71	31.70	30	32.97	15	36.59	26	28.26

Vaginal assisted	17	7.59	7	7.69	4	9.76	6	6.52
Number of Children	1.62 (.82)		1.48 (.62)		1.68 (.82)		1.61 (.63)	
Race	N = 224		N = 91		N = 41		N = 92	
Black	2	.89	2	2.20	-	-	-	-
East Asian	6	2.68	3	3.30	-	-	3	3.26
Indigenous	4	1.79	2	2.20	2	4.89	-	-
Latin American or Hispanic	3	1.34	1	1.10	-	-	2	2.17
Middle Eastern	-	-	-	-	-	-	-	-
South Asian	2	.89	1	1.10	1	2.44	-	-
Southeast Asian	3	1.34	2	2.20	1	2.44	-	-
White	197	87.95	77	84.62	36	87.80	84	91.30
Mixed Race	7	3.13	3	3.30	1	2.44	3	3.26
Education	N = 224		N = 91		N = 41		N = 92	
No Post-Secondary Degree	14	6.25	7	7.69	3	7.32	4	4.35
Post-Secondary Degree	210	93.75	84	92.31	38	92.68	88	95.65
Employment								
Caring for young children full-time or on full-time or self-employed parental leave	155	69.20	62	68.13	32	78.05	61	66.30
Working full-time	39	17.4	17	18.68	4	9.76	18	19.57
Working/self-employed part-time	23	10.27	9	9.89	4	9.76	10	10.87
Unemployed	3	1.34	1	1.10	-	-	2	2.17
Full-time student	4	1.79	2	2.20	1	2.44	1	1.09
Part-time student	-	-						
Income	All (n = 222)	%	P-LPP (n = 90)	%	N = 41		N = 91	
Under $49,999 CAD	11	4.95	6	6.67	0	0	5	5.49

Between $50,000 and $149,000 CAD	124	55.86	53	58.89	23	56.10	48	52.75
Over $150,000 CAD	87	39.19	31	34.44	18	43.90	38	41.76
Lumbopelvic pain in the past 4-weeks								
Yes	132	58.93						
No	92	41.07						
Pain started during pregnancy/postpartum								
Yes	91	68.94						
No	41	31.06						
Since giving birth, did you think you changed how you walk/run?								
Yes	102	45.54	51	56.04	18	43.90	33	35.87
No	123		40		23		59	
Tampa Scale of Kinesiophobia	21.26 (5.29)		22.68 (5.24)[1]		20.62 (5.73)		20.01 (4.44)[1]	
Physical Activity								
Light PA	203.35 (403.88)		183.53 (246.92)		229.88 (362.33)		210.92 (530.27)	
MVPA	215.40 (171.72)		185.16 (171.44)[2]		200.68 (128.02)		251.87 (183.38)[2]	
Meeting MVPA Guidelines								
150 min/week	137	61.12	45[3]	49.45	27	65.85	65[3]	70.65
120 min/week	155	69.20	54[4]	59.34	30	73.17	71[4]	77.17

Note.

[1] $F(2, 221) = 6.80$; **$p = <.01$;** P-LPP > N-LPP $d = .55$ **($p < .01$)**

[2] $F(2, 221)$: 3.73; **$p < .05$**; post hoc P-LPP < N-LPP $d = -.38$; **$p <.05$**

[3] $X^2(2) = 9.12$, **$p <.05$**; post hoc P-LPP < N-LPP, **$p <.05$**

$_4X^2(2) = 7.20$, **p <.05**; post hoc P-LPP < N-LPP, **p <.05**

4.4.4 Main Analyses

There was a moderate and significant effect of the M-PAC constructs and postpartum-related variables (i.e., affective attitude, instrumental attitude, perceived capability, perceived opportunity, behavioural regulation, habit, identity, fear of movement, changed gait, and LPP) on the PA profile: $F(10, 193) = 14.81$; Pillai's trace = .44; Wilks' lambda = .56; $\eta p^2 = .080$; p-value $< .001$. The discriminant function analysis with an MVPA cut-off of 150 min/week revealed two significant discriminant functions, the first one could explain 89.35% of the variance and the second one could explain 10.65% of the variance. The first discriminant function had a Wilks' Lambda of .001 [X^2 (20) = 1311.23, $p < .001$; eigenvalue = 78.94; canonical r = .99, $R^2 = .99$) and the second discriminant function had a Wilks' Lambda of .096 [X^2 (10) = 456.87, $p < .001$; eigenvalue = 9.41, canonical r = .95, $R^2 = .90$). Based on the correlation with the first discriminant function, the order of importance for the predictors (from high to low) was: identity ($r = .93$; $p < .001$), affective attitude ($r = .83$; $p < .001$), behavioural regulation ($r = .82$; $p < .001$), habit ($r = .69$; $p < .001$), perceived opportunity ($r = .58$; $p < .001$), instrumental attitude ($r = .46$; $p < .001$), fear of movement ($r = -.30$; $p < .001$), LPP ($r = -.27$; $p < .001$), perceived capability ($r = .24$; $p < .001$), and perceived change in gait ($r = .11$; $p > .05$). The order of importance for the predictors of the second discriminant function was the following: fear of movement ($r = -.62$; $p < .001$), habit ($r = .42$; $p < .001$), behavioural regulation ($r = -.23$; $p < .001$), perceived opportunity ($r = .23$; $p < .01$), instrumental attitude ($r = -.21$; $p < .01$), LPP ($r = -.15$), perceived change in gait ($r = -.15$; $p < .05$), identity ($r = .12$; $p > .05$), affective attitude ($r = .04$; $p > .05$), and perceived capability ($r = .10$; $p > .05$).

In the hierarchical analyses, the Wilks' lambda decreased upon progressing from a model that only included reflective processes ($\lambda = .04$), to the addition of regulatory processes ($\lambda = .03$), to the addition of reflexive processes ($\lambda = .02$). Furthermore, the likelihood ratio tests were both significant ($p < .001$), indicating that adding predictors to the model was beneficial.

In terms of the follow-up one-way ANOVAs (Table 2), successful intenders had the highest scores for all variables except fear of movement where it had the lowest (attributing to lower fear of movement), perceived capabilities, and perceived change in walking/running gait. The following constructs significantly predicted unsuccessful intenders from non-intenders: behavioural regulation ($d = 1.20$), reactive regulation ($d = 1.13$), identity (d = .92), proactive regulation ($d = .92$), self-monitoring ($d = .81$), affective attitude ($d = .78$), and instrumental attitude ($d = .57$). The following constructs significantly predicted successful from unsuccessful intenders: identity ($d = .88$), habit ($d = .84$), affective attitude ($d = .74$), fear of movement ($d = -.66$), perceived opportunity (d = .58), and reactive regulation ($d = .46$).

Table 7

One-way Analysis of Variances

Variable	Non-Intenders (NI) n = 47	Unsuccessful Intenders (UI) n = 40	Successful Intenders (SI) n = 117	ANOVA	Pr(>F)	Post hocs (Effect size Cohen's d or Hedges' d)
Reflective Constructs						
Affective Attitude†	3.28 (.99)	4.00 (.82)	4.50 (.61)	F(2.00, 72.78) = 33.28	**p < .001**	NI < UI (.78)* < SI (.74)* UI < SI (1.64)*
Instrumental Attitude†	4.43 (.55)	4.72 (.46)	4.78 (.39)	F(2.00, 77.23) = 8.17	**p < .001**	NI < UI (.57)* , SI (.15) UI < SI (.80)*
Perceived Capability†	3.07 (.91)	3.20 (.61)	3.39 (.87)	F(2.00, 94.62) = 2.52	p > .05	NI , UI (.17), SI (.23) NI , SI (.36)
Perceived Opportunity†	3.21 (1.01)	3.60 (1.02)	4.12 (.82)	F(2.00, 78.08) = 16.30	**p < .001**	NI, UI (.38) < SI (.58)* NI < SI (1.02)*
Regulatory Constructs						
Behaviour Regulation	3.16 (1.14)	4.44 (.97)	4.89 (1.08)	F(2, 201) = 43.81	**p < .001**	NI < UI (1.20)*, SI (.43) NI < SI (1.58)*
Proactive Regulation	3.12 (1.69)	4.53 (1.32)	5.02 (1.65)	F(2, 201) = 23.66	**p < .001**	NI < UI (.92)*, SI (.31) NI < SI (1.14)*
Reactive Regulation†	3.07 (1.50)	4.66 (1.24)	5.22 (1.22)	F(2,00, 82.19) = 38.07	**p < .001**	NI < UI (1.13)* < SI (.46)* NI < SI (1.64)*
Social Monitoring	3.37 (1.49)	3.88 (1.52)	4.08 (1.53)	F(2, 201) = 3.74	**p < .05**	NI, UI (.34), SI (.14) NI < SI (.47)*
Self-Monitoring	3.12 (1.87)	4.59 (1.75)	5.10 (1.66)	F(2, 201) = 22.06	**p < .001**	NI < UI (.81)*, SI (.30) NI < SI (1.15)*
Reflexive Constructs						
Habit	2.34 (1.11)	2.76 (1.15)	3.63 (.99)	F(2, 201) = 28.72	**p < .001**	NI, UI (.37) < SI (.84)* NI < SI (1.25)*
Identity†	2.26 (1.04)	3.25 (1.12)	4.06 (.84)	F(2.00, 76.82) = 58.02	**p < .001**	NI < UI (.92)* < SI (.88)* NI < SI (1.99)*

Postpartum-Relevant Variables						
Fear of Movement	22.4 (5.17)	23.4 (5.35)	20.00 (5.06)	F(2, 201) = 7.99	**p < .001**	NI, UI (.19) > SI (-.66)* NI > SI (-.47)*
Changed Gait	No = 29 Yes = 18	No = 20 Yes = 20	No = 61 Yes = 56	F(2, 201) = .77	p > .05	NI, UI (.23), SI (.04) NI, SI (.19)
LPP†	No = 13 Yes = 34	No = 14 Yes = 26	No = 57 Yes = 60	F(2.00, 88.68) = 3.69	**p < .05**	NI, UI (.16), SI (.27) NI < SI (.43)*

Note.

* p < .05

† Homogeneity of variance was significant, therefore, Welch's ANOVA, Games Howell Post Hoc Test, and Hedge's d were applied.

LPP Moderation

When running the two-way ANOVAs, the type III ANOVA test was applied due to the unbalanced cells (Appendix B Supplemental Tables 5, 8). According to the two-way ANOVAs, when comparing individuals with P-LPP to individuals with no LPP, there was a significant interaction between PA profile and P-LPP on perceived opportunity and reactive regulation. Post hoc analyses revealed that perceived opportunity (d = 1.23) and reactive regulation (d = .82) only predicted intention-PA translation in individuals without LPP. This significant interaction only persisted among individuals with LPP (regardless of pain onset) compared to individuals with no pain for perceived opportunity (d = 1.19).

4.4.5 Secondary Analyses

Using an MVPA cut-off of 120 min/week, there was still a moderate and significant effect of the PA profile on the dependent variables and two discriminant functions were revealed with similar correlations of each predictor with each discriminant function (see Appendix B Supplemental Material 1, Supplemental Table 6). Post hoc analyses also generally matched the earlier post hocs with successful intenders holding the highest scores for all variables except perceived capabilities, social monitoring, perceived change in gait, and LPP (Appendix B Supplemental Table 7). Key differences were that reactive regulation no longer predicted successful from unsuccessful intenders, while behaviour regulation as a composite (d = .52) and self-monitoring as an element (d = .52) did.

4.5 Discussion

Engaging in regular PA following childbirth is associated with numerous health and wellness benefits to birth parents and their children, yet participation is often low. Theoretical underpinnings of postpartum PA is limited, particularly for individuals who are also experiencing common pregnancy-related MSK conditions, such as LPP. This study sought to determine 1) the postpartum PA intention-behaviour gap 2) the reflective, regulatory, reflexive, and postpartum-related variables of PA intention-behaviour translation, 3) and the impact of the presence of postpartum LPP on intention-behaviour translation.

The postpartum PA intention-behavior gap (25.5%) was lower than hypothesized and lower than the gap in adults in general (47.6%; Feil et al., 2023) and the gap reported by mothers with children <5 years (36%; Grant et al., 2022). Feil and colleagues reported population, PA measure, and risk of bias moderated the size of the intention behaviour gap (2023). Specifically, students had the highest gap (56.1%), followed by parents (50.4%), convenient samples of adults (44.6%), and those with health risks (40.0%). The gap was higher with studies of high risk of bias and studies that used an objective PA measure (70.8%) compared to self-report measures (42.3-44.5%; Feil et al., 2023). The lower gap in this study may be reflective of the self-report PA measure used or due to sampling whereby the study attracted more active individuals to participate and as a result the data reflected a strong intention-behaviour relationship. Nonetheless, there was still considerable variance amongst the three profiles (i.e., non-intenders, unsuccessful intenders, successful intenders) which warrants further assessment of the remaining questions.

We hypothesized that the postpartum PA intention-behaviour gap would be predicted by regulatory behaviours, habit, and identity, commensurate with M-PAC theory and previous research (Quinlan et al., 2017; Rhodes, Beauchamp, et al., 2021). While all of these constructs contributed meaningfully to profile variance, identity, habit, affective attitude, fear of movement, perceived opportunity, and reactive regulation (the emotion regulation element of the behavioural regulation composite) specifically discriminated successful from unsuccessful intenders with effect sizes ranging from small (reactive regulation) to large (habit, identity). These findings validate the M-PAC framework, demonstrating upward prediction of intention-PA translation by reflective, regulatory, and reflexive processes (Rhodes, La, et al., 2021). They also support the inclusion of postpartum-related variables (e.g., fear of movement, LPP) to account for the proposed expanded complexity of the postpartum experience and clinical considerations (Courneya, 2014).

Based on these findings, future postpartum PA interventions should consider incorporating elements that target PA identity, habit, affective attitude, fear of movement, perceived opportunity, and reactive (i.e., emotion) regulation. These elements are generally conceived as post-intentional and have not been historically integrated into postpartum PA interventions (Gilinsky et al., 2015; Lim et al., 2020; Peralta et al., 2021; Turner et al., 2023).

Interventions targeting reflexive constructs of habit and identity in the general population have resulted in small positive changes on habit and identity respectively (Ma et al., 2023; Rhodes, Wierts, et al., 2025). There are no optimal BCTs for intervening on PA identity, however, interventions that specifically targeted identity/integrated regulation (e.g., via cognitive restructuring of PA beliefs, positive self-talk, identifying personal reasons for making a change) contributed to larger effects compared to interventions that targeted additional variables with identity as a secondary consideration (Rhodes, Wierts, et al., 2025). Problem-solving technique is an optimal BCT for targeting PA habit (Ma et al., 2023) and could assist postpartum individuals in devising action plans for developing a PA habit that account for a variable context (e.g., unreliable or evolving infant nap schedules; Edie et al., 2021).

Two variables that include affect-related matters predicted intention-behaviour translation, affective attitude and reactive (emotion) regulation. Prior research has demonstrated a medium effect of interventions on improving affective judgments about PA, however it is unknown which BCTs moderate intervention effectiveness (Rhodes et al., 2019). One study on affect-related constructs with respect to postpartum PA found that affective response (i.e., how one feels in response to PA) had an indirect effect on MVPA, however affective judgments (i.e., one's expectations of enjoyment, fun, and pleasure of PA) did not predict MVPA (Rhodes et al., 2023). Ultimately, self-regulation and mindfulness strategies that optimize how one feels *during* a bout of exercise (e.g., self-paced with emphasis on feeling pleasant or enjoyment) should be prioritized over how one feels *after* exercise (Rhodes et al., 2023; Williams et al., 2012). The overall effect of interventions on reactive regulation related to PA is unknown, likely due to the fact that up until recently, a measure for reactive PA regulation was not available (Rhodes & Lithopoulos, 2023). Reactive regulation PA interventions have typically included Acceptance and Commitment Therapy (ACT), psychological flexibility, and/or mindfulness practices (Pears & Sutton, 2021; Rhodes, Barton, et al., 2025). These intervention components have also proven effective for reducing pain in general adults with chronic pain (Hughes et al., 2017; Paschali et al., 2024) and therefore, could potentially assist postpartum individuals in managing their pain as well as engaging in PA.

Perceived opportunity includes the perception of both physical and social environments that affect access to PA engagement, independent of motivation to perform PA (Lithopoulos et al., 2023). The overall effect of interventions on perceived opportunity for PA has not been assessed. Potential BCTs to improve perceived opportunity include restructuring physical environment and social support (Hollman, Sui, et al., 2025). Group-based PA interventions have the potential to increase perceptions to both physical (i.e., providing a location to be active) and social (i.e., social support) opportunities yet group-based postpartum PA interventions have not consistently demonstrated efficacy on postpartum PA (Peralta et al., 2021). One potential reason is that group-interventions may be leveraging friend support while family support may be even more essential for engaging in postpartum PA (Bennetter et al., 2023). Another reason is that postpartum may experience barriers to attending group-based PA programs, for example, financial costs, availability of childcare or nap schedules, and therefore addressing PA opportunities at home may be essential to complement group-sessions for consistent PA engagement (Edie et al., 2021).

Interventions, particularly those that incorporate multimodal therapies (i.e., combine physical and psychological therapies), have a medium effect on reducing fear of movement amongst individuals with chronic musculoskeletal pain (Xu et al., 2020). Exposure with control is a multi-modal therapy that targets fear-avoidance beliefs through experiential learning whereby individuals are gradually introduced to valued activities in a manner that minimizes emotional distress and sympathetic responses (O'Sullivan et al., 2018). Similar to ACT and mindfulness practices for reactive regulation (Rhodes, Barton, et al., 2025), exposure with control may initially involve targeted body relaxation, slow diaphragmatic breathing and body scanning, and subsequent progress to a gradual and graded re-introduction of valued activities (O'Sullivan et al., 2018). Postpartum individuals may want to consider starting with low-impact modes of PA (e.g., walking, cycling, strength training, pilates) that have been shown to decrease commonly experienced MSK conditions, such a pelvic girdle pain and urinary incontinence (Vesting et al., 2024).

The third hypothesis was exploratory with regard to the impact of LPP on the postpartum intention-PA gap and whether it moderated predictors of intention-PA translation. There was no significant difference in the PA intention-behaviour gap between individuals with P-LPP

(35.0%) compared to those with NP-LPP (19.2%) and N-LPP (19.7%). The presence of LPP did interact with perceived opportunity whereby perceived opportunity only predicted translation among individuals without LPP. This was a surprising finding given that social support and environment (potential components of perceived opportunity) are key enablers to PA by individuals with pain (Gebauer et al., 2020; Li et al., 2024). Future research may need to tease out social support and environment to determine whether they have unique predictions on postpartum intention-PA translation and whether their predictions are moderated by LPP. Ultimately, PA interventions targeting postpartum individuals with LPP may reflect postpartum PA interventions for non-clinical postpartum populations with appropriate tailoring recommendations that account for pain symptoms, associated disability, and higher levels of kinesiophobia observed in this group.

The secondary analysis exploring the updated 120-min MVPA cut point (Davenport, Ruchat, et al., 2025) revealed very similar results to our a priori 150-min MVPA findings, although, reactive regulation no longer predicted successful from unsuccessful intenders while behaviour regulation (as a composite) and self-monitoring (as an element) did. It is possible that the lower cut point may have captured more postpartum individuals in the PA adoption phase, which may rely more on explicit processes, such self-monitoring, compared to implicit process like affect (Rhodes & Sui, 2021). Of course, this is merely speculation as the measures were framed for 150-min MVPA and a test with the correspondence to the new guidelines is still warranted.

4.5.1 Limitations

Despite the strengths of this study, there are several limitations worth noting. First, given its cross-sectional design, this study is limited in demonstrating causal relations. Second, "matching" of PA intentions and behaviours may have occurred, however, there is generally no functional difference between cross-sectional and longitudinal studies (< six months) in classifying PA profiles (Feil et al., 2023; Rhodes & Plotnikoff, 2005). That said, postpartum is a unique period of ongoing changes and therefore, future postpartum research on PA profiles should apply longitudinal designs. Third, decisional intention was measured as a single item which may limit reliability, however, the dichotomous item tends to be reliable when compared to multi-item measures and has established predictive validity on PA (Courneya, 1994). Similarly, MVPA was dichotomized to facilitate the formation of intention-behaviour profiles and prior research has shown that PA measures with dichotomous scales demonstrate high reliability with continuous scales (Courneya, 1994). Fourth, there was an unexpectedly high rate of MVPA (over 60% were meeting PA guidelines), although a high rate is typical in general population surveys (Guthold et al., 2018). The high rate may have resulted from more active individuals being attracted to participating in the study, the self-report PA measure, or the focus on online recruitment. Future research should consider using objective measurement (e.g., accelerometry) and more diverse recruitment strategies such as in-person recruitment through healthcare services that provide care to perinatal individuals. Finally, most of the population identified as white, were highly educated, and had a household income over $55,000, implying that these results may not be generalizable to a more diverse demographic. Efforts were made to incorporate participants of all socio-economic status by providing an honorarium, however, it ultimately needed to be changed to a donation.

4.6 Conclusion

This study is the first of its kind to assess the postpartum PA intention-behaviour gap and determine reflective, regulatory, reflexive, and postpartum-relevant predictors of this gap. This study found a 25.5% intention-behaviour gap which was most predicted by identity, habit, affective attitude, fear of movement, perceived opportunity, and reactive regulation. Future research is needed to determine whether this gap is sensitive to PA measurement or sampling methods. Future postpartum PA interventions (that target both non-clinical as well as individuals with LPP) should consider incorporating intervention elements that target forming a PA identity, habit, affective attitude, emotion regulation, perceived opportunity, and decreasing fear of movement.

Footnotes

[1]As an incentive, respondents were originally provided a $10 honorarium upon completing the questionnaire, however upon receiving an abundance of false participant responses (>1000), honorarium delivery was replaced with a donation. Sixty one of the included participants were from the original questionnaire that offered an honorarium.

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Data availability statement. The participants of this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research supporting data is not available.

Chapter 5: A Co-Design Study to Tailor a Theoretically-Informed, Evidence-Based Physical Activity Behaviour Change Intervention to Postpartum Individuals with Lumbopelvic Pain

5.1 Abstract

Background: Postpartum physical activity (PA) is associated with improved physical and mental health, yet 55% of postpartum individuals do not meet PA recommendations. Concurrently, one quarter of postpartum individuals experience lumbopelvic pain (LPP), and available PA behaviour change interventions are not tailored to postpartum LPP. In addition, most postpartum PA interventions are informed by social cognitive frameworks which do not account for the commonly observed PA intention-behaviour gap. The multi-process action control (M-PAC) framework includes post-intentional constructs, such as emotion regulation, habit, and identity, that facilitate intention-behaviour translation. The purpose of this study was to co-design a theory-informed (M-PAC) mobile application (app) PA intervention tailored to postpartum individuals with LPP. **Methods:** Ten community partners (n = 5 individuals with postpartum LPP and n = 5 healthcare providers) partook in a three-phase iterative co-design study to tailor a pre-existing PA app prototype (that currently targets adults 18+ years) to postpartum individuals with LPP. This involved 1) interviews to determine high-level modifications, 2) an online survey (4-months after the interviews) to determine satisfaction with and feedback of the updated app, and 3) think-aloud interviews (2-months after the surveys) to assess usability and final feedback of the app and a second online survey to determine the level of meaningful engagement. App modifications followed each round of feedback. **Results:** The first interview revealed more content needed that is relatable to the complex postpartum LPP experience. The first online survey demonstrated overall satisfaction with the app (M = 3.78±.67

out of 5) and suggestions including improved visual display and increased interactivity. Think-aloud interviews confirmed that the app was user friendly and ready for pilot testing. The second online survey portrayed an extremely meaningful experience by partners ($M = 93.69 \pm 9.02$ out of 100). **Conclusions:** This study served as an example of co-design methodology that can meaningfully engage knowledge users in the development of a theory-driven evidence-informed PA intervention. The next phase of app development will involve a pilot test among postpartum individuals with LPP.

5.2 Introduction

Giving birth is one of the most substantial life changes, physically, emotionally, and socially, that some individuals will endure in their lifetime. There has been recent mounting evidence supporting the role of engaging in physical activity (PA) on ameliorating some of the common challenges that postpartum individuals face and enhancing both physical and mental health during this period. Recent meta-analyses have shown that engaging in PA postpartum is associated with a reduced risk of diabetes by 28%, it improves cardiovascular disease risk factors, decreases the risk of developing depression by 45%, and it decreases depressive and anxiety symptoms (Deprato et al., 2025; Jones, Moolyk, et al., 2025). Furthermore, engaging in PA prior to 12-weeks postpartum is associated with even greater reductions in postpartum depression (Deprato et al., 2025), speaking to the importance of supporting and encouraging postpartum individuals to engage in PA as soon as possible following childbirth.

In support of the recent emphasis on the importance of postpartum PA, the first ever stand-alone PA guidelines for postpartum was recently published (Davenport, Ruchat, et al., 2025). It recommends that postpartum individuals initiate light-intensity PA (e.g., easy walking, pelvic floor muscle training) early after childbirth, and to gradually increase (with consideration of incision healing, lochia, and psychological readiness) to 120 min/week of moderate-to-vigorous PA (MVPA; Davenport et al., 2025). While surveillance data of postpartum individuals meeting these recently updated guidelines is not yet available, surveillance evidence shows that about 55% of postpartum were not meeting prior guidelines of 150 min/week MVPA (Bull et al., 2020b; Coll et al., 2015; Evenson et al., 2012, 2013, 2024; Lesser et al., 2023). Given the many benefits to postpartum PA, its promotion should be a public health priority.

Postpartum PA interventions to date have shown promise on increasing total PA (inclusive of all intensities) and MVPA frequency; however their effect on MVPA volume is unsubstantiated (Gilinsky et al., 2015; Lim et al., 2020; Turner et al., 2023). Most postpartum PA interventions to date have been informed by social cognitive frameworks which focus on developing knowledge, self-efficacy, and social support for postpartum PA (Gilinsky et al., 2015; Hollman, Tran, et al., 2025). A limitation to social cognitive frameworks is that they may not account for the PA intention-behaviour gap (the proportion of individuals who do not act on their PA intentions; Feil et al., 2023), nor do they account for more impulsive, reflexive drivers of behaviour such as habit (i.e., automatic cue-PA associations) or identity (i.e., PA as part of one's self concept) (Rebar, 2017; Rhodes, Rebar, et al., 2025). A recent study found that over a quarter of postpartum individuals who intend to be physically active do not follow through with these intentions, speaking to the importance of targeting processes that promote intention-behaviour translation when intervening on postpartum PA (Hollman et al., 2026).

The multi-process action control (M-PAC) framework is an example of a PA behaviour change theory that incorporates reflective processes, primarily representing social cognitive frameworks (e.g., instrumental and affective attitudes, perceived opportunity and capability), that aim to develop intentions, with post-intentional regulatory and reflexive processes (Rhodes, 2017). Regulatory processes include behaviours, such as planning, self-monitoring, and reframing goals based on observed progress (Carver & Scheier, 1998) and emotion regulation, while reflexive processes include habit and identity (Rhodes, 2017). A recent study that applied the M-PAC framework to postpartum PA found support of this conceptualization, by showing that identity and habit were the primary drivers predicting successful from unsuccessful intenders (Hollman et al., 2026).

In addition, traditional PA theories and frameworks may need to be expanded to account for the potentially complex and interacting physical, emotional, and social factors experienced during this period (Courneya, 2014; Donnelly et al., 2021). In support of this premise, Hollman et al. (2026) found specifically that fear of movement, a construct not traditionally included among M-PAC constructs, was a significant and moderate predictor of postpartum intention-PA translation, speaking to the importance of assessing and targeting such postpartum-relevant factors when intervening on postpartum PA.

Another factor worth considering is postpartum lumbopelvic pain (LPP), defined as pain in the low back and or pelvis (i.e., pelvic girdle pain), that is experienced by 25% of postpartum individuals (Wu et al., 2004). Postpartum LPP has been associated with reduced PA, increased fear of movement, and a three-fold increased risk of postpartum depression (Gutke et al., 2007; Hollman et al., 2026). Clinical practice guidelines and recommendations for postpartum LPP consistently recommend regular PA (Pulsifer et al., 2022; Vleeming et al., 2008; Weis et al., 2021). They suggest for PA to be modified for pain symptoms, however, it is unknown whether available PA interventions are effective or if modification is helpful for improving PA among postpartum individuals with LPP. To date, most PA interventions for postpartum LPP have targeted muscle-strengthening exercises, and indeed a recent systematic review found a greater reduction in LPP symptom severity for more intensive or specific interventions that target muscular-strengthening exercises (Ruchat et al., 2025). Given the previously mentioned mental and health benefits of aerobic PA, evaluating the effectiveness of a theory-informed intervention that targets postpartum PA guidelines among postpartum individuals with LPP is warranted.

In addition to being grounded in theory-, up-to-date evidence, and following systematic, iterative development, there have been recent calls to incorporate knowledge users (i.e., individuals who are likely to use the research results to make informed decisions regarding health polices, programs, and/or practices; Government of Canada, 2012), in behavioural intervention design, delivery, and reporting (Bacon et al., 2020). Ultimately behavioural interventions need to be acceptable and engaging among knowledge users to result in intended health behaviours and outcomes. There are many different ways that knowledge users can be involved in research and to date there is no gold standard method, but rather, the involvement should be based on the context (Greenhalgh et al., 2019).

Recent publications that have applied co-design methods in relation to postpartum PA promotion have included a diverse range of methods, such as advisory group meetings, social media communication groups, workshops, focus groups, and semi-structured interviews (James, 2025; Makama et al., 2024; Racey et al., 2025; Wilkinson et al., 2023). Given that co-design methods have only recently been incorporated into postpartum PA intervention design and delivery, it is unknown whether co-developed postpartum PA interventions are more effective for changing postpartum PA behaviour. There is, however, evidence of postpartum PA intervention studies reporting notorious challenges in recruiting and retaining postpartum research participants (Haste et al., 2018; Lesser et al., 2024), speaking to the value of including postpartum individuals in PA research and intervention design. No postpartum PA interventions to date have been co-designed in collaboration with postpartum individuals with LPP or healthcare providers with expertise in managing postpartum LPP which in relation to postpartum PA promotion.

As such, this study will describe the tailoring of a theory-informed, evidence-based PA intervention to postpartum individuals with LPP, applying co-design methods. While many frameworks for systematic behaviour intervention development are available (Czajkowski &

Hunter, 2021), the IDEAS (Integrate, Design, Assess, and Share) framework specifically targets the development of digital behaviour change interventions (Mummah et al., 2016). This current study specifically describes iterative phases 3-7 involving grounding the app in behavioural theory, specifically the M-PAC framework (Rhodes, La, et al., 2021), prototyping potential versions of the mHealth app, gathering feedback from users, and using the feedback to ideate updated prototypes for additional feedback. The ultimate purpose of this iterative study is to co-develop a minimum viable product that is acceptable and usable among knowledge users and can subsequently be tested in proof of concept and/or feasibility, and efficacy studies (Mummah et al., 2016). A secondary purpose is to describe an example of co-design methodology that provides a meaningful experience for knowledge users and can be applied in future behaviour intervention co-design research.

5.3 Methods

5.3.1 Study Design

This study received ethical approval from the Human Research Ethics Board at the University of Victoria (ID: 24-0284) and follows reporting guidelines from the short form GRIPP2 (second iteration of the Guidance for Reporting Involvement of Patients and the Public) (Staniszewska et al., 2017) and the consolidated criteria for reporting qualitative research (COREQ) (Tong et al., 2007). In this study, the Patient Engagement in Research (PEIR) Framework and its associated workbook were used to guide the co-design methodology (Hamilton et al., 2018; Hamilton et al., 2018). The PEIR framework consists of eight components for fostering meaningful patient engagement and can be used to guide partnership between end-users and researchers. See Appendix C Supplemental Table 1 to see how the PEIR Framework workbook and eight PEIR framework components were tailored for the purpose and scope of this study. In order to quantitatively evaluate the meaningful engagement in the research process, partners filled in the PEIR Scale-22 (PEIRS-22) at the end of the study (Hamilton et al., 2021).

5.3.2 Knowledge Users

Ten knowledge users were recruited during January to April, 2025 to act as participant/partners (referred to as "partners" for the remainder of this article) in the study: five individuals who experienced postpartum LPP in the past five years and didn't meet postpartum PA guidelines, and five health providers with experience managing the health of postpartum individuals with LPP. Sampling prioritized a representative sample that included necessary lived and practiced expertise from relevant knowledge user groups (Leask et al., 2019). Given that paid parental leave and funded postpartum-specific healthcare services differ by country, it was decided to limit participants to those residing in Canada (Bourcier et al., 2017; de Souza et al., 2022). While there are no strictly defined sample size recommendations for co-design methods or the analyses applied in this study (i.e., reflexive thematic analysis of semi-structured interviews; Braun & Clarke, 2021; Leask et al., 2019), five of each knowledge user group was deemed appropriate for the scope and purpose of this study, to assure diversity of each group, and for the activities required of each partner over an expected 6-month+ study period (Braun & Clarke, 2021b). Partners were recruited through social media advertisements (i.e., Facebook, Instagram), including paid advertisements.

5.3.3 Intervention

This study involved tailoring a pre-existing PA promotion mobile app, called the PAL (Physical Activity for Life) app (Hollman, Sui, et al., 2025), to postpartum individuals with LPP. The original PAL app was created using the Pathverse Platform, a "no-code" mobile app builder for researchers (Liu et al., 2022). The intention of the PAL app was to result in Canadian adults achieving the recommended guidelines of 150-min of MVPA per week (Ross et al., 2020). The PAL app is built upon a web-based intervention (Liu et al., 2019) that integrates M-PAC components (Rhodes, La, et al., 2021) as well relevant PA intervention and app literature, a pedagogical framework (the BOPPPS [bridge-in, outcomes, pre-assessment, participatory learning, post-assessment, summary] model (Brillinger, 2021)), and expert opinion (Hollman, Sui, et al., 2025). The Pathverse Platform enables researchers to organize content into modules that are collections of cards representing content in the form of text, media (e.g., images, videos), multiple choice quizzes, and surveys (Liu et al., 2022). The PAL app houses 13 modules, of 25-30 cards each, including 12 PA theory-related lessons, a References module, and a Help module. Lesson 0 includes an app tutorial and introduction, Lessons 1-6 cover reflective processes for building PA intentions, Lessons 7-9 cover regulatory processes of goal-setting, self-monitoring, and emotion regulation to help translate intentions into PA behaviour, and Lessons 10-11 cover reflexive processes of habit and identity to promote PA maintenance. Prior research has shown that the first prototypes of the PAL app were deemed usable and acceptable among Canadian adults who were not meeting 150 min/week of MVPA (Hollman, Sui, et al., 2025).

5.3.4 Procedure

There were three main phases in this study, each with unique objectives and methods of data collection. Using multiple forms of data collection has been recommended to enhance research implementation (Atkins et al., 2017).

Phase 1: Baseline Meeting and First Interview

First, there was a 30-45min baseline meeting to describe the co-design ground rules using the PEIR framework workbook (See Appendix C Supplemental Table 1 for application of the

PEIR workbook to this study; Hamilton et al., 2017). The meeting was held over Zoom (*Video Conferencing, Web Conferencing, Webinars, Screen Sharing*, 2025). Following the baseline meeting, partners were emailed a link to the Letter of Information and Consent Form and a demographics questionnaire, using REDCap electronic data capture tools hosted at University of Victoria (Harris et al., 2009, 2019), along with a PDF document with instructions on how to download the PAL app. Upon providing consent for the study, partners were asked to review the PAL app for two weeks and then scheduled to complete a first round of interviews.

The objective of the first interview was to determine high level changes of the app according to knowledge user feedback. They were 45-60min and took place online over Zoom. Interviews included questions on the overall first impressions of the PAL app, barriers and enablers to using the app, and recommendations for modifications to increase the likelihood that postpartum individuals with LPP would use the app (See Appendix C Supplemental Material 1 for the First Interview Guide). The questionnaire included both broad, open ended questions (e.g., *What changes would you make to the mHealth app to increase the likelihood of using it to guide you in returning to physical activity postpartum?*), as well as questions specifically pertaining to the M-PAC framework (e.g., for a question related to regulatory processes, "*What strategies do you think postpartum individuals with LPP could use to be active around the schedule of their infant/other children?"* Rhodes et al., 2021). A similar approach of using theory-informed questions to influence the topic guide rather than a rigid structure of theory-based questions was recommended by McGowan et al. (2020). There were also questions pertaining to two personas to facilitate response creativity and diversity whereby knowledge users were encouraged to consider viewpoints of fictional personas in addition to their own (see a description of the two personas used in Appendix B Supplemental Material 1; Dominello et al., 2025). The personas were developed using findings from prior postpartum PA research (e.g., Hollman et al., 2026). At the end of the interview, partners were asked if they would like to work on or contribute to any of the suggested app changes. The interview guide and protocol were piloted with a postdoctoral researcher from the research lab and the main modification after the pilot test was that a few prompting questions related to perceived capability and perceived opportunity were removed to ensure the guide wasn't too long (above 40min to complete) and/or repetitive. Interviews were audio-recorded and transcribed verbatim using Zoom features.

Phase 2: First Online Survey

Four months later, upon completion of the first round of app edits informed by the first round of interviews, partners were emailed a link to an online survey that was housed in REDCap (Harris et al., 2009, 2019). Atkins et al. (2017) suggested that surveys may be more relevant when more is known about the issue and as such, the intent of this survey was to acquire specific feedback related to overall satisfaction of each module and feature, now that the broad feedback from the interviews had been applied. The survey took 30-45min and preparation for the survey involved reviewing the updated version of the app. First it asked overall feedback of the updated app and subsequently, it asked about feedback pertaining to each individual educational module, with a total of 19 modules and a References module, and features (e.g., module videos, Trackers feature, Goals feature, Activities feature, Social Forum feature, Menu feature). For each item, the survey asked 1) "What do you think of…[X module or feature]?" with responses scored from 1= very dissatisfied to 5 = very satisfied, 2) "Are there any further changes you would make to … [X module or feature]?", and 3) If yes, "Please describe these changes." At the end of the survey, participants were asked to provide any additional changes to the app that they would like to see and hadn't been mentioned yet. The online survey had the option to save progress and complete at another time if they were unable to complete it in one sitting.

Phase 3: Think-Aloud Interview and Second Online Survey

Two months later, upon completion of the second round of app edits informed by the first online survey, partners took part in a second interview (30-45min) to assess the "user friendliness" of the updated app and to determine any additional suggested modifications. Prior to the interview, partners were emailed instructions to prepare them for the interview. During the interview, partners were asked to go through a series of tasks with the app and to think-aloud as they went through them (Eccles & Arsal, 2017; Ericsson & Simon, 1998). As per think-aloud recommendations (Eccles & Arsal, 2017; Ericsson & Simon, 1998), they were provided with warm-up tasks to ensure they were speaking their thoughts out loud rather than explaining them. The tasks were as follows (and were similar to tasks used by Willms et al. (2023)): 1) navigate to the Lumbopelvic Pain Considerations module and go through it, 2) fill in an activity card and see the Survey History under Menu, 3) go to the Menu, Resources, and view the 2025 Canadian Guidelines for Physical Activity, Sedentary Behaviour & Sleep Throughout the First Year Postpartum, 4) go to the References module, click on the link to References, and click on a link for one of the references in the online document, 5) using the Trackers feature, log an exercise, 6) using the Goals feature, log a goal, 7) using the Activities feature, add an activity, and 8) using the Social Forum feature, choose a topic and type "test." At the end of the think-aloud interview, partners were asked if there were any other changes they would like to make to the app. The second interview guide and protocol were not pilot tested. Interviews were audio- and video-recorded and transcribed using Zoom.

Upon completion of the second interview, partners were asked to fill out a second online survey using REDCap (Harris et al., 2009, 2019) to determine the quality of knowledge user engagement in the study. The first 22-items were from the PEIRS-22 to measure meaningful knowledge user engagement in research with seven sections/subscales: procedural requirements (7-items), convenience (1-item), contributions (1-item), team environment and interaction (3-items), support (1-item), feel valued (1-item), and benefits (1-item). Each item uses a 5-point Likert scale scored from 0 = strongly disagree to 4 = strongly agree (Hamilton et al., 2021). The PEIRS-22 has demonstrated acceptable internal consistency, structural validity, reliability, and interpretability (Hamilton et al., 2021). At the end of the survey, partners were also asked if they would be open to being contacted in the future regarding additional research related to postpartum PA.

Partner Compensation

Partners were compensated with $85.

5.3.5 Analysis

Interview

The findings were first synthesized inductively, using reflexive thematic analysis (Braun & Clarke, 2022) and subsequently were synthesized deductively with the TDF (Atkins et al., 2017; McGowan et al., 2020) for the first interview and with Nielsen's 10 usability heuristics (Nielsen, 1994) for the think-aloud interview. The TDF was chosen for the first round of interviews because it includes 14 domains representing a broad range of 33 behaviour and behaviour change theories most relevant to implementation questions (e.g., barriers and facilitators to using an intervention). Furthermore, the TDF domains can easily be matched to the M-PAC theory constructs (Rhodes, La, et al., 2021) that informed this intervention. The TDF also allows for broader assessment of themes beyond M-PAC constructs to make certain that all relevant themes from the interviews were captured (Cane et al., 2012). Neilsen's 10 usability heuristics (Nielsen, 1994) were selected for the think-aloud interviews because the intention of those interviews was to determine user-friendliness of the app. This method of inductive followed be deductive syntheses has been recommended by prior research applying the TDF because it ensures that non-TDF material is maintained in analyses (McGowan et al., 2020).

The findings were then presented to at least one other member of the research committee to reflect on matching of the codes to the TDF theoretical domains or usability heuristics, respectively, and generation of themes that represented codes that were not captured by the theoretical domains or usability heuristics, respectively. Of note, the primary author (HH) who was responsible for overseeing both the inductive and deductive phases also conducted the interviews and transcribed the interviews with the assistance of Zoom transcription. Throughout these phases of data collection and familiarization, she reflected on her subjective experiences as a doctoral candidate researcher with emerging expertise in postpartum PA and PA behaviour change theory research, a mother of young children, a prior healthcare professional with experience in managing postpartum LPP, someone with lived experience of musculoskeletal pain postpartum that challenged her return to MVPA postpartum, and someone who has worked closely with the Pathverse development team since the app's inception. She also has recent experience in conducting a usability study of the first three lessons of the PAL app among inactive Canadian adults (who were not postpartum; Hollman, Sui, et al., 2025). She drew on these experiences when generating codes, matching them to theoretical and usability domains, and developing themes that were not congruent with the theoretical and usability domains. These aspects of combining a researcher's subjective experience to their data familiarization and code and theme development are key aspects to reflexive thematic analysis (Braun & Clarke, 2021a).

Online Surveys

Questions with quantitative scores were analysed with descriptive statistics and open-ended responses were summarized in a table and presented to at least one member of the research committee. For the first online survey, a satisfaction score of >3 was deemed acceptable (similar to Hollman et al., 2022) to move forward to feasibility, given that scores of 3 to 5 indicated increasing levels of satisfaction. For the PEIRS-22, overall scores of <70.1, 70.1 to <82.7, 82.7 to <92.0, and 92.0 to 100 corresponded to low, moderate, very, and extreme degrees of meaningfulness respectively (Wang et al., 2023).

5.4 Results

5.4.1 Participant Characteristics

Out of the 45 individuals who initially expressed interest in participating in the study, twelve completed the baseline meeting. Of those twelve participants, two did not continue stating time limitations as their reason. Ten participants were ultimately included in the study (n = 5 individuals with a history of postpartum LPP and n = 5 healthcare providers). The postpartum individuals resided in Western and Central Canada, were (See Table 8), on average, 33.40 (SD = 3.21) years old, 17.6 (SD = 13.13; range: 4-38) months postpartum, identified as East Asian (n = 2), White (n = 2), and South Asian (n = 1), and all had some form of college or university certificate, degree, or diploma. The healthcare providers resided in Western and Central Canada, were, on average, 38.40 (SD = 7.70) years old, identified as White (n = 4), and South Asian (n = 1), and all had at least a Bachelor's degree. Three were physiotherapists (n = 3 trained in pelvic health and n = 2 trained in orthopedic) and two were chiropractors. One postpartum individual dropped out after completing the first interview due to unknown reason.

Table 8

Participant/Partner Demographic Characteristics

Population	Postpartum Individual n = 5	Healthcare Provider n = 5
Age (years) Mean (SD)	33.40 (3.21)	38.40 (7.70)
Province		
Alberta	1	1
British Columbia	3	2
Ontario	1	2
Race		
East Asian	2	0
South Asian	1	1
White	2	4
Gender		
Woman	5	5
Education		
College, CEGEP or other non-university certificate or diploma (other than trades certificates or diplomas)	1	0
University certificate or diploma below the bachelor's level	1	0
Bachelor's degree (e.g., B.A., B.A. (Hons), B.Sc., B.Ed., LL.B.)	1	1
University certificate, diploma or degree above the bachelor's level	2	4
Time Postpartum Mean(SD)	17.6 (13.13) Range: 4-38	NA
Profession		
Chiropractor	NA	2
Physiotherapist (Orthopedic)	NA	2
Physiotherapist (Pelvic Floor)	NA	3

5.4.2 First Interview Feedback

Feedback from the five postpartum and five healthcare provider partners can be found in Appendix C Supplemental Table 2.

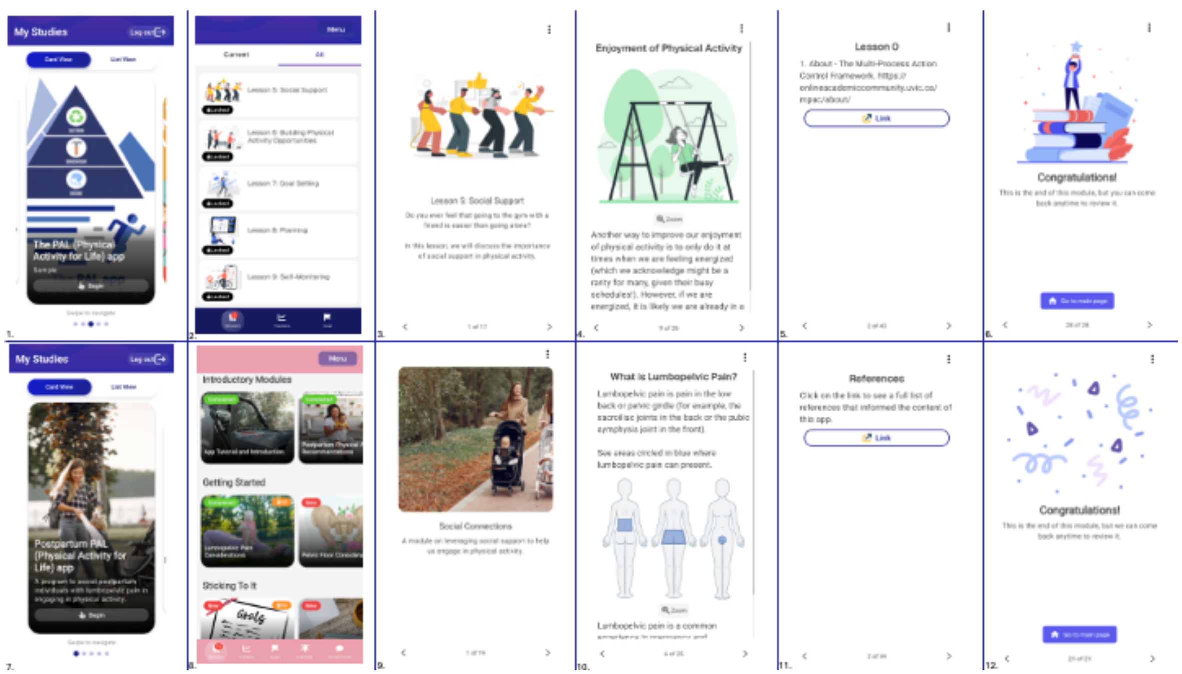
Feedback Pertaining to the Theoretical Domains Framework. Feedback was synthesized under all 14 TDF domains (Cane et al., 2012). For the *knowledge* domain, partners requested for the content to be more customized to the postpartum and LPP experience. For example, adding evidence-based content on the pelvic floor, postpartum PA safety, pain relief, and return-to-running. For the *skills* domain, partners requested examples of and videos of different types of exercises that emphasized slow progression and are appropriate to postpartum and when experiencing pain. For the *social/professional role and identity* domain, there was discrepancy around the idea of a postpartum PA identity. While all healthcare provider and three postpartum partners agreed with the concept of a postpartum PA identity and that PA is a part of and helps to strengthen capability towards the demands of parenthood, two postpartum partners specifically stated that they did not see an overlap between motherhood and a PA identity. For the *beliefs about capabilities* domain, there was consensus that the postpartum body can feel like a new territory and to encourage slow progression and normalizing postpartum experiences and challenges. For the *optimism* domain, partners reported a mixed overall perception of the app. Specifically, two postpartum partners stated it felt too academic and two healthcare provider partners reported confusion of the app's intent and that a comprehensive update was needed. For the *beliefs about consequences* domain, partners suggested adding examples of physical and mental benefits of postpartum PA and including benefits specific to pain. For the *reinforcement* domain, partners suggested adding app reminders and pairing PA with other routines (e.g., infant naps) while encouraging a flexible schedule. Two postpartum partners and one healthcare provider partner requested desire for more gamification as incentive to use the app. Related to the *intentions* domain, participants expressed an overall need for more incentive (e.g., by providing more postpartum-specific information) both for using the app as well as being regularly active. For the *goals* domain, postpartum partners suggested providing examples of goals for users to set and how they could be modified for LPP. Additionally two healthcare providers suggested making a list of opportunities for being active. For the *memory, attention, and decision processes* domain, partners expressed a need for shorter chunks of content due to the common experiences of fatigue and limited time and to replace text content with audio or videos. For the *environmental context and resources* domain, partners suggested recommendations for exercising with baby (e.g., available home equipment) and using a baby carrier (e.g., proper fit; reduce use if it aggravates pain) or stroller (e.g., alternate swinging arms). For the *social influences* domain, partners expressed that the app is lacking the social aspect and that social support may not be available to everyone and the importance of recognizing this. For the *emotion* domain, partners expressed how postpartum people want to feel while exercising, including descriptors such as confident, strong, normal, energized, happy, and wanted. Finally, for the *behavioural regulation* domain, partners discussed providing achievable suggestions to help postpartum users feel better and still maintain some activity when having a bad day due to increased pain or fatigue. They described challenges of scheduling PA and rather suggested combing it with the infant schedule. Partners valued trackers, including a PA tracker that also allows logging exercises from previous days due to time fluctuations. Two healthcare provider partners also suggested incorporating pain tracking.

Feedback Pertaining to Usability. While three postpartum and one healthcare provider partners reported the app was overall user-friendly, there were several reports of usability issues that needed attention. Usability issues included acronyms (e.g., MPAC, LPA, MPA) needing defining, app glitches, improved matching of quizzes to content, and enabling typing rather that scrolling when logging PA time. There was mixed feedback regarding the visual display and partners did not like that modules were blocked.

Changes made to the app following the first interview. Upon presenting the first interview findings to the research committee, several changes were made to the app. See Appendix C Supplemental Table 2 for a full list of changes and Figure 3 for screen shots of the app before and after the changes were made. The content underwent substantial changes to ensure all modules were more relevant to postpartum individuals with LPP. This involved replacing the general adult PA guidelines and Get Active Questionnaire (GAQ; Duggan, 2021; Ross et al., 2020) with the postpartum PA guidelines (Davenport, Ruchat, et al., 2025) and the postpartum GAQ (Davenport, Christopher, et al., 2025) and emphasizing postpartum-specific physical and mental health benefits of PA (e.g., Deprato et al., 2025; Jones et al., 2025) and slow, individualized progression, starting with low-impact exercises. Two modules were added to describe postpartum LPP, pelvic floor dysfunction, and rectus diastasis abdominis and included suggestions for how to modify exercise when experiencing these conditions (e.g., through pacing or graded exercise) (Almeida de Oliveira et al., 2025; Antcliff et al., 2018). An early module was added with video examples of simple exercises (e.g., deep breathing, core activation, thoracic mobility, lumbopelvic strengthening) as well as a module that focused on return-to-running postpartum. Several features were activated or modified, including the Social Forum (to facilitate inter-user discussions), Activities (to facilitate app reminders), My Points (to facilitate gamification and provide points for users upon completing modules), Goal suggestions under Menu, and Notes (to facilitate note-taking). Several Resources were added to the Menu, including a video of how to use the app, suggestions for grab-n-go exercises, and several links to websites related to pelvic floor dysfunction and postpartum PA. All modules were unblocked and grouped to facilitate user flexibility and improve navigation. All images were replaced to represent real-life postpartum images and the custom app theme was changed to pink. The Pathverse platform programming team addressed the usability issues including the survey card glitches and enabling users to type in their logged minutes of exercise rather than scrolling through the minutes. They also added a Pain Tracking Feature that allows users to track their pain in relation to their logged exercises. Finally, one module summary video was created to evaluate in the online survey before proceeding to creating videos for the remaining modules.

Figure 3

Screen Shots of the Original PAL App (cards 1-6) and the Updated Postpartum PAL App (cards 7-12)



5.4.3 First Online Survey Feedback

Feedback from nine participants (n = 4 postpartum people and n = 5 healthcare providers) was gathered during the first online survey. One postpartum person dropped out of the study due to unknown reason. Overall the app received a mean score of 3.78 (SD = .67) out of 5 and app lesson mean satisfaction scores ranged from 3.78 (SD = .97) for the "Part of Who We Are" lesson to 4.67 (SD = .50) for the "Examples of Beginner Postpartum Exercises" lesson. The References module was scored 3.67 (SD = 1.12) and the app embedded videos were scored 3.78 (SD = .83). The mean feature satisfaction scores ranged from 3.44 (SD = 1.24) for the Menu Survey History feature to 4.22 (.83) for the Trackers feature. Feedback on suggested changes for the updated app and the corresponding changes that were made can be found in Appendix C Supplemental Table 3.

5.4.4 Second Interview Feedback

Postpartum People

Four postpartum partners completed the think aloud usability interviews (Appendix C Supplemental Table 4).

Feedback Pertaining to App Usability. Regarding *Visual of System Status*, one partner stated that the auto-correct feature in the activity cards is helpful. Related to the *Match Between the System and the Real World*, partners demonstrated ease in going through a module, using the Menu, and logging exercises and goals. Additionally, they experienced ease in using activity cards and the Activities feature. Only one participant was able to see a video and they reported clicking on the video to play is intuitive. Negative feedback included the irrelevance of the "time" on the deadline for setting a goal and confusion around selecting a study in the My Studies screen. Regarding the *User Control and Freedom*, partners demonstrated ease in navigating through the app and being able to exit from modules and embedded web-links. Negative feedback included an inability to edit an added activity or goal in the Activities or Goals features and when a partner pressed on the back arrow on the Resources, it took them out of the Menu completely. In relation to *Consistency and Standards*, partners demonstrated the

Resources and Social Forum features were easily accessible and intuitive. Negative feedback included episodic confusion of where to type in information. In relation to *Error Prevention*, partners revealed that the Tracker screenshot image in the Lumbopelvic Pain Considerations module was confusing. Regarding *Recognition Rather than Recall*, one partner suggested that partially completed modules should be labeled as "In Progress." In relation to *Flexibility and Efficiency of Use,* one partner expressed that don't want to be forced to select "everyday" when adding an activity in the Activities feature and to have the option to label logged exercises as "completed with a baby." Regarding *Aesthetic and Minimalist Design*, partners demonstrated ease in accessing a reference through the References module and scrolling through the Social Forum discussion topics. One suggestion was to be able to add a photo to a logged exercise. In relation to *Help Users Recognize, Diagnose, and Recover from Errors*, partners revealed the embedded videos were not working and there was no workaround. Regarding *Help and Documentation* partners revealed the Menu was difficult to access directly from a module.

Feedback Pertaining to App in General. Four partners stated that overall the app is on the right track and one partner expressed they would need more time with the app to come up with further improvements.

Healthcare Providers

Five healthcare provider partners completed the think aloud usability interviews (See Appendix C Supplemental Table 5).

Feedback Pertaining to App Usability. Regarding *Visibility of System Status*, one partner demonstrated auto-correct was not working on their activity card and a desire for a progress bar to monitor PA. In relation to *Match Between the System and the Real World*, partners demonstrated ease with navigating through a module, accessing Resources from the

Menu, finding and accessing Survey History from the Menu, and logging an exercise with the Tracker feature. Negative feedback and suggestions included a different order of items when logging a goal with the Goals feature (i.e., naming the goal before labeling its priority;), confusion over the zoom label on images, and confusion over MVPA and LPA acronyms when logging an exercise with the Trackers feature. Regarding *User Control and Freedom*, partners demonstrated ease and intuition in navigating and using app features. Negative feedback and suggestions included an unexpected path when users pressed Done after accessing a Reference, they were taken back to the card with the link rather than to the document with the list of references, an inability to edit a logged goal with the Goals feature, and confusion from the Goal box in the Trackers feature. Regarding *Consistency and Standards*, partners demonstrated ease in accessing a Resource by clicking View and ease with typing at the bottom of the card for a discussion topic in the Social Forum feature. One partner expressed confusion with the Tracker feature "how hard were you working" labeled alternating words and numbers. Regarding *Error Prevention*, partners stating that the Tracker screenshot image in the Lumbopelvic Pain Considerations module was confusing, pressing save did not work when adding a goal with the Goals feature, the Trackers feature scroll bars ran off the edges of the cards, and the pop-up keypads were dysfunction. In relation to *Recognition Rather than Recall*, partners suggested "In Progress" labels for partially completed modules that the traffic light image and description were only needed once. Regarding *Flexibility and Efficiency of Use*, partners suggested for the user to be able to change the layout of the features and the ability to sort modules as they are completed. Regarding *Aesthetic and Minimalist Design*, partners expressed ease in navigating the app and finding the features. Suggestion included changing the app banner colour, increasing font sizes, and improving card content alignment. Regarding *Help Users Recognize, Diagnose, and Recover* *from Errors,* partners revealed the embedded videos were not working and they were not able to access them a roundabout way. In relation to *Help and Documentation*, partners noting that the Menu was difficult to access directly from the modules.

Feedback Pertaining to App in General. Partners stated that the app overall was on the right track. Suggestions included having audio option for modules and additional exercise videos.

Changes made to the app following the second interview. The following changes were made to the app: the app banner was changed to a gender neutral green colour, the screen shot image of the pain tracker was removed and replaced with a video to describe the feature, module videos were embedded to each module, and additional exercise videos were added to the Examples of Beginner Postpartum Exercises module. The research team informed the Pathverse development team of app usability issues and that partners desired in-progress module labels and for the app to save module progress made by users.

5.4.5 Second Online Survey Feedback

The mean score on the PEIRS-22 (Hamilton et al., 2021) was 93.69 (SD = 9.02) out of 100, with scores ranging from 73.86 to 100.00. The constructs with the highest mean scores were Contributions (M = 97.22, SD = 8.33), Convenience (M = 96.30, SD = 6.05), and Feel Valued (M = 95.83, SD = 8.84), while the constructs with the lowest mean scores were Benefits (M = 89.82, SD = 16.02), Environment and Interaction (M = 90.28, SD = 15.02), Support (M = 93.06, SD = 14.13), and Procedural Requirements (M = 93.25, SD = 10.48).

5.5 Discussion

The purpose of this study was to co-design a theory-informed and evidence-based PA behaviour change mobile app that is tailored to postpartum individuals with LPP. The methods involved collaboration with two key knowledge user groups: 1) individuals with lived expertise in postpartum LPP and were not active during the postpartum period and 2) healthcare providers with expertise in managing postpartum LPP. To the best of our knowledge, this study is the first to describe the co-design of a PA intervention tailored to postpartum LPP. Following the iterative co-design procedure, the app was deemed acceptable, usable, and ready for subsequent pilot testing, and knowledge users reported an extremely meaningful co-design study experience. This discussion will cover key feedback and changes that were made to the app to improve its acceptability and usability through the iterative study process as well as lessons learned to inform future co-design methods for developing behaviour change interventions.

The first phase of this study demonstrated that the app in its original form (targeting PA promotion among adults 18+) was not acceptable for promoting PA among postpartum individuals with LPP and that several high-level changes were needed. Similar to participants from prior postpartum PA research (Nicklas et al., 2020) partners in this study expressed an overall desire for more content and diverse images that were relevant to the postpartum experience, including its complexity and challenges. Feedback from both groups of knowledge users during this phase largely echoed one another, for example, both emphasized that planning for postpartum PA is incredibly difficult, given the constantly fluctuating postpartum schedule and fatigue. Rather than trying to plan for PA to occur at a regular time or frequency, they expressed pairing PA with other routines (i.e., their infant's routines) or pairing with someone else (i.e., availability of social support) to ensure it turns into a habit. This is supported by prior research that demonstrated PA plans that focus on placing PA within a routine are more effective than planning PA for specific times of day (Keller et al., 2017). Prior M-PAC-informed PA interventions have typically included habit formation content later in the intervention, upon receiving content related to the initial development and translation of PA intentions (Hollman, Sui, et al., 2022; Sui et al., 2024). However, while habit is a more distal construct in explaining intention-PA translation (Rhodes, La, et al., 2021), behaviour change techniques targeting habit formation may be placed earlier in an intervention to promote habit formation, as implied by feedback received by partners of this study. This study provides an example where knowledge user input may be useful, not only in the selection of behaviour change techniques (Michie et al., 2011), but also in the order of their delivery. Further research is still needed to test whether the ordering if behaviour change techniques has an impact on intervention effectiveness.

One topic where the two knowledge user groups differed in the first interview was the concept of a postpartum PA identity. While all healthcare providers were in support, two of the five partners were not congruent with this idea. This finding was also reiterated in the first online survey whereby one postpartum partner specifically noted that the "Part Of Who We Are" module (the module pertaining to developing a PA identity) could be removed completely. This is a noteworthy observation given that a recent study demonstrated identity as the strongest predictor of intention-PA translation among postpartum individuals (both with and without LPP) (Hollman et al., 2026) and suggested targeting PA identity in future postpartum PA behaviour change interventions. Additionally, identity was one of the most reliable predictors of the PA intention-behaviour gap in a systematic review of all potential moderators (Rhodes et al., 2022). Content related to PA identity is likely more useful to individuals who are already engaged in regular PA and future iterations of this app might want to deliver context-specific content. For example, it could use a simple questionnaire that helps determine where users are along the continuation of developing PA intentions, translating PA intentions, and maintaining regular PA (similar to Hollman, Vanderloo, et al., 2025). This questionnaire would then signal the app to provide specific modules tailored to where users are along this continuum. Overall, this finding supports the importance of intervention designers knowing the evidence (e.g., evidence-based predictors of PA and intention-PA translation) well so it can be balanced against diverging views of knowledge users.

During the second phase of this study, both partner groups expressed overall satisfaction in the updated app. They also provided additional minor suggestions such as reduced reading content. Prior research from postpartum individuals has similarly recommended short and fragmented opportunities for engaging with online educational material and that brief and easily digestible material are essential (Guerra-Reyes et al., 2016). This is a challenge for intervention developers when trying to balance theoretical content with user preference (Hollman, Sui, et al., 2025). To address this feedback, while maintaining the essence of the theory guiding this intervention, the research group decided to create videos of each lesson that users could choose to watch instead of reading through the cards of the modules. The next phase of intervention feasibility testing (Mummah et al., 2016) can then compare user engagement between module card and video content.

Additional suggestions provided by postpartum partners in the first survey included gamification and individualized exercise advice. Prior research on gamification of postpartum PA apps found that badges were not effective in offering extrinsic motivation for goal achievement or monitoring and authors suggested future interventions provide enhanced incentive systems through monetary and non-monetary awards (Napolitano et al., 2021). Additional research demonstrated postpartum individuals expressed enthusiasm for tangible rewards like gift cards rather than points and badges (Nicklas et al., 2020). Funding applications for subsequent feasibility and efficacy testing of this intervention should include a budget for monetary rewards that can be tied to the embedded points system of the Pathverse platform (Liu et al., 2022). Alternatively, to ensure scalability and sustainability, a user investment-based incentive could be applied where users put aside a lump sum of money and gain interest on their investment for the duration of the study (Willms et al., 2023a). Individualized exercise advise could involve a feature that guides the user to exercise videos best fit for them, based on their needs (in the Examples of Beginner Postpartum Exercises module). While this could be a valuable feature, providing specific individualized exercise suggestions is currently outside the scope of the app platform (Liu et al., 2022). Future iterations of the app could consider incorporating artificial intelligence to assist with selecting workouts. In fact, available exercise apps such as One Peloton and Strava have recently starting leveraging artificial intelligence to assist users in selecting individualized workouts (*Peloton IQ*, 2025; *Strava | Running, Cycling & Hiking App - Train, Track & Share*, 2026) and, therefore, partnering with these apps to support this feature might also be considered. It would be important to include healthcare providers and postpartum individuals in the process of developing this collaborative feature to ensure the activities support postpartum people with LPP and are not intimidating.

The third phase of this study sought to determine user-friendliness of the updated app as well as the quality of knowledge user engagement in the research program. Overall, both groups of knowledge users demonstrated ease in navigating and using the app. Many partners identified unique minor usability issues (that were not identified by any other partners) establishing the importance of testing usability on a diverse sample with a diverse range of smartphones. Establishing app usability (i.e., the app's intrinsic properties) is an important step in app development as it ensures that extrinsic metrics (e.g., app user engagement, behaviour change) can be attributed to the app itself (World Health Organization, 2016). The quality of knowledge user engagement in this study was deemed extremely meaningful (Wang et al., 2023), implying that the methods used in this research can be considered in other behaviour change intervention development programs that intend to maximize meaningful engagement by knowledge users. Given that the updated app is acceptable and usable among both groups of knowledge users, the next step is now to move forward along the IDEAS intervention development framework to phase 8 and pilot test the app among its target audience, inactive postpartum individuals with LPP (Mummah et al., 2016).

Despite its strengths, there are several limitations to this research worth noting. First, while the demographics of the sample was diverse, future research is needed to target postpartum individuals of lower education (i.e., without any form of college certificate or diploma) and individuals who do not identify as women. Second, it is still unknown whether behaviour change interventions that incorporate co-design methods are more effective in leading to behaviour change and what the most impactful design for co-design methodology is (Slattery et al., 2020). The clear description of co-design methods involved in this study as well as the evaluation of meaningful engagement by the partners will inform future co-design meta-syntheses that attempt to answer these research gaps.

5.6 Conclusion

To summarize, an evidence-based, theory-informed postpartum PA mobile intervention tailored to postpartum PA was designed and developed in collaboration with key knowledge users. Overall, partners expressed the updated app is on the right track and now ready for pilot and empirical testing. Furthermore, they conveyed an overall meaningful experience with the co-design methodology applied in the study, implying that these methods could be applied in other related behaviour change intervention development programs. Key lessons learned were that at least one round of knowledge user feedback is needed to create an acceptable and usable mHealth app tailored to postpartum people with LPP; knowledge user feedback can inform behaviour change technique order of delivery; researchers need to have a strong grasp of basic behaviour research, pertaining to the target population and context, to be able to balance it with potentially diverging feedback from a smaller (and possibly less representative) sample size of actively engaged knowledge users; and mHealth usability testing should be performed on a wide range of smartphone devices.

Chapter 6: Discussion

6.1 Dissertation Aims

The overall purpose of this dissertation was to develop an evidence-based, acceptable, feasible, scalable, and low-cost PA promotion mHealth app that is tailored to postpartum individuals with LPP using a behaviour change intervention development framework, behaviour change theory, and co-design methods. This was collectively achieved through three consecutive research studies. Chapter 3 sought to determine mediators of postpartum PA behaviour change interventions through a systematic review to determine key constructs that interventions need to target. Chapter 4 involved a cross-sectional survey to determine the postpartum intention-PA behaviour gap, predictors of intention-PA translation, and whether the intention-PA gap and predictors of its translation were moderated by the presence of LPP. Specifically, predictors assessed included reflective, regulatory, and reflexive constructs of the M-PAC framework (Rhodes, La, et al., 2021) as well as postpartum-relevant variables, including LPP, fear of movement, and perceived change in walking/running gait (Moore et al., 2021). Finally, Chapter 5 used co-design methods to tailor an evidence-based, theory-informed PA mHealth app to postpartum individuals with LPP. This study involved collaboration with two populations of key knowledge users: 1) individuals with lived expertise of postpartum LPP who were also not active postpartum and 2) healthcare providers with experience in managing postpartum LPP. This discussion chapter summarizes these three studies, addresses each of these questions, and provides detail of how the findings contribute to broader research literature. Finally, this chapter will highlight the limitations of the research and future research priorities.

6.2 Summary of Dissertation Studies

Study 1 (Hollman, Tran, et al., 2025) was a systematic review to identify putative mediators of postpartum PA behaviour change interventions. Intervention studies were included if they contained 1) individuals ≤12-months postpartum, 2) a PA intervention, 3) a no exercise or different exercise comparator, and 4) a change in PA and putative mediator outcome that could be classified with the Theoretical Domains Framework (TDF) (Cane et al., 2012). The results were categorized by mediation path, mediator TDF domain, and PA outcome. There were four mediation paths assessed (MacKinnon, 2012): 1) Path A, which is the effect of the PA intervention on the putative mediator, 2) Path B, which is the effect of the putative mediator on PA, controlling for the PA intervention, 3) Path C, which is the total effect of the PA intervention on PA without controlling for the mediator, and 4) Path AB, which is the effect of the PA intervention on PA behaviour through the mediator and is the product of Path A and Path B. PA outcomes included MVPA, total PA, walking, light PA, MSE, and PFMT. Additionally, we included an Omnibus PA category to include data from papers that reported total PA but not MVPA. Twenty-eight articles (3,328 participants) were eligible and summary effects for Paths AB, A, B, and C were calculated from two, 19, two, and 18 unique studies respectively. For the mediation Path AB, we found very small effects from the domains of beliefs about capabilities ($r = .08$), beliefs about consequences ($r = .02$), environmental context and resources ($r = .01$), and social influences ($r = .08$). For Path A, we found small effects from the domains beliefs about capabilities ($r = .11$), beliefs about consequences ($r = .14$), intentions ($r = -.24$), and behavioural regulation ($r = .25$); and very small effects from the domains knowledge ($r = .09$), environmental context and resources ($r = .02$), social influences ($r = .04$), and emotions. For Path B, we found small effects from the domains beliefs about capabilities ($r = .23$), beliefs about consequences ($r = .24$), social influences ($r = .22$), and environmental context and resources ($r = -.16$). Finally, we found a small total effect (Path C; $r = .12$) of postpartum PA interventions on PA. Altogether, these findings imply that postpartum PA interventions were mediated by outcomes from the domains of beliefs about capabilities, beliefs about consequences, environmental context and resources, and social influences, and therefore, future postpartum PA interventions should, at a minimum, target these outcomes that are classified under these domains.

Study 2 (Hollman et al., 2026) involved a cross-sectional study to determine 1) the postpartum intention-PA gap, 2) predictors of intention-PA translation using M-PAC constructs and postpartum PA-relevant variables, and 3) whether the findings were moderated by the presence of LPP. A sample of $n = 224$ individuals <12-months postpartum (mean age = 33.18; SD = 3.91; 58.9% with LPP) completed 1) M-PAC measures, 2) postpartum-relevant variables, 3) intention to engage in PA, and 4) PA participation. They were classified into four intention-behaviour profiles: 1) *non-intenders* who were not meeting 150 min of weekly MVPA, 2) *unsuccessful intenders* who had positive intentions but were not meeting 150 min weekly MVPA, and 3) *successful intenders* who were translating their positive intentions and were meeting ≥150 min weekly MVPA. This study found that the postpartum intention-PA gap (i.e., the proportion of unsuccessful intenders in relation to the total number of intenders [unsuccessful intenders plus successful intenders]) was 25.5% and it was predicted by identity ($d = .88$), habit ($d = .84$), affective attitude ($d = .74$), fear of movement ($d = -.66$), perceived opportunity ($d = .58$), and reactive regulation ($d = .46$). The intention-PA gap was not significantly different between postpartum individuals with LPP compared to no LPP, however, the presence of LPP attenuated the effect of perceived opportunity on intention-PA translation. Specifically, intention-PA translation was only predicted by perceived opportunity amongst postpartum individuals without LPP. These findings indicated that future postpartum PA interventions should target PA identity, habit, affective attitude, fear of movement, reactive regulation, and perceived opportunity. They also confirm the preconceived notion that the M-PAC framework may need to be extended to account for the complexity of the postpartum experience.

Study 3 (Chapter 5) applied co-design methods to tailor a theory-informed, evidence based mHealth PA intervention to postpartum individuals with LPP. It involved meaningful collaboration with two groups of key knowledge users: five individuals with lived expertise of postpartum LPP and five healthcare providers with expertise in managing postpartum LPP. The study involved an initial interview among partners to determine high-level changes to the app, a first online survey to determine satisfaction with and additional feedback of the updated app, a second think-aloud interview to assess usability of the app and gather final app feedback, and a second online survey to determine the extent of meaningful engagement experienced by partners throughout the study. App modifications were made following each round of feedback. Feedback from the first interview informed key high-level changes, such as more content and diverse images that are relatable to the complex postpartum and LPP experience. The first online survey demonstrated overall satisfaction with the app ($M = 3.78$, $SD = .67$) among the partners, with additional modification suggestions including reducing text, changing the app banner colour, and increasing opportunities for user interaction. Feedback from the think-aloud interview confirmed that the app was overall user friendly and ready for the next phase of pilot testing. The second online survey revealed an overall highly meaningful experience experienced by partners ($M = 93.69$, $SD = 9.02$). Ultimately, an evidence-based, theory-informed mobile PA promotion app was tailored to postpartum individuals with LPP and partners reported meaningful experiences with the co-design methods applied.

6.3 Theoretical Contributions

This dissertation contributed several general theoretical contributions. The first is that available postpartum PA behaviour change interventions are mediated by outcomes from the domains for beliefs about capabilities, believes about consequences, environmental context and resources, and social influences (Hollman, Tran, et al., 2025). These constructs are largely related to social cognitive (Ajzen, 1991; Bandura, 1986) and socioecological frameworks (McLeroy et al., 1988). The second is that we found that the postpartum intention-behaviour gap is 25.5%, and intention-PA translation is predicted by largely post-intentional constructs, including identity, habit, affective attitude, fear of movement, perceived opportunity, and reactive regulation. These findings provide evidence that future postpartum PA behaviour change interventions should target these constructs and the potential for them to act as mediators should also be assessed. The third is that this dissertation provides an example of how a PA intervention can be "grounded in theory" (i.e., M-PAC (Rhodes, La, et al., 2021)), using findings from Hollman et al. (2026; 2025), guided by the IDEAS framework (Mummah et al., 2016), and informed by a meaningful knowledge user engagement framework (Hamilton et al., 2018). The concepts of grounding in behaviour change theory, following systematic intervention development processes, and incorporating meaningful engagement with knowledge users have all been deemed essential for the development of feasible, acceptable, effective, and implementable behaviour change interventions (Bacon et al., 2020; Skivington et al., 2021).

6.3.1 Theoretical contribution #1: Reflexive Processes in Predicting and Intervening on Postpartum Physical Activity

Postpartum PA behaviour change interventions have shown small or inconclusive effects on increasing postpartum MVPA (Gilinsky et al., 2015; Lim et al., 2020; Peralta et al., 2021; Turner et al., 2023) and up to the time of this dissertation, there was no available consistent research that identified causal predictors of successful postpartum MVPA change. Testing the mediation effects of behaviour change interventions (as per Hollman et al., 2025) provides the strongest inference for identifying causal predictors of PA change. Causal predictors are intervention elements that are causally "responsible" for achieving desired behaviour change (Kraemer et al., 2002; Teixeira et al., 2015). A major limitation to postpartum PA behaviour change literature, identified in Hollman et al. (2025), was that very few (only three) postpartum PA behaviour change intervention studies have applied mediation analyses (Albright et al., 2019; Cramp & Brawley, 2006; Fjeldsoe et al., 2013; Hollman, Tran, et al., 2025). This resulted in a limited synthesis of mediators, from only four domains of the TDF (Cane et al., 2012) and very small effect sizes, indicating there are likely alternative mediators contributing to the causal effects of postpartum PA behaviour change interventions. None of the studies identified in Hollman et al. (2025), regardless of whether they applied mediation analyses, reported postpartum PA behaviour change for populations with LPP. This study identified a clear need for future postpartum PA behaviour change interventions to test predictive causality of regulatory and reflexive mediators, demonstrating the importance and novelty of developing a postpartum PA behaviour change intervention that is informed by the M-PAC framework (Rhodes, La, et al., 2021). Of note, regulatory constructs represent behavioural, cognitive, and affective regulation strategies (e.g., planning, self-monitoring, and emotion-regulation), while reflexive constructs are the consequence of repeated actions and action control from cues over time (e.g., habit, identity; Rhodes et al., 2021)

Prior systematic reviews that have synthesized putative mediators of PA behaviour change interventions identified autonomous motivation, self-efficacy, and use of self-regulation skills for lifestyle obesity interventions involving behaviour and weight change (Teixeira et al., 2015), although the overall size of mediation effect was not synthesized. Similar to Hollman et al. (2025) a meta-analysis of PA behaviour change interventions among adults reported very small effects for mediators classified under the domains beliefs about capabilities, beliefs about consequences, social influences, emotions, and behavioural regulation (Rhodes, Boudreau, et al., 2021). Additionally, the authors found very small mediation effects of core constructs from social cognitive theory (Bandura, 1997), self-determination theory (Deci & Ryan, 2004, 2013), theory of planned behaviour (Ajzen, 1991), and the transtheoretical model (Prochaska & DiClemente, 1982). Similar to the conclusions in Hollman et al. (2025), Rhodes and colleagues noted that further research was needed to assess policy, environmental, social, and non-conscious constructs in mediating PA behaviour change interventions (Rhodes, Boudreau, et al., 2021; Rhodes, McEwan, et al., 2019b).

Following this recommendation, Hollman et al. (2026) was one of the first studies to explore (and confirm) reflexive constructs (i.e., habit and identity) as predictors of the intention-PA translation among postpartum individuals with and without LPP. This finding is supported by limited prior literature demonstrating an association between postpartum PA and PA identity (Lesser et al., 2023) and that intention-PA translation (among a non-clinical postpartum population) is predicted by regulatory (i.e., planning) and reflexive (i.e., habit and identity) constructs (Rhodes, Beauchamp, et al., 2021). Most postpartum PA literature in relation to identity has explored the relations between athlete and mother identities (Appleby & Fisher, 2009; Darroch & Hillsburg, 2017; Palmer & Leberman, 2009), often noting tension between athlete and mother identities. It is important to note that athlete and exercise identities are likely distinct constructs, yet more research is needed to empirically test this proposition (Palermo & Rancourt, 2021; Rhodes, Wierts, et al., 2025). A recent qualitative study reported all participants felt a change in themselves as exerciser or athlete in relation to becoming a mother (Ritondo et al., 2024). Some participants felt their exerciser identity aligned with motherhood while others experienced conflict between these identities. Some participants specifically reported losing their exercise identity upon becoming a mother. This shift in identity was perceived to lead participants to rethink how they prioritized PA, with some believing their exercise identity could support their mother identity (i.e., as a role model for their child), while others found that they were not able to prioritize their PA as result of the substantial obligations associated with a mother identity (Ritondo et al., 2024). Participants reported shifting their meaning of PA from organized exercise to self-care, mental health, and a desire to be in good health for their children. Findings from Ritondo and colleagues (2024) may also be in alignment with identity reframing (Rhodes, Rebar, et al., 2025), whereby, participants reported redefining what PA meant to them, and rather than thinking of PA as an intense workout that was independent of their life schedule, PA was defined as walking or playing with their children.

Another study demonstrated the potential interaction between postpartum PA habit and identity whereby engaging in PA was achieved through including their infants in their PA (Bean et al., 2023). They also noted that adaptability was critical (i.e., recognizing that PA sessions may be shorter or longer, depending on the day) when developing a PA habit postpartum (Bean et al., 2023). Adaptability took two forms, with the first being adaptability to motherhood, whereby PA was performed in a way that both mother and child benefitted (e.g. indoor PA during infant nap, hiking to expose the child to outdoors). The second was adaptability around motherhood whereby postpartum individuals chose to bring their infant to the activity that brought them, as a parent, enjoyment (Bean et al., 2023). These findings imply that postpartum PA habit may be achieved by combining PA with pre-existing infant routines. Altogether, the findings from available studies exploring the relationship between postpartum PA and reflexive processes of identity and habit echo the findings from Hollman et al. (2026) and further signal the importance of targeting these constructs in future postpartum PA interventions.

To summarize, this dissertation contributes valuable information that postpartum PA is related to reflexive processes and that future postpartum PA interventions should consider targeting habit and identity constructs.

6.3.2 Theoretical contribution #2: Expanding Behaviour Change Theories to Account for Complex Postpartum Experience

Studies 2 and 3 provided quantitative and qualitative evidence that the M-PAC framework (Rhodes, La, et al., 2021) needs expanding to account for the complex postpartum experience. M-PAC is useful in behaviour change intervention research because it proposes a causal structure between constructs that ultimately determine PA. However, a limitation to the M-PAC theory, and a likely limitation of any generalist theory (Courneya, 2014), is that its constructs may be not be exhaustive for every population. Recent literature has emphasized applying a biopsychosocial model in promoting postpartum PA (Davenport, Ruchat, et al., 2025; Donnelly et al., 2022). This model suggests that returning to PA should be considered in relation to biopsychosocial constructs including physical deconditioning, changes to body mass, sleeping patterns, breastfeeding, relative energy deficiency in sport, postpartum fatigue, fear of movement, psychological well-being, and socioeconomic status (Donnelly et al., 2021). While the biopsychosocial model is helpful in explaining that a multitude of physical, psychological, and social factors can have an impact on health behaviours, it is limited in providing a causal structure to distinguish cause-effect from correlations, and thus reduces its applicability in developing effective behaviour change interventions (Roberts, 2023). Alternatively, Courneya

(2014) described a framework for PA and cancer survivorship that includes a causative structure and argues for expanding PA theory to account for additional population-specific variables. Courneya (2014) suggested that there are four primary associations between PA and population-related variables worth exploring: 1) population-related variables may be determinants of PA, 2) population-related variables may be moderators of PA determinants, 3) population-related variables may be outcomes of PA, and 4) population-related variables may be moderators of PA. This dissertation explored the first two associations between postpartum-related variables and PA, explained in further detail below.

The first proposed association is of postpartum-related variables as determinants of PA and was explored in this dissertation. In Hollman et al. (2026), we found that the presence of LPP (that started during pregnancy or postpartum) was associated with significantly less postpartum MVPA, however, it was not a significant moderator of the intention-behaviour gap. As mentioned in the dissertation Introduction, available research does not consistently demonstrate this inverse relationship, with many studies showing equally low rates of PA between postpartum individuals with and without LPP (Bergström et al., 2017; Gutke et al., 2011; Mogren, 2006; Mukkannavar et al., 2014). Given that some postpartum-related variables may be determinants of PA, it is important to also examine their impact on potential mediators of these associations (Courneya, 2014). For example, results from Hollman et al. (2026) demonstrated increased fear of movement among postpartum individuals with LPP, and reduced fear of movement predicted intention-PA translation. Fear of movement was also significantly negatively associated with the following constructs of the M-PAC framework: affective attitude ($r = -.36$), instrumental attitude ($r = -.44$), perceived capability ($r = -.44$), perceived opportunity ($r = -.27$), habit ($r = -.25$), and identity ($r = -.31$). The only construct it was not associated with was behavioural regulation (r = -.14; p > .05). Behaviour regulation is a collection of tactics applied in effort to achieve action control (i.e., translating intentions into behaviours) (Rhodes, La, et al., 2021). Behaviour regulation tactics are diverse, including a range of behavioural, cognitive, and affective processes. It is possible that fear of movement may have more of an impact on some behavioural regulation tactics compared to others. For example, it might reduce the proactive regulation (i.e., planning the when, where, what and how to enact PA) tactic as a consequence of reduced PA intentions, but may have an increased impact on social monitoring and relying on others for feedback (Rhodes & Lithopoulos, 2023).

The second proposed association, also explored by this dissertation, is that postpartum-related variables may be moderators of PA determinants. In Study 2 we found that the presence of LPP only significantly moderated the effect of perceived opportunities on intention-behaviour translation whereby perceived opportunities only predicted translation among individuals without LPP. The presence of postpartum LPP did not moderate the effect of identity, habit, affective attitude, fear of movement, or reactive regulation on intention-PA translation. These findings support the robustness of M-PAC and opens the opportunity for future exploration of moderators. Postpartum-related variables may also moderate associations with PA from demographic variables (e.g., age, sex, education), medical variables (e.g., mode of delivery, body mass index), and environmental variables (e.g., access to childcare).

While this dissertation did not explicitly explore the third association, the 2025 Canadian Guidelines for PA, sedentary behaviour and sleep throughout the first year postpartum demonstrates an output that was primarily informed by postpartum-related variables as outcomes of PA (Davenport, Ruchat, et al., 2025). To inform these guidelines, five systemic reviews were conducted, demonstrating that a minimum threshold of 120-min per week of MVPA was recommended for clinically meaningful health benefits, such as improved psychological well-being (i.e., reduced prevalence of depression and symptoms of depression and anxiety (Deprato et al., 2025)), pelvic floor health (i.e., reduced risk of urinary incontinence (Beamish et al., 2025)), musculoskeletal health (i.e., reduced symptoms of low back and pelvic girdle pain (Ruchat et al., 2025)), cardiometabolic health (i.e., improved weight low, body mass index, and blood lipides (Jones, Moolyk, et al., 2025)), and reduction in fatigue (Jones, Ruchat, et al., 2025). Ultimately, similar to the field of PA and cancer survivorship, determining the effect of PA on postpartum-related variables is important for the field of postpartum PA because it highlights the outcomes that are likely the most significant to postpartum individuals, healthcare providers, and policy-makers. Determining the effect of PA on postpartum-related variables also prompts the importance and urgency of identifying and/or creating effective ways to support engagement in postpartum PA.

The fourth association is that postpartum-related variables may be moderators of PA outcomes, whereby the response to exercise may increase or decrease, depending on the postpartum-related variable. As mentioned by Courneya, this association is a fundamental consideration as it implies that PA research on other populations may not be translatable to postpartum PA (2014). Although this proposition was not explicitly explored in this dissertation, the first example that likely comes to mind for postpartum is that of birth method. In Canada, over one-third of births occur via caesarean section and this rate is rising (Canada, 2024). Giving birth via caesarean is associated with higher rates of reduced quality of life, including increased pain, fatigue, depression, and anxiety (Christopher et al., 2019; Kuo et al., 2014; Lee & Lee, 2007). The postpartum PA guidelines highlighted a key research gap pertaining to mode of delivery, declaring inadequate available research to inform whether recommendations for engaging in PA should differ by mode of delivery (Davenport, Ruchat, et al., 2025). Relating back to this proposition, postpartum PA outcomes may differ by mode of delivery.

Postpartum LPP is another postpartum-related variable worth assessing as a moderator of PA outcome. For example, postpartum individuals with LPP are more susceptible to depression (Gutke et al., 2007) and therefore, individuals with LPP may experience greater PA-associated improvements in depression compared to those without LPP. Additionally, PA may either reduce pain among individuals with LPP (Ruchat et al., 2025) or, alternatively, it may induce pain aggravation and potentially result in increased fear of movement and/or reduced PA behaviour (Goubran et al., 2025). As mentioned by Courneya, there are conceptual and methodological issues pertaining to research testing this fourth proposition (Courneya, 2014). For example, the moderator should be included as a counterpart in the study and sampling should be stratified by the moderator, randomization stratification should be based on the moderator, moderator counterparts should be randomized to intervention and comparison groups, and a statistical test of the interaction effect and with adequate power should be conducted (Courneya, 2014). Similar to PA and cancer survivorship studies, few postpartum PA studies have included all of these design features to test postpartum-relevant variables (e.g., mode of delivery, LPP) as moderators and, therefore, these should be explored in the future.

6.4 Practical Implications

This dissertation has several broad practical implications. First, Study 2 and 3 focus on reflexive processes in relation to postpartum PA. These are areas of much interest because there is currently little practical guidance on intervention design for promoting PA identity and habit (Ma et al., 2023; Rhodes, Wierts, et al., 2025; Strachan et al., 2025). As such, the approach taken to inform the development of this intervention that targets PA identity and habit will add to this literature more generally. Second, Study 3 is one of the first to design a PA intervention using a no-code mobile app builder (Liu et al., 2022). Given the widespread rates of physical inactivity (Strain et al., 2024), scalable, low-cost, and sustainable solutions for intervening on PA are needed. mHealth interventions meet these requirements yet recent evidence shows that available PA mHealth apps have only demonstrated small to moderate effect sizes on PA change with effect size decreasing over time (Mönninghoff et al., 2021). As such the methods of this study can inform resource- and time-efficient mHealth development for more effective and theoretically-informed PA promotion mHealth apps.

Study 3 can be used in the broader co-design literature to help determine whether co-designed behaviour change interventions are more effective than those that were not informed by co-design (Slattery et al., 2020). This argument is similar to the theory-based versus no clear stated theory interventions where there is some mixed evidence of whether theory is important for downstream intervention effectiveness (Gourlan et al., 2016; McEwan et al., 2019). In theory, the integration of co-design methods into behaviour change intervention development should result in more applicable and effective interventions, however the current evidence base is insufficient to test this (Slattery et al., 2020). Describing transparent co-design methods as we have done in Study 3, following the GRIPP 2 (Staniszewska et al., 2017) reporting checklist for reporting patient and public involvement in research, will help future syntheses looking to determine the impact of co-design on intervention effectiveness, thus informing future intervention development frameworks.

6.4.1 Practical Implication #1: Methods to Encourage Meaningful Engagement in Behaviour Change Intervention Design

The first principle of the Canadian Institutes for Health Research Strategy for Patient-Oriented Research is that "patients need to be involved in all aspects of research to ensure questions and result are relevant" (Canadian Institutes of Health Research, 2018). Furthermore, there have been calls in behaviour change intervention development research that knowledge users (i.e., patient groups, practitioners, policy makers (Canadian Institutes of Health Research, 2012)) should be included throughout behaviour change intervention development and implementation (Bacon et al., 2020). A knowledge user's involvement and level of engagement in the research process may vary in intensity and complexity, depending on the nature of the research (Canadian Institutes of Health Research, 2012). Importantly knowledge user engagement should be of high quality to ensure contributions are relevant and rigorous as well as feasible and acceptable among knowledge users (Forsythe et al., 2019; Hamilton et al., 2021).

While most policymakers, researchers, and research funding bodies agree that knowledge of user engagement in research is essential, there remain different perspectives on how involvement should occur (Wicks et al., 2018). In 2019, a systematic review identified 65 frameworks intended to guide knowledge user engagement in research (Greenhalgh et al., 2019). Frameworks were largely only used by research groups that developed them and there was limited evidence that any framework was better than another, implying that selection of framework was context specific. Furthermore, based on their findings, authors of this study concluded that rather than following an available framework, researchers may consider taking available evidence and co-designing their own framework to suit their research needs (Greenhalgh et al., 2019).

In the present dissertation, we chose to apply the patient engagement in research (PEIR) framework as it includes readily available implementation tools, including a workbook to guide meaningful engagement and can be tailored to the research context (Hamilton et al., 2018; Hamilton et al., 2018) as well as the PEIR-22 questionnaire to measure meaningful engagement of knowledge users (Hamilton et al., 2021). Additionally, we aimed to promote active involvement (as recommended for co-design; Sanders & Stappers, 2008) of knowledge users by gathering iterative feedback on three evolving prototypes of the mHealth app. In this study, we provided opportunities for knowledge users to draft specific changes to be made to the mHealth app and offered partners to be co-authors and co-presenters of an academic manuscript and presentation related to this research.

The partners in this study reported an overall mean score of 93.69 (SD = 9.02) out of 100, indicating an extremely high degree of meaningfulness (Wang et al., 2023). This finding is useful for other behaviour change intervention development projects because it implies other researchers can apply similar methods with confidence that they will generate meaningful experiences among knowledge users partners in their projects as well. These findings are also useful to co-design literature at large whereby if this project moves forward to feasibility and efficacy/effectiveness testing, this research program can be used in research syntheses aimed at determining whether meaningful knowledge user engagement is in fact associated with more effective behaviour change interventions (Slattery et al., 2020).

6.4.2 Practical Implication #2: Balancing Active Knowledge User Engagement and Preferences with Theory and Robust, Replicable Methodology

A challenge that we experienced in designing Study 3, which applied co-design methods, was knowing how “actively” to involve knowledge users. Sanders and Stappers (2008) is one of the most widely recognized resources for co-design and they emphasized the differences between user-centred design and co-design. While both methods involve knowledge users to enhance acceptability and usability of research outputs, user-centred design involves more passive engagement from knowledge users, while co-design involves active engagement of knowledge users as partners in the research process (Sanders & Stappers, 2008). For example, in user-centred design, researchers might collect data from knowledge users through observation or interviews to generate ideas for products that might be useful "for" knowledge users. Alternatively, in co-design, knowledge users have the position of an "expert of his/her experience" and thus work "with" researchers in various phases including knowledge development, idea generation, and concept experience (Sanders & Stappers, 2008). These distinctions, however, are not consistent in more recent literature. For example, Slattery and colleagues (2020) defined co-design as "meaningful end-user engagement in research design and includes instances of engagement that occur across all stages of the research process and range in intensity from relatively passive to highly active and involved." In their review of co-design methods, they found that focus groups, interviews, and surveys were the most common forms of co-design activities (Slattery et al., 2020), yet, these are arguably examples of passive engagement from knowledge users.

Highly active engagement of knowledge users might involve equal decision-making, power, and responsibility across the entire research process (Slattery et al., 2020). A challenge to researchers in applying this form of active engagement is determining at what point the research ethics board needs to be involved. For example, we found ourselves wondering whether we needed to acquire ethics approval to reach out to a lay audience and select knowledge users to partner with. Diversity of knowledge users involved in co-design is recommended (Greenhalgh et al., 2019) and, therefore, diverse forms of recruitment might be needed to identify knowledge users and ensure minimizing bias and the likelihood of researchers simply reaching out to potential knowledge users who are in their inner circle. This also leads to a second challenge in obtaining adequate diversity and representation with a small sample size of knowledge users that are involved in the active engagement. Historically, behaviour change interventions were designed primarily from the results of large group statistical evidence (i.e., basic behavioural science; Czajkowski & Hunter, 2021), which ultimately has better representation but may not account for nuances of some populations and/or contexts. As such, a challenge for a researcher, as we experienced in Study 3, is to balance robust and widespread findings from basic behavioural science (for example in our case, the findings from Study 2 (Hollman et al., 2026) with the contrasting feedback from a smaller sample of actively engaged knowledge users (as seen in Study 3).

A third challenge with this highly active approach is maintaining the core theory of the intervention and the wealth of knowledge from previous research that substantiates that theory. A common theme from partners in Study 3 was to reduce content and text and one partner even suggested removing the PA identity module completely. This might speak to the concept of combining user-centered and co-design methods. For example, including personas (i.e., seemingly real but fictional users; typically a method from user-centred design) might ensure that feedback from knowledge users takes into account both their own point of view as well as other potential users' points of view (Dominello et al., 2025). While we included personas in the first round of feedback of Study 3, bringing them back in the second and third rounds of feedback may have provided more diverse input from knowledge users.

In Study 3, we decided to acquire research ethics prior to communicating with any partners. We presumed that we would want to document the process of both obtaining as well as engaging with knowledge users to inform future co-design studies because available co-design research is lacking in transparency of the exact details that went into the co-design methods (Slattery et al., 2020). While we included passive forms of knowledge user engagement, such as through interviews and surveys, we did also apply several active components. First, having three rounds of feedback from knowledge users enabled them to evaluate changes that were made to the app in response to their feedback and ensure the changes were in fact reflective of their feedback. Alternatively, we could have involved knowledge users in the synthesis of interview and online survey findings, however, we decided that obtaining their feedback on changes made provided greater value for their time. Second, we did provide partners the opportunity to make changes to the app. Examples included the wording of some of the module content and selection of additional embedded videos. This process could have involved more active involvement of partners by actually giving them access to the Pathverse program (Liu et al., 2022), enabling them to make direct changes to the program. Ultimately, the research group decided against this approach as it would be difficult to monitor and document the changes made. Furthermore, the Pathverse app has some user limitations, for example it is not always possible to edit features (e.g., re-order Menu Resources) and sometimes it loses card content when changes are made. As such, it made sense for only the Primary Researcher to make direct changes to the program itself. Finally, we provided knowledge users opportunities to be co-authors and co-presenters on research outputs related to this study, which will take place following the defence of this dissertation.

To summarize, the methods applied in Study 3 included a combination of passive and active knowledge user engaged activities and, as previously mentioned, resulted in a meaningful experience among knowledge users. These methods contribute to co-design literature as a whole by specifically describing how both passive and active methods can be used to optimize co-design outputs.

6.5 Future Directions

Limitations for each study have been discussed in the limitations sections of Hollman et al. (2026; 2025) and Chapter 5 and, therefore, this section will focus on future directions of this research. First, while most behaviour change intervention development frameworks recommend grounding interventions in theory (Bacon et al., 2020; Czajkowski et al., 2015; Mummah et al., 2016; Skivington et al., 2021), there is no standardized method for this process. In this research, we used a systematic review of PA intervention mediators (Hollman, Tran, et al., 2025), a cross-sectional study of predictors of intention-behaviour translation (Hollman et al., 2026), and a theory-guided intervention tailoring co-design study (Chapter 5). Alternatively, we could have focused more time on qualitative research to determine additional postpartum-related variables to test and implement in Hollman et al. (2026) and Study 3. Additionally, and as previously mentioned, we could have diverted more resources to a longitudinal study of postpartum intention-behaviour translation to generate stronger evidence of predictor causality. Future research is needed to guide comprehensive methods of grounding behaviour change interventions in theory.

The second future direction is that while our intentions were broad in applying the TDF (i.e., a composite of 33 behaviour and behaviour change theories; Cane et al., 2012) to Hollman et al. (2025) and Study 3, this dissertation is limited in that it primarily focused on testing the M-

PAC framework in relation to postpartum PA (Rhodes, La, et al., 2021). Future research should continue to apply alternative theories in relation to postpartum PA, with the caveat that this dissertation did provide evidence that studying constructs of the social cognitive domain alone (which the majority of prior postpartum PA research is informed by (Gilinsky et al., 2015; Hollman, Tran, et al., 2025)) is inadequate to describe postpartum PA. Future research should continue to explore reflexive (e.g., habit, identity, automatic schema, social identity, affective response to PA) constructs from the dual process frameworks (Deutsch & Strack, 2006).

The third consideration is that rather than developing and designing a postpartum PA intervention from the ground up, we tailored a pre-existing evidence-based and theoretically informed PA intervention to postpartum individuals with LPP, using Pathverse, a "no-code" app design platform (Liu et al., 2022). The Pathverse platform includes pre-existing app features and limited resources for embedding some knowledge user requests, such as enhanced gamification and the option for the user to receive tailored exercise suggestions. Future research with unlimited time and resources, although likely unpractical, might consider developing and designing an app with a dedicated app developer team that is not confined to the functions of a pre-existing app design platform. Of course this might also result in longer periods of app development before and after each round of knowledge user feedback, potentially resulting in reduced motivation or interest from knowledge users towards the project. To mitigate this, artificial intelligence could potentially be leveraged to optimize app development procedures.

Ultimately the next step of this research is evaluate the intervention in feasibility and efficacy testing. Future iterations of the intervention may also want to consider partnering with available platforms (e.g., One Peloton, Strava) (*Peloton IQ*, 2025; *Strava | Running, Cycling & Hiking App - Train, Track & Share*, 2026) that have the resources to generate individualised exercise recommendations based on postpartum-related variables such as time postpartum, history of exercise, postpartum-related symptoms, state of fatigue, time available. Of course, further research and partnering with knowledge users are also needed to determine which of these postpartum-related variables are necessary for informing such an individualized program. Additionally, to strategize content delivery, the intervention could consider capturing ecological momentary assessment to inform just-in-time adaptive interventions and thereby deliver intervention content in smaller chunks and when it is most appropriate to the user (Hardeman et al., 2019). For example, future interventions could use daily surveys to measure fear of movement, pain intensity, or fatigue to trigger module delivery at high readiness moments (Dunton, 2017).

6.6 Conclusions

To summarize, this research program involved the development and design of a PA mHealth app tailored to postpartum individuals with LPP. It was *guided* by the IDEAS framework for digital behaviour change intervention development (Mummah et al., 2016), *grounded* in the M-PAC framework (Rhodes, La, et al., 2021) and additional postpartum-relevant variables (e.g., fear of movement; (Courneya, 2014)), and it incorporated *meaningful knowledge user engagement* using the PEIR framework (Hamilton et al., 2018). This research program provides important theoretical contributions, such as the importance of reflexive processes in determining postpartum PA and expanding available behaviour change theories and frameworks to account for postpartum-relevant variables mediating both PA behaviours and outcomes. Additionally, this dissertation provides practical evidence of meaningful knowledge user engagement methods that can be applied to other behaviour change intervention development programs and the co-design literature as a whole. The next step is now to move forward to evaluate the app in feasibility, efficacy, effectiveness testing and ultimate wide-spread implementation.

References

Abbasi, M., & van den Akker, O. (2015). A systematic review of changes in women's physical activity before and during pregnancy and the postnatal period. *Journal of Reproductive and Infant Psychology*, *33*(4), 325–358. (2015-36978-002). https://doi.org/10.1080/02646838.2015.1012710

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, Theories of Cognitive Self-Regulation*, *50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Ajzen, I. (2002). *Constructing a TPB questionnaire: Conceptual and methodological considerations*. http://www.unix.oit.umass.edu/~aizen/pdf/tpb.measurement.pdf

Albright, C. L., Maddock, J. E., & Nigg, C. R. (2006). Physical activity before pregnancy and following childbirth in a multiethnic sample of healthy women in Hawaii. *Women & Health*, *42*(3), 95–110. https://doi.org/10.1300/J013v42n03_06

Albright, C. L., Wilkens, L. R., Saiki, K., White, K. K., & Steffen, A. D. (2019). Mediators of a 12-month change in physical activity in ethnically diverse sample of postpartum women. *Translational Journal of the American College of Sports Medicine*, *4*(19), 215–224. https://doi.org/10.1249/TJX.0000000000000106

Aldabe, D., Ribeiro, D. C., Milosavljevic, S., & Dawn Bussey, M. (2012). Pregnancy-related pelvic girdle pain and its relationship with relaxin levels during pregnancy: A systematic review. *European Spine Journal*, *21*(9), 1769–1776. https://doi.org/10.1007/s00586-012-2162-x

Almasaudi, A. S., Alashmali, S., Zedan, H. S., Kutbi, H. A., Alharbi, M. D., & Baattaiah, B. A. (2024). The associations between dairy product intake, fatigue status, and physical activity among postpartum women in Saudi Arabia: A cross-sectional study. *BMC Public Health*, *24*(1), 2759. https://doi.org/10.1186/s12889-024-20294-2

Almeida de Oliveira, L., Gross, A. R., Carlesso, L., Hanna, S., Bakaa, N., Silva, D., Hayden, J. A., & Macedo, L. G. (2025). Graded activity for chronic low back pain. *The Cochrane Database of Systematic Reviews*, *2025*(2), CD015507. https://doi.org/10.1002/14651858.CD015507

Almousa, S., Lamprianidou, E., & Kitsoulis, G. (2018). The effectiveness of stabilising exercises in pelvic girdle pain during pregnancy and after delivery: A systematic review. *Physiotherapy Research International*, *23*(1), 1–1.

Alsobayel, H., Buragadda, S., Aljuaid, S., Basamad, L., Alshehri, S., Alhenaki, M., Murayshed, H., & Melam, G. R. (2020). Sociodemographic factors associated with postpartum physical activity levels in working women. *Women & Health*, *60*(1), 60–71. https://doi.org/10.1080/03630242.2019.1610828

Anderson, D. F., & Cychosz, C. M. (1994). Development of an exercise identity scale. *Perceptual and Motor Skills*, *78*(3), 747–751. https://doi.org/10.1177/003151259407800313

Antcliff, D., Keeley, P., Campbell, M., Woby, S., Keenan, A.-M., & McGowan, L. (2018). Activity pacing: Moving beyond taking breaks and slowing down. *Quality of Life Research*, *27*(7), 1933–1935. https://doi.org/10.1007/s11136-018-1794-7

Aota, E., Kitagaki, K., Tanaka, K., Tsuboi, Y., Matsuda, N., Horibe, K., Perrein, E., & Ono, R. (2021). The impact of sedentary behavior after childbirth on postpartum lumbopelvic pain prolongation: A follow-up cohort study. *Journal of Women's Health*. https://doi.org/10.1089/jwh.2020.8695

Appleby, K. M., & Fisher, L. A. (2009). “Running in and out of Motherhood”: Elite distance runners’ experiences of returning to competition after pregnancy. *Women in Sport and Physical Activity Journal*, *18*(1), 3–17. https://doi.org/10.1123/wspaj.18.1.3

Ashford, S., Edmunds, J., & French, D. P. (2010). What is the best way to change self-efficacy to promote lifestyle and recreational physical activity? A systematic review with meta-analysis. *British Journal of Health Psychology*, *15*(2), 265–288. https://doi.org/https://doi.org/10.1348/135910709X461752

Atkins, L., Francis, J., Islam, R., O’Connor, D., Patey, A., Ivers, N., Foy, R., Duncan, E. M., Colquhoun, H., Grimshaw, J. M., Lawton, R., & Michie, S. (2017). A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems. *Implementation Science*, *12*(1), Article 1. https://doi.org/10.1186/s13012-017-0605-9

Baattaiah, B. A., Zedan, H. S., Almasaudi, A. S., Alashmali, S., & Aldhahi, M. I. (2022). Physical activity patterns among women during the postpartum period: An insight into the potential impact of perceived fatigue. *BMC Pregnancy and Childbirth*, *22*(1), 678. https://doi.org/10.1186/s12884-022-05015-0

Bacon, S. L., Campbell, T. S., & Lavoie, K. L. (2020). Rethinking how to expand the evidence base for health behavior change in cardiovascular disease prevention. *JACC*, *75*(20), 2619–2622. https://doi.org/10.1016/j.jacc.2020.03.055

Badon, S. E., Oberman, N., Ramsey, M., Quesenberry, C. P., Kurtovich, E., Chavez, L. G., Brown, S. D., Albright, C. L., Bhalala, M., & Avalos, L. A. (2025). Effect of a tailored ehealth physical activity intervention on physical activity and depression during postpartum: Randomized controlled trial (The Postpartum Wellness Study). *JMIR Mental Health*, *12*(1), e64507. https://doi.org/10.2196/64507

Badr, H. A., & Zauszniewski, J. A. (2017). Meta-analysis of the predictive factors of postpartum fatigue. *Applied Nursing Research*, *36*, 122–127. https://doi.org/10.1016/j.apnr.2017.06.010

Bahadoran, P., Abbasi, F., Yousefi, A. R., & Kargarfard, M. (2007). Evaluating the effect of exercise on the postpartum quality of life. *Iranian Journal of Nursing and Midwifery Research*, *12*(1), 17–20.

Bahadoran, P., Tirkesh, F., & Oreizi, H. R. (2014). Association between physical activity 3-12 months after delivery and postpartum well-being. *Iranian Journal of Nursing and Midwifery Research*, *19*(1), 82–87.

Balestroni, G., & Bertolotti, G. (2012). EuroQol-5D (EQ-5D): An instrument for measuring quality of life. *Monaldi Archives for Chest Disease*, *78*(3). https://doi.org/10.4081/monaldi.2012.121

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall.

Bandura, A., 1925. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman.

Baranowski, T., Anderson, C., & Carmack, C. (1998). Mediating variable framework in physical activity interventions: How are we doing? how might we do better? *American Journal of Preventive Medicine*, *15*(4), 266–297. https://doi.org/10.1016/S0749-3797(98)00080-4

Barbacsy-MacDonald, I. (2011). *Physical activity and postpartum functional status in primiparous women* [Queen’s University]. http://hdl.handle.net/1974/6812

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*(6), 1173–1182. https://doi.org/10.1037//0022-3514.51.6.1173

Bashirian, S., Ouji, Z., Afshari, M., Barati, M., Heydarimoghadam, R., & Soltanian, A. (2020). Effect of an educational intervention based on the BASNEF model on promoting physical activity among postpartum women. *International Quarterly of Community Health Education*, *40*(2), 151–158. https://doi.org/10.1177/0272684X19858897

Bastiaenen, C. H., de Bie, R. A., Vlaeyen, J. W., Goossens, M. E., Leffers, P., Wolters, P. M., Bastiaanssen, J. M., Brandt, P. A. van den, & Essed, G. G. (2008). Long-term effectiveness and costs of a brief self-management intervention in women with pregnancy-related low back pain after delivery. *BMC Pregnancy and Childbirth*, *8*(1), 19. https://doi.org/10.1186/1471-2393-8-19

Bastiaenen, C. H., de Bie, R. A., Wolters, P. M., Vlaeyen, J. W., Bastiaanssen, J. M., Klabbers, A. B., Heuts, A., van den Brandt, P. A., & Essed, G. G. (2004). Treatment of pregnancy-related pelvic girdle and/or low back pain after delivery design of a randomized clinical trial within a comprehensive prognostic cohort study [ISRCTN08477490]. *BMC Public Health*, *4*(1), 67. https://doi.org/10.1186/1471-2458-4-67

Bastiaenen, C. H., de Bie, R. A., Wolters, P. M., Vlaeyen, J. W., Leffers, P., Stelma, F., Bastiaanssen, J. M., Essed, G. G., & van den Brandt, P. A. (2006). Effectiveness of a tailor-made intervention for pregnancy-related pelvic girdle and/or low back pain after delivery: Short-term results of a randomized clinical trial. *BMC Musculoskeletal Disorders*, *7*(1), 19. https://doi.org/10.1186/1471-2474-7-19

Bauer, P. W., Pivarnik, J. M., Feltz, D. L., Paneth, N., & Womack, C. J. (2014). Relationship of past-pregnancy physical activity and self-efficacy with current physical activity and postpartum weight retention. *American Journal of Lifestyle Medicine*, *8*(1), 68–73. https://doi.org/10.1177/1559827613498061

Beales, D. J., Gaynor, O., Harris, J., Fary, R., O'Sullivan, P. B., Slater, H., Graven-Nielsen, T., & Palsson, T. S. (2019). Correlations between the active straight leg raise, sleep and somatosensory sensitivity during pregnancy with post-partum lumbopelvic pain: An initial exploration. *Scandinavian Journal of Pain*, *19*(1), 53–60. https://doi.org/10.1515/sjpain-2018-0081

Beales, D., Lutz, A., Thompson, J., Wand, B. M., & O'Sullivan, P. (2016). Disturbed body perception, reduced sleep, and kinesiophobia in subjects with pregnancy-related persistent lumbopelvic pain and moderate levels of disability: An exploratory study. *Manual Therapy*, *21*, 69–75. https://doi.org/10.1016/j.math.2015.04.016

Beales, D., Slater, H., Palsson, T., & O'Sullivan, P. (2020). Understanding and managing pelvic girdle pain from a person-centred biopsychosocial perspective. *Musculoskeletal Science & Practice*, *48*, 102152. https://doi.org/10.1016/j.msksp.2020.102152

Beamish, N. F., Davenport, M. H., Ali, M. U., Gervais, M. J., Sjwed, T. N., Bains, G., Sivak, A., Deering, R. E., & Ruchat, S.-M. (2025). Impact of postpartum exercise on pelvic floor disorders and diastasis recti abdominis: A systematic review and meta-analysis. *British Journal of Sports Medicine*, *59*(8), 562–575. https://doi.org/10.1136/bjsports-2024-108619

Bean, C., Lesser, I., & Ritondo, T. (2023). Women moving forward in pictures: Using digital photographs to explore postpartum women's physical activity experiences. *Qualitative*

Research in Sport, Exercise and Health, *15*(5), 669–691. https://doi.org/10.1080/2159676X.2023.2185283

Bellows-Riecken, K. H., & Rhodes, R. E. (2008). A birth of inactivity? A review of physical activity and parenthood. *Preventive Medicine*, *46*(2), 99–110. https://doi.org/10.1016/j.ypmed.2007.08.003

Bennett, G. G., & Glasgow, R. E. (2009). The delivery of public health interventions via the internet: Actualizing their potential. *Annual Review of Public Health*, *30*(1), 273–292. https://doi.org/10.1146/annurev.publhealth.031308.100235

Bennetter, K. E., Richardsen, K. R., Vøllestad, N. K., Jenum, A. K., Robinson, H. S., Mdala, I., & Waage, C. W. (2023). Associations between social support and physical activity in postpartum: A Norwegian multi-ethnic cohort study. *BMC Public Health*, *23*(1), Article 1. https://doi.org/10.1186/s12889-023-15507-z

Bergström, C., Persson, M., & Mogren, I. (2014). Pregnancy-related low back pain and pelvic girdle pain approximately 14 months after pregnancy – pain status, self-rated health and family situation. *BMC Pregnancy and Childbirth*, *14*(1), 48.

Bergström, C., Persson, M., Nergård, K.-A., & Mogren, I. (2017). Prevalence and predictors of persistent pelvic girdle pain 12 years postpartum. *BMC Musculoskeletal Disorders*, *18*(1), 399. https://doi.org/10.1186/s12891-017-1760-5

Berry, D. C., Hall, E. G., Neal, M. N., Adatorwovor, R., Schwartz, T. A., & Stuebe, A. (2016). Results of the optimizing outcomes in women with gestational diabetes mellitus and their infants, a cluster randomized, controlled pilot study: Lessons learned. *Journal of National Black Nurses' Association*, *27*(2), 1–10.

Bick, D., Taylor, C., Bhavnani, V., Healey, A., Seed, P., Roberts, S., Zasada, M., Avery, A., Craig, V., Khazaezadah, N., McMullen, S., O'Connor, S., Oki, B., Ntim, E., Poston, L., & Ussher, M. (2020). Lifestyle information and commercial weight management groups to support maternal postnatal weight management and positive lifestyle behaviour: The SWAN feasibility randomised controlled trial. *BJOG: An International Journal of Obstetrics & Gynaecology*, *127*(5), 636–645. https://doi.org/10.1111/1471-0528.16043

Bijlholt, M., Ameye, L., Van Uytsel, H., Devlieger, R., & Bogaerts, A. (2021). The INTER-ACT e-health supported lifestyle intervention improves postpartum food intake and eating behavior, but not physical activity and sedentary behavior—A randomized controlled trial. *Nutrients*, *13*(4), Article 4. https://doi.org/10.3390/nu13041287

Blyholder, L., Chumanov, E., Carr, K., & Heiderscheit, B. (2017). Exercise behaviors and health conditions of runners after childbirth. *Sports Health*, *9*(1), 45–51. https://doi.org/10.1177/1941738116673605

Bø, K., Artal, R., Barakat, R., Brown, W. J., Davies, G. A. L., Dooley, M., Evenson, K. R., Haakstad, L. A. H., Kayser, B., Kinnunen, T. I., Larsén, K., Mottola, M. F., Nygaard, I., van Poppel, M., Stuge, B., & Khan, K. M. (2017). Exercise and pregnancy in recreational and elite athletes: 2016/17 evidence summary from the IOC Expert Group Meeting, Lausanne. Part 3—exercise in the postpartum period. *British Journal of Sports Medicine*, *51*(21), 1516–1525. https://doi.org/10.1136/bjsports-2017-097964

Boehm, B. W. (1988). A spiral model of software development and enhancement. *Computer*, *21*(5), 61–72. Computer. https://doi.org/10.1109/2.59

Boonstra, A. M., Schiphorst Preuper, H. R., Balk, G. A., & Stewart, R. E. (2014). Cut-off points for mild, moderate, and severe pain on the visual analogue scale for pain in patients with chronic musculoskeletal pain. *PAIN®*, *155*(12), 2545–2550. https://doi.org/10.1016/j.pain.2014.09.014

Borodulin, K., Evenson, K. R., & Herring, A. H. (2009). Physical activity patterns during pregnancy through postpartum. *BMC Women's Health*, *9*(1), 32. https://doi.org/10.1186/1472-6874-9-32

Bourcier, A., Dmochowski, R., Cervigni, M., Haab, F., & ois. (2017). International survey on pelvic floor rehabilitation after childbirth. *Ics.Org*. https://www.ics.org/2017/abstract/791

Bouwer, R. T., & Brandt, C. (2025). Returning to Running Postpartum: A Scoping Review. *The Journal of Women's & Pelvic Health Physical Therapy*, *49*(3), 149. https://doi.org/10.1097/JWH.0000000000000341

Brand, R., & Ekkekakis, P. (2018). Affective–Reflective Theory of physical inactivity and exercise. *German Journal of Exercise and Sport Research*, *48*(1), 48–58. https://doi.org/10.1007/s12662-017-0477-9

Braun, V., & Clarke, V. (2021a). One size fits all? What counts as quality practice in (reflexive) thematic analysis? *Qualitative Research in Psychology*, *18*(3), 328–352. https://doi.org/10.1080/14780887.2020.1769238

Braun, V., & Clarke, V. (2021b). To saturate or not to saturate? Questioning data saturation as a useful concept for thematic analysis and sample-size rationales. *Qualitative Research in Sport, Exercise and Health*, *13*(2), 201–216. https://doi.org/10.1080/2159676X.2019.1704846

Braun, V., & Clarke, V. (2022). Conceptual and design thinking for thematic analysis. *Qualitative Psychology*, *9*(1), 3–26. https://doi.org/10.1037/qup0000196

Brillinger, K. (2021). *Creating a BOPPPS Lesson Plan – Faculty Learning Hub*. Faculty Learning Hub. https://tlconestoga.ca/creating-a-boppps-lesson-plan/

Brown, W. J., Bauman, A. E., Bull, F. C., & Burton, D. N. W. (2012). *Development of Evidence based Physical Activity Recommendations for Adults (18 64 years)*. Report prepared for the Australian Government Department of Health.

Brown, W. J., Hayman, M., Haakstad, L. A. H., Lamerton, T., Mena, G. P., Green, A., Keating, S. E., Gomes, G. A. O., Coombes, J. S., & Mielke, G. I. (2022). Australian guidelines for physical activity in pregnancy and postpartum. *Journal of Science and Medicine in Sport*, *25*(6), 511–519. https://doi.org/10.1016/j.jsams.2022.03.008

Bull, F. C., Al-Ansari, S. S., Biddle, S., Borodulin, K., Buman, M. P., Cardon, G., Carty, C., Chaput, J.-P., Chastin, S., Chou, R., Dempsey, P. C., DiPietro, L., Ekelund, U., Firth, J., Friedenreich, C. M., Garcia, L., Gichu, M., Jago, R., Katzmarzyk, P. T., … Willumsen, J. F. (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *British Journal of Sports Medicine*, *54*(24), 1451–1462. https://doi.org/10.1136/bjsports-2020-102955

Burkart, S., Marcus, B. H., Pekow, P., Rosal, M. C., Manson, J. E., Braun, B., & Chasan-Taber, L. (2020). The impact of a randomized controlled trial of a lifestyle intervention on postpartum physical activity among at-risk hispanic women: Estudio PARTO. *PloS One*, *15*(7), e0236408. (32706812). https://doi.org/10.1371/journal.pone.0236408

Burke, P. J. (2016). Identity change. *Social Psychology Quarterly*, *69*(1), 81–96. https://doi.org/10.1177/019027250606900106

Burton, C., Doyle, E., Humber, K., Rouxel, C., Worner, S., Colman, R., & Palmer, S. (2019). The biopsychosocial barriers and enablers to being physically active following childbirth:

A systematic literature review. *Physical Therapy Reviews*, *24*(3–4), 143–155. https://doi.org/10.1080/10833196.2019.1632049

Canada, P. H. A. of. (2024, January 16). *Perinatal Health Indicators—Canada.ca* [Datasets;statistics;education and awareness]. https://health-infobase.canada.ca/phi/

Canadian Institutes of Health Research. (2012, May 25). *Knowledge User Engagement—CIHR*. https://cihr-irsc.gc.ca/e/49505.html

Canadian Institutes of Health Research. (2018, June 18). *About SPOR*. https://cihr-irsc.gc.ca/e/51036.html

Cane, J., O'Connor, D., & Michie, S. (2012). Validation of the theoretical domains framework for use in behaviour change and implementation research. *Implementation Science*, *7*(1), Article 1. https://doi.org/10.1186/1748-5908-7-37

Caneiro, J. P., Smith, A., Bunzli, S., Linton, S., Moseley, G. L., & O'Sullivan, P. (2022). From fear to safety: A roadmap to recovery from musculoskeletal pain. *Physical Therapy*, *102*(2), pzab271. https://doi.org/10.1093/ptj/pzab271

Carbonnel, F., & Ninot, G. (2019). Identifying frameworks for validation and monitoring of consensual behavioral intervention technologies: Narrative review. *Journal of Medical Internet Research*, *21*(10), e13606. https://doi.org/10.2196/13606

Cardol, M., de Haan, R. J., de Jong, B. A., van den Bos, G. A. M., & de Groot, I. J. M. (2001). Psychometric properties of the impact on Participation and Autonomy Questionnaire. *Archives of Physical Medicine and Rehabilitation*, *82*(2), 210–216. https://doi.org/10.1053/apmr.2001.18218

Carlsson, A. M. (1983). Assessment of chronic pain. I. Aspects of the reliability and validity of the visual analogue scale. *Pain*, *16*(1), 87–101. https://doi.org/10.1016/0304-3959(83)90088-X

Carson, V., Adamo, K., & Rhodes, R. E. (2018). Associations of parenthood with physical activity, sedentary behavior, and sleep. *American Journal of Health Behavior*, *42*(3), 80–89. https://doi.org/10.5993/AJHB.42.3.8

Carver, C. S., & Scheier, M. F. (1998). *On the Self-Regulation of Behavior*. Cambridge, Univ. Press.

Chhabra, H. S., Sharma, S., & Verma, S. (2018). Smartphone app in self-management of chronic low back pain: A randomized controlled trial. *European Spine Journal*, *27*(11), 2862–2874. https://doi.org/10.1007/s00586-018-5788-5

Christopher, S. M., Donnelly, G., Brockwell, E., Bo, K., Davenport, M. H., Vivo, M. D., Dufour, S., Forner, L., Mills, H., Moore, I. S., Olson, A., & Deering, R. E. (2024). Clinical and exercise professional opinion of return-to-running readiness after childbirth: An international Delphi study and consensus statement. *British Journal of Sports Medicine*, *58*(6), 299–312. https://doi.org/10.1136/bjsports-2023-107489

Christopher, S. P., McCullough, J. P., Snodgrass, S. J., & Cook, C. P. (2019). Predictive risk factors for first-onset lumbopelvic pain in postpartum women: A systematic review. *Journal of Women*, *43*(3), 127–135. https://doi.org/10.1097/JWH.0000000000000133

Clark, M., & Thorpe, H. (2023). “I just don’t trust my pelvic floor”: Examining the bio-social barriers to maternal health and physical activity participation in a sample of mothers’ from New Zealand. *SSM - Qualitative Research in Health*, *3*, 100261. https://doi.org/10.1016/j.ssmqr.2023.100261

Cliff, D. P., McNeill, J., Vella, S. A., Howard, S. J., Santos, R., Batterham, M., Melhuish, E., Okely, A. D., & de Rosnay, M. (2017). Adherence to 24-Hour Movement Guidelines for the Early Years and associations with social-cognitive development among Australian preschool children. *BMC Public Health*, *17*(Suppl 5), 857. mnh (29219104). https://doi.org/10.1186/s12889-017-4858-7

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd ed.). Routledge. https://doi.org/10.4324/9780203771587

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155–159. https://doi.org/10.1037/0033-2909.112.1.155

Coll, C., Domingues, M., Santos, I., Matijasevich, A., Horta, B., & Hallal, P. (2015). Changes in leisure-time physical activity from the pre-pregnancy to the postpartum period: 2004 Pelotas (Brazil) birth cohort study. *Journal of Physical Activity & Health*, *13*. https://doi.org/10.1123/jpah.2015-0324

Colleran, H. L., Hiatt, A., Wideman, L., & Lovelady, C. A. (2019). The effect of an exercise intervention during early lactation on bone mineral density during the first year postpartum. *Journal of Physical Activity and Health*, *16*(3), 197–204. https://doi.org/10.1123/jpah.2018-0232

Conner, M., & Norman, P. (2015). *Predicting and Changing Health Behaviour: Research and Practice with Social Cognition Models*. McGraw-Hill Education (UK).

Courneya, K. S. (1994). Predicting repeated behavior from intention: The issue of scale correspondence. *Journal of Applied Social Psychology*, *24*(7), 580–594. https://doi.org/10.1111/j.1559-1816.1994.tb00601.x

Courneya, K. S. (2014). Physical activity and cancer survivorship: A simple framework for a complex field. *Exercise and Sport Sciences Reviews*, *42*(3), 102. https://doi.org/10.1249/JES.0000000000000011

Courneya, K. S., Jones, L. W., Rhodes, R. E., & Blanchard, C. M. (2004). Effects of different combinations of intensity categories on self-reported exercise. *Research Quarterly for Exercise and Sport*, *75*(4), 429–433. https://doi.org/10.1080/02701367.2004.10609176

Craig, C. L., Marshall, A. L., Sj??Str??M, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., Pratt, M., Ekelund, U., Yngve, A., Sallis, J. F., & Oja, P. (2003). International Physical Activity Questionnaire: 12-country reliability and validity: *Medicine & Science in Sports & Exercise*, *35*(8), 1381–1395. https://doi.org/10.1249/01.MSS.0000078924.61453.FB

Cramp, A. G., & Brawley, L. R. (2006). Moms in motion: A group-mediated cognitive-behavioral physical activity intervention. *International Journal of Behavioral Nutrition and Physical Activity*, *3*(1), 23. https://doi.org/10.1186/1479-5868-3-23

Cramp, A. G., & Brawley, L. R. (2009). Sustaining self-regulatory efficacy and psychological outcome expectations for postnatal exercise: Effects of a group-mediated cognitive behavioural intervention. *British Journal of Health Psychology*, *14*(3), 595–611. https://doi.org/10.1348/135910708X383732

Cramp, A. G., & Bray, S. R. (2011). Understanding exercise self-efficacy and barriers to leisure-time physical activity among postnatal women. *Maternal and Child Health Journal*, *15*(5), 642–651. (2011-11662-012). https://doi.org/10.1007/s10995-010-0617-4

Czajkowski, S. M., & Hunter, C. M. (2021). From ideas to interventions: A review and comparison of frameworks used in early phase behavioral translation research. *Health Psychology*, *40*(12), 829–844. https://doi.org/10.1037/hea0001095

Czajkowski, S. M., Powell, L. H., Adler, N., Naar-King, S., Reynolds, K. D., Hunter, C. M., Laraia, B., Olster, D. H., Perna, F. M., Peterson, J. C., Epel, E., Boyington, J. E., & Charlson, M. E. (2015). From ideas to efficacy: The ORBIT model for developing behavioral treatments for chronic diseases. *Health Psychology*, *34*(10), 971–982. (2015-03938-001). https://doi.org/10.1037/hea0000161

Dakic, J. G., Cook, J., Hay-Smith, J., Lin, K.-Y., Ekegren, C., & Frawley, H. C. (2022). Pelvic floor symptoms are an overlooked barrier to exercise participation: A cross-sectional online survey of 4556 women who are symptomatic. *Physical Therapy*, *102*(3), pzab284. https://doi.org/10.1093/ptj/pzab284

Daley, A. J., Blamey, R. V., Jolly, K., Roalfe, A. K., Turner, K. M., Coleman, S., McGuinness, M., Jones, I., Sharp, D. J., & MacArthur, C. (2015). A pragmatic randomized controlled trial to evaluate the effectiveness of a facilitated exercise intervention as a treatment for postnatal depression: The PAM-PeRS trial. *Psychological Medicine*, *45*(11), 2413–2425. https://doi.org/10.1017/S0033291715000409

Daley, A. J., Jolly, K., Bensoussane, H., Ives, N., Jebb, S. A., Tearne, S., Greenfield, S. M., Yardley, L., Little, P., Tyldesley-Marshall, N., Pritchett, R. V., Frew, E., & Parretti, H. M. (2020). Feasibility and acceptability of a brief routine weight management intervention for postnatal women embedded within the national child immunisation programme in primary care: Randomised controlled cluster feasibility trial. *Trials*, *21*(1), Article 1. https://doi.org/10.1186/s13063-020-04673-9

Daley, A. J., Winter, H., Grimmett, C., McGuinness, M., McManus, R., & MacArthur, C. (2008). Feasibility of an exercise intervention for women with postnatal depression: A pilot randomised controlled trial. *The British Journal of General Practice*, *58*(548), 178–183. https://doi.org/10.3399/bjgp08X277195

Darroch, F., & Hillsburg, H. (2017). Keeping pace: Mother versus athlete identity among elite long distance runners. *Women's Studies International Forum*, *62*, 61–68. https://doi.org/10.1016/j.wsif.2017.03.005

Davenport, M. H., Christopher, S., Deering, R. E., Prevett, C., Dufour, S., Forte, M., Beamish, N., Adamo, K., Bo, K., Brockwell, E., Brunet-Pagé, É., Chari, R., Vivo, M. D., Fleming, K., Hassan, A., Hayman, M., Lane, K. N., Mottola, M. F., Neil-Sztramko, S. E., … Ruchat, S.-M. (2025). International Delphi study of clinical and exercise professionals' opinion of physical activity prescreening and contraindications for participating in postpartum physical activity. *British Journal of Sports Medicine*, *59*(8), 527–538. https://doi.org/10.1136/bjsports-2024-109104

Davenport, M. H., Giroux, I., Sopper, M. M., & Mottola, M. F. (2011). Postpartum exercise regardless of intensity improves chronic disease risk factors. *Medicine & Science in Sports & Exercise*, *43*(6), 951–958. https://doi.org/10.1249/MSS.0b013e3182051155

Davenport, M. H., Ruchat, S.-M., Jaramillo Garcia, A., Ali, M. U., Forte, M., Beamish, N., Fleming, K., Adamo, K. B., Brunet-Pagé, É., Chari, R., Lane, K. N., Mottola, M. F., & Neil-Sztramko, S. E. (2025). 2025 Canadian guideline for physical activity, sedentary behaviour and sleep throughout the first year post partum. *British Journal of Sports Medicine*, bjsports-2025-109785. https://doi.org/10.1136/bjsports-2025-109785

Davies, G. A. L., Wolfe, L. A., Mottola, M. F., & MacKinnon, C. (2003). Joint SOGC/CSEP clinical practice guideline: Exercise in pregnancy and the postpartum period. *Canadian Journal of Applied Physiology*, *28*(3), 329–341. https://doi.org/10.1139/h03-024 de Souza, A. C., Carbonera, L. A., & Rocha, E. (2022). Paid parental leave: Different scenarios around the world. *Stroke*, *53*(1), e23–e25. https://doi.org/10.1161/STROKEAHA.121.035919

Deci, E. L., & Ryan, R. M. (2004). *Handbook of Self-determination Research*. University Rochester Press.

Deci, E. L., & Ryan, R. M. (2013). *Intrinsic Motivation and Self-Determination in Human Behavior*. Springer Science & Business Media.

Deeks, J. J., Higgins, J. P., Altman, D. G., & on behalf of the Cochrane Statistical Methods Group. (2019). Analysing data and undertaking meta-analyses. In *Cochrane Handbook for Systematic Reviews of Interventions* (pp. 241–284). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781119536604.ch10

Deering, R. E., Senefeld, J., Pashibin, T., Neumann, D. A., Cruz, M., & Hunter, S. K. (2018). Fatigability of the lumbopelvic stabilizing muscles in women 8 and 26 weeks postpartum. *Journal of Women's Health Physical Therapy*, *42*(3), 128–138. mnh (30740039). https://doi.org/10.1097/JWH.0000000000000109

Deering, R., Pashibin, T., Cruz, M., Hunter, S. K., & Hoeger Bement, M. (2019). Fatiguing trunk flexor exercise decreases pain sensitivity in postpartum women. *Frontiers in Physiology*, *10*, 315. mnh (30971949). https://doi.org/10.3389/fphys.2019.00315

Deprato, A., Ruchat, S.-M., Ali, M. U., Cai, C., Forte, M., Gierc, M., Meyer, S., Sjwed, T. N., Shirazi, S., Matenchuk, B. A., Jones, P. A. T., Sivak, A., & Davenport, M. H. (2025). Impact of postpartum physical activity on maternal depression and anxiety: A systematic review and meta-analysis. *British Journal of Sports Medicine*, *59*(8), 550–561. https://doi.org/10.1136/bjsports-2024-108478 deRosset, L., Berry, D., Sanchez-Lugo, L., Ritter, K., Purdum, C., Santolim, V., Gilliland, R., & Pender, L. (2013). Mama Sana. . . Usted Sana: Lessons learned from a postpartum weight loss intervention for hispanic women with infants six months or less. *Hispanic Health Care International*, *11*(2), 78–86.

Deutsch, R., & Strack, F. (2006). Duality models in social psychology: From dual processes to interacting systems. *Psychological Inquiry*, *17*(3), 166–172. https://doi.org/10.1207/s15327965pli1703_2

Dicianno, B. E., Parmanto, B., Fairman, A. D., Crytzer, T. M., Yu, D. X., Pramana, G., Coughenour, D., & Petrazzi, A. A. (2015). Perspectives on the evolution of mobile (mhealth) technologies and application to rehabilitation. *Physical Therapy*, *95*(3), 397–405. https://doi.org/10.2522/ptj.20130534

Ding, D., Lawson, K. D., Kolbe-Alexander, T. L., Finkelstein, E. A., Katzmarzyk, P. T., Mechelen, W. van, & Pratt, M. (2016). The economic burden of physical inactivity: A global analysis of major non-communicable diseases. *The Lancet*, *388*(10051), 1311–1324. https://doi.org/10.1016/S0140-6736(16)30383-X

Dipietro, L., Evenson, K. R., Bloodgood, B., Sprow, K., Troiano, R. P., Piercy, K. L., Vaux-Bjerke, A., Powell, K. E., & Committee, F. T. 2018 P. A. G. A. (2019). Benefits of physical activity during pregnancy and postpartum: An umbrella review. *Medicine & Science in Sports & Exercise*, *51*(6), 1292–1302. https://doi.org/10.1249/MSS.0000000000001941

Dodd, J. M., Deussen, A. R., O'Brien, C. M., Schoenaker, D. A. J. M., Poprzeczny, A., Gordon, A., & Phelan, S. (2018). Targeting the postpartum period to promote weight loss: A systematic review and meta-analysis. *Nutrition Reviews*, *76*(8), 639–654. https://doi.org/10.1093/nutrit/nuy024

Dol, J., Richardson, B., Aston, M., McMillan, D., Tomblin Murphy, G., & Campbell-Yeo, M. (2022). Health information seeking in the postpartum period: A cross-sectional survey. *Journal of Neonatal Nursing*, *28*(2), 118–122. https://doi.org/10.1016/j.jnn.2021.08.008

Dombrowski, S. U., O'Carroll, R. E., & Williams, B. (2016). Form of delivery as a key 'active ingredient' in behaviour change interventions. *British Journal of Health Psychology*, *21*(4), 733–740. https://doi.org/10.1111/bjhp.12203

Dominello, A., Cheek, C., & Clay-Williams, R. (2025). The use of personas to involve consumers in healthcare co-design: A scoping review. *BMC Health Services Research*, *25*(1), 649. https://doi.org/10.1186/s12913-025-12786-7

Donnelly, G. M., Brockwell, E., Rankin, A., & Moore, I. S. (2022). Beyond the musculoskeletal system: Considering whole-systems readiness for running postpartum. *Journal of Women's Health Physical Therapy*, *46*(1), 48–56. https://doi.org/10.1097/JWH.0000000000000218

Donnelly, G. M., Moore, I. S., Brockwell, E., Rankin, A., & Cooke, R. (2021). Reframing return-to-sport postpartum: The 6 Rs framework. *British Journal of Sports Medicine*. https://doi.org/10.1136/bjsports-2021-104877

Doran, F., & Davis, K. (2011). Factors that influence physical activity for pregnant and postpartum women and implications for primary care. *Australian Journal of Primary Health*, *17*(1), 79–85. https://doi.org/10.1071/PY10036

Draper, S. W., & Norman, D. A. (1986). *User Centered System Design: New Perspectives on Human-Computer Interaction*. Lawrence Erlbaum Associates.

Duckworth, A. L., Gendler, T. S., & Gross, J. J. (2016). Situational strategies for self-control. *Perspectives on Psychological Science*, *11*(1), 35–55. https://doi.org/10.1177/1745691615623247

Duggan, M. (2021, January 20). CSEP Get Active Questionnaire. *Canadian Society for Exercise Physiology (CSEP)*. https://csep.ca/2021/01/20/pre-screening-for-physical-activity/

Dunton, G. F. (2017). Ecological momentary assessment in physical activity research. *Exercise and Sport Sciences Reviews*, *45*(1), 48. https://doi.org/10.1249/JES.0000000000000092

Durham, H. A., Morey, M. C., Lovelady, C. A., Brouwer, R. J. N., Krause, K. M., & Østbye, T. (2011). Postpartum physical activity in overweight and obese women. *Journal of Physical Activity and Health*, *8*(7), 988–993. https://doi.org/10.1123/jpah.8.7.988

Durnea, C. M., Khashan, A. S., Kenny, L. C., Durnea, U. A., Smyth, M. M., & O'Reilly, B. A. (2014). Prevalence, etiology and risk factors of pelvic organ prolapse in premenopausal primiparous women. *International Urogynecology Journal*, *25*(11), 1463–1470. https://doi.org/10.1007/s00192-014-2382-1

Durnea, C. M., O'Reilly, B. A., Khashan, A. S., Kenny, L. C., Durnea, U. A., Smyth, M. M., & Dietz, H. P. (2015). Status of the pelvic floor in young primiparous women. *Ultrasound in Obstetrics & Gynecology*, *46*(3), 356–362. https://doi.org/10.1002/uog.14711

Eccles, D. W., & Arsal, G. (2017). The think aloud method: What is it and how do I use it? *Qualitative Research in Sport, Exercise and Health*, *9*(4), 514–531. https://doi.org/10.1080/2159676X.2017.1331501

Edie, R., Lacewell, A., Streisel, C., Wheeler, L., George, E., Wrigley, J., Pietrosimone, L., & Figuers, C. (2021). Barriers to exercise in postpartum women: A mixed-methods systematic review. *The Journal of Women's & Pelvic Health Physical Therapy*, *45*(2), 83. https://doi.org/10.1097/JWH.0000000000000201

Ehsani, F., Sahebi, N., Shanbehzadeh, S., Arab, A. M., & ShahAli, S. (2020). Stabilization exercise affects function of transverse abdominis and pelvic floor muscles in women with postpartum lumbo-pelvic pain: A double-blinded randomized clinical trial study. *International Urogynecology Journal*, *31*(1), 197–204. mnh (31016337). https://doi.org/10.1007/s00192-019-03877-1

Ekelund, U., Tarp, J., Ding, D., Sanchez-Lastra, M. A., Dalene, K. E., Anderssen, S. A., Steene-Johannessen, J., Hansen, B. H., Morseth, B., Hopstock, L. A., Sagelv, E., Nordström, P., Nordström, A., Hagströmer, M., Dohrn, I.-M., Diaz, K. M., Hooker, S., Howard, V. J., Lee, I.-M., & Fagerland, M. W. (2026). Deaths potentially averted by small changes in physical activity and sedentary time: An individual participant data meta-analysis of prospective cohort studies. *The Lancet*, *0*(0). https://doi.org/10.1016/S0140-6736(25)02219-6

Ellis, K., Pears, S., & Sutton, S. (2019). Behavioural analysis of postnatal physical activity in the UK according to the COM-B model: A multi-methods study. *BMJ Open*, *9*(8), e028682. https://doi.org/10.1136/bmjopen-2018-028682

Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. *Science*, *196*(4286), 129–136.

Ericsson, K. A., & Simon, H. A. (1998). How to study thinking in everyday life: Contrasting think-aloud protocols With descriptions and explanations of thinking. *Mind, Culture, and Activity.*, *5*(3), 178–186. https://doi.org/10.1207/s15327884mca0503_3

Evenson, K. R., Aytur, S. A., & Borodulin, K. (2009). Physical activity beliefs, barriers, and enablers among postpartum women. *Journal of Women's Health*, *18*(12), 1925–1934. https://doi.org/10.1089/jwh.2008.1309

Evenson, K. R., Brouwer, R. J. N., & Østbye, T. (2013). Changes in physical activity among postpartum overweight and obese women: Results from the KAN-DO study. *Women & Health*, *53*(3), 317–334. https://doi.org/10.1080/03630242.2013.769482

Evenson, K. R., Brown, W. J., Brinson, A. K., Budzynski-Seymour, E., & Hayman, M. (2024a). A review of public health guidelines for postpartum physical activity and sedentary behavior from around the world. *Journal of Sport and Health Science*, *13*(4), 472–483. https://doi.org/10.1016/j.jshs.2023.12.004

Evenson, K. R., Brown, W. J., Brinson, A. K., Budzynski-Seymour, E., & Hayman, M. (2024b). A review of public health guidelines for postpartum physical activity and sedentary behavior from around the world. *Journal of Sport and Health Science*, *13*(4), 472–483. https://doi.org/10.1016/j.jshs.2023.12.004

Evenson, K. R., Herring, A. H., & Wen, F. (2012). Self-reported and objectively measured physical activity among a cohort of postpartum women: The PIN postpartum study. *Journal of Physical Activity and Health*, *9*(1), 5–20. https://doi.org/10.1123/jpah.9.1.5

Farao, J., Malila, B., Conrad, N., Mutsvangwa, T., Rangaka, M. X., & Douglas, T. S. (2020). A user-centred design framework for mHealth. *PLOS ONE*, *15*(8), e0237910. https://doi.org/10.1371/journal.pone.0237910

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/BF03193146

Feil, K., Fritsch, J., & Rhodes, R. E. (2023). The intention-behaviour gap in physical activity: A systematic review and meta-analysis of the action control framework. *British Journal of Sports Medicine*, *57*(19), 1265–1271. https://doi.org/10.1136/bjsports-2022-106640

Ferguson, C. J. (2009). An effect size primer: A guide for clinicians and researchers. *Professional Psychology: Research and Practice*, *40*(5), 532–538. (2009-18332-014). https://doi.org/10.1037/a0015808

Fernandez, N., Copenhaver, D. J., Vawdrey, D. K., Kotchoubey, H., & Stockwell, M. S. (2017). Smartphone use among postpartum women and implications for personal health record utilization. *Clinical Pediatrics*, *56*(4), 376–381. https://doi.org/10.1177/0009922816673438

Fernando, M., Nilsson-Wikmar, L., & Olsson, C. B. (2020). Fear-avoidance beliefs: A predictor for postpartum lumbopelvic pain. *Physiotherapy Research International*, *25*(4). https://doi.org/10.1002/pri.1861

Ferrari, R. M., Siega-Riz, A. M., Evenson, K. R., Moos, M.-K., Melvin, C. L., & Herring, A. H. (2010). Provider advice about weight loss and physical activity in the postpartum period. *Journal of Women's Health*, *19*(3), 397–406. https://doi.org/10.1089/jwh.2008.1332

Finlayson, K., Crossland, N., Bonet, M., & Downe, S. (2020). What matters to women in the postnatal period: A meta-synthesis of qualitative studies. *PLOS ONE*, *15*(4), e0231415. https://doi.org/10.1371/journal.pone.0231415

Fjeldsoe, B. S., Miller, Y. D., & Marshall, A. L. (2010). MobileMums: A randomized controlled trial of an SMS-based physical activity intervention. *Annals of Behavioral Medicine*, *39*(2), 101–111. https://doi.org/10.1007/s12160-010-9170-z

Fjeldsoe, B. S., Miller, Y. D., & Marshall, A. L. (2013). Social cognitive mediators of the effect of the MobileMums intervention on physical activity. *Health Psychology*, *32*(7), 729–738. (2012-12930-001). https://doi.org/10.1037/a0027548

Forsythe, L. P., Carman, K. L., Szydlowski, V., Fayish, L., Davidson, L., Hickam, D. H., Hall, C., Bhat, G., Neu, D., Stewart, L., Jalowsky, M., Aronson, N., & Anyanwu, C. U. (2019). Patient engagement In research: Early findings from the patient-centered outcomes research institute. *Health Affairs*, *38*(3), 359–367. https://doi.org/10.1377/hlthaff.2018.05067

Fowler, M., & Highsmith, J. (2001). The agile manifesto. *Software Development*, *9*(8), 28–35.

Gabrielli, S., Dianti, M., Maimone, R., Betta, M., Filippi, L., Ghezzi, M., & Forti, S. (2017). Design of a mobile app for nutrition education (TreC-LifeStyle) and formative evaluation with families of overweight children. *JMIR mHealth and uHealth*, *5*(4), e7080. https://doi.org/10.2196/mhealth.7080

Garad, R., McPhee, C., Chai, T. L., Moran, L., O'Reilly, S., & Lim, S. (2020). The role of health literacy in postpartum weight, diet, and physical activity. *Journal of Clinical Medicine*, *9*(8), Article 8. https://doi.org/10.3390/jcm9082463

Gardner, B. (2015). A review and analysis of the use of 'habit' in understanding, predicting and influencing health-related behaviour. *Health Psychology Review*, *9*(3), 277–295. https://doi.org/10.1080/17437199.2013.876238

Gardner, B., Abraham, C., Lally, P., & Bruijn, G.-J. de. (2012). Towards parsimony in habit measurement: Testing the convergent and predictive validity of an automaticity subscale of the Self-Report Habit Index. *International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 1–12. https://doi.org/10.1186/1479-5868-9-102

Gausel, A. M., Dalen, I., Kjærmann, I., Malmqvist, S., Andersen, K., Larsen, J. P., & Økland, I. (2019). Adding chiropractic treatment to individual rehabilitation for persistent pelvic girdle pain 3 to 6 months after delivery: A pilot randomized trial. *Journal of Manipulative and Physiological Therapeutics*, *42*(8), 601–607. https://doi.org/10.1016/j.jmpt.2018.12.006

Gebauer, S., Schootman, M., Xian, H., & Xaverius, P. (2020). Neighborhood built and social environment and meeting physical activity recommendations among mid to older adults with joint pain. *Preventive Medicine Reports*, *18*, 101063. https://doi.org/10.1016/j.pmedr.2020.101063

Gervais, M. J., Ruchat, S.-M., Ali, M. U., Sjwed, T., Matenchuk, B. A., Meyer, S., Mottola, M. F., Adamo, K. B., Sivak, A., & Davenport, M. H. (2025). Impact of postpartum physical activity on maternal anthropometrics: A systematic review and meta-analysis. *British Journal of Sports Medicine*, *59*(8), 605–617. https://doi.org/10.1136/bjsports-2024-108449

Gilinsky, A. S. (2014). *Promoting physical activity among postnatal women: The More Active Mums in Stirling (MAMMiS) study [Ph.D. thesis]* [University of Stirling]. http://dspace.stir.ac.uk/handle/1893/21226#.V2FYH9krKM8.

Gilinsky, A. S., Dale, H., Robinson, C., Hughes, A. R., McInnes, R., & Lavallee, D. (2015). Efficacy of physical activity interventions in post-natal populations: Systematic review, meta-analysis and content coding of behaviour change techniques. *Health Psychology Review*, *9*(2), 244–263. https://doi.org/10.1080/17437199.2014.899059

Girard, M.-P., O'Shaughnessy, J., Doucet, C., Ruchat, S. M., & Descarreaux, M. (2020). Association between physical activity, weight loss, anxiety, and lumbopelvic pain in postpartum women. *Journal of Manipulative and Physiological Therapeutics*, *43*(6), 655–666. https://doi.org/10.1016/j.jmpt.2019.11.008

Godin, G., & Shephard, R. J. (1997). Godin leisure-time exercise questionnaire. *Medicine & Science in Sports & Exercise*, *29*(6), S36–S38.

Goom, T., Donnelly, G., & Brockwell, E. (2019). *Returning to running postnatal – guidelines for medical, health and fitness professionals managing this population*. https://www.absolute.physio/wp-content/uploads/2019/09/returning-to-running-postnatal-guidelines.pdf

Goubran, M., Farajzadeh, A., Lahart, I. M., Bilodeau, M., & Boisgontier, M. P. (2025). Relationship between fear of movement and physical activity in patients with cardiac, rheumatologic, neurologic, pulmonary, or pain conditions: A systematic review and meta-analysis. *Physical Therapy*, *105*(6), pzaf050. https://doi.org/10.1093/ptj/pzaf050

Gourlan, M., Bernard, P., Bortolon, C., Romain, A. J., Lareyre, O., Carayol, M., Ninot, G., & Boiché, J. (2016). Efficacy of theory-based interventions to promote physical activity. A meta-analysis of randomised controlled trials. *Health Psychology Review*, *10*(1), 50–66. https://doi.org/10.1080/17437199.2014.981777

Grant, S. J., Lithopoulos, A., & Rhodes, R. E. (2022). Understanding action control of physical activity among mothers with young children. *International Journal of Sport and Exercise Psychology*, *20*(2), 569–585. https://doi.org/10.1080/1612197X.2020.1869805

Greaves, C. J., Sheppard, K. E., Abraham, C., Hardeman, W., Roden, M., Evans, P. H., & Schwarz, P. (2011). Systematic review of reviews of intervention components associated with increased effectiveness in dietary and physical activity interventions. *BMC Public Health*, *11*(1), Article 1. https://doi.org/10.1186/1471-2458-11-119

Greenhalgh, T., Hinton, L., Finlay, T., Macfarlane, A., Fahy, N., Clyde, B., & Chant, A. (2019). Frameworks for supporting patient and public involvement in research: Systematic review and co-design pilot. *Health Expectations*, *22*(4), 785–801. https://doi.org/10.1111/hex.12888

Groth, S. W., & David, T. (2008). New mothers' views of weight and exercise. *MCN. The American Journal of Maternal Child Nursing*, *33*(6), 364–370. https://doi.org/10.1097/01.NMC.0000341257.26169.30

Grotle, M., Garratt, A. M., Krogstad Jenssen, H., & Stuge, B. (2012). Reliability and construct validity of self-report questionnaires for patients with pelvic girdle pain. *Physical Therapy*, *92*(1), 111–123. https://doi.org/10.2522/ptj.20110076

Guardino, C. M., Hobel, C. J., Shalowitz, M. U., Ramey, S. L., Dunkel Schetter, C., & Community Child Health Network (CCHN). (2018). Psychosocial and demographic predictors of postpartum physical activity. *Journal of Behavioral Medicine*, *41*(5), 668–679. https://doi.org/10.1007/s10865-018-9931-x

Guerra-Reyes, L., Christie, V. M., Prabhakar, A., Harris, A. L., & Siek, K. A. (2016). Postpartum health information seeking using mobile phones: Experiences of low-income mothers. *Maternal and Child Health Journal*, *20*(1), 13–21. https://doi.org/10.1007/s10995-016-2185-8

Guthold, R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2018). Worldwide trends in insufficient physical activity from 2001 to 2016: A pooled analysis of 358 population-based surveys with 1·9 million participants. *The Lancet Global Health*, *6*(10), e1077–e1086. https://doi.org/10.1016/s2214-109x(18)30357-7

Gutke, A., Betten, C., Degerskär, K., Pousette, S., & Olsén, M. F. (2015). Treatments for pregnancy-related lumbopelvic pain: A systematic review of physiotherapy modalities. *Acta Obstetricia et Gynecologica Scandinavica*, *94*(11), 1156–1167. mnh (26018758). https://doi.org/10.1111/aogs.12681

Gutke, A., Boissonnault, J., Brook, G., & Stuge, B. (2018). The severity and impact of pelvic girdle pain and low-back pain in pregnancy: A multinational study. *Journal of Women's Health*, *27*(4), 510–517. https://doi.org/10.1089/jwh.2017.6342

Gutke, A., Josefsson, A., & Oberg, B. (2007). Pelvic girdle pain and lumbar pain in relation to postpartum depressive symptoms. *Spine*, *32*(13), 1430–1436. https://doi.org/10.1097/BRS.0b013e318060a673

Gutke, A., Lundberg, M., Östgaard, H. C., & Öberg, B. (2011). Impact of postpartum lumbopelvic pain on disability, pain intensity, health-related quality of life, activity level, kinesiophobia, and depressive symptoms. *European Spine Journal*, *20*(3), 440–448. https://doi.org/10.1007/s00586-010-1487-6

Gutke, A., Sjödahl, J., & Oberg, B. (2010). Specific muscle stabilizing as home exercises for persistent pelvic girdle pain after pregnancy: A randomized, controlled clinical trial. *Journal of Rehabilitation Medicine*, *42*(10), 929–935. mnh (21031289). https://doi.org/10.2340/16501977-0615

Gutke, A., Sundfeldt, K., & De Baets, L. (2021). Lifestyle and chronic pain in the pelvis: State of the art and future directions. *Journal of Clinical Medicine*, *10*(22), Article 22. https://doi.org/10.3390/jcm10225397

Hagger, M. S., & Luszczynska, A. (2014). Implementation intention and action planning interventions in health contexts: State of the research and proposals for the way forward.

Applied Psychology: Health and Well-Being, *6*(1), 1–47. https://doi.org/10.1111/aphw.12017

Hall, J. T., Ebeling, M., Shary, J. R., Forestieri, N., & Wagner, C. L. (2018). The relationship between physical activity and vitamin D status in postpartum lactating and formula-feeding women. *The Journal of Steroid Biochemistry and Molecular Biology, Proceedings of the 20th Vitamin D Workshop*, *177*, 261–265. https://doi.org/10.1016/j.jsbmb.2017.08.015

Hamilton, C. B., Hoens, A. M., Backman, C. L., McKinnon, A. M., McQuitty, S., English, K., & Li, L. C. (2018). An empirically based conceptual framework for fostering meaningful patient engagement in research. *Health Expectations*, *21*(1), 396–406. https://doi.org/10.1111/hex.12635

Hamilton, C. B., Hoens, A. M., McKinnon, A. M., McQuitty, S., English, K., Hawke, L. D., & Li, L. C. (2021). Shortening and validation of the Patient Engagement In Research Scale (PEIRS) for measuring meaningful patient and family caregiver engagement. *Health Expectations*, *24*(3), 863–879. https://doi.org/10.1111/hex.13227

Hamilton, C., Hoens, A. M., Backman, C. L., English, K., McKinnon, A. M., McQuitty, S., & Li, L. C. (2018). *Workbook to guide the development of a patient engagement in research (PEIR) plan*. Arthritis Research Canada and Vancouver. http://www.arthritisresearch.ca/wp-content/uploads/2018/06/PEIR-Plan-Guide.pdf

Hardeman, W., Houghton, J., Lane, K., Jones, A., & Naughton, F. (2019). A systematic review of just-in-time adaptive interventions (JITAIs) to promote physical activity. *International Journal of Behavioral Nutrition and Physical Activity*, *16*(1), 31. https://doi.org/10.1186/s12966-019-0792-7

Harris, P. A., Taylor, R., Minor, B. L., Elliott, V., Fernandez, M., O'Neal, L., McLeod, L., Delacqua, G., Delacqua, F., Kirby, J., & Duda, S. N. (2019). The REDCap consortium: Building an international community of software platform partners. *Journal of Biomedical Informatics*, *95*, 103208. https://doi.org/10.1016/j.jbi.2019.103208

Harris, P. A., Taylor, R., Thielke, R., Payne, J., Gonzalez, N., & Conde, J. G. (2009). Research electronic data capture (REDCap)—A metadata-driven methodology and workflow process for providing translational research informatics support. *Journal of Biomedical Informatics*, *42*(2), 377–381. https://doi.org/10.1016/j.jbi.2008.08.010

Haste, A., Adamson, A. J., McColl, E., Araujo-Soares, V., & Bell, R. (2018). Problems recruiting and retaining postnatal women to a pilot randomised controlled trial of a web-delivered weight loss intervention. *BMC Research Notes*, *11*(1), 203. https://doi.org/10.1186/s13104-018-3305-x

Havens, K. L., Johnson, E. V., Day, E. N., Holdener, C. J., & Starnes, C. P. (2022). Infant carrying in the united states: A survey of current practices, physical and mental health benefits, and challenges of babywearing. *Journal of Women's Health Physical Therapy*, *46*(1), 25–34. https://doi.org/10.1097/JWH.0000000000000227

Hayman, M., Alfrey, K.-L., Cannon, S., Alley, S., Rebar, A. L., Williams, S., Short, C. E., Altazan, A., Comardelle, N., Currie, S., Denton, C., Harrison, C. L., Lamerton, T., Mena, G. P., Moran, L., Mottola, M., Nagpal, T. S., Vincze, L., & Schoeppe, S. (2021). Quality, features, and presence of behavior change techniques in mobile apps designed to improve physical activity in pregnant women: Systematic search and content analysis. *JMIR mHealth and uHealth*, *9*(4), e23649. https://doi.org/10.2196/23649

Hendrie, G. A., James-Martin, G., Williams, G., Brindal, E., Whyte, B., & Crook, A. (2019). The development of VegEze: Smartphone app to increase vegetable consumption in Australian adults. *JMIR Formative Research*, *3*(1), e10731. https://doi.org/10.2196/10731

Hermawati, S., & Lawson, G. (2014). Managing obesity through mobile phone applications: A state-of-the-art review from a user-centred design perspective. *Personal and Ubiquitous Computing*, *18*(8), 2003–2023. https://doi.org/10.1007/s00779-014-0757-4

Hesketh, K. R., Evenson, K. R., Stroo, M., Clancy, S. M., Østbye, T., & Benjamin-Neelon, S. E. (2018). Physical activity and sedentary behavior during pregnancy and postpartum, measured using hip and wrist-worn accelerometers. *Preventive Medicine Reports*, *10*, 337–345. https://doi.org/10.1016/j.pmedr.2018.04.012

Hevner, A. R. (2007). *A Three Cycle View of Design Science Research*. *19*, 7.

Highton, P. J., Funnell, M. P., Tziannou, A., Rowlands, A. V., Sukumar, N., Gillies, C. L., Gray, L. J., Yates, T., Davies, M. J., Saravanan, P., & Khunti, K. (2026). Structured group education programme and accompanying mHealth intervention to promote physical activity in women with a history of gestational diabetes (Baby Steps): 4-year follow-up of a randomised controlled trial. *Diabetes, Obesity and Metabolism*, *28*(1), 754–758. https://doi.org/10.1111/dom.70199

Hinton, P. S., & Olson, C. M. (2001). Postpartum exercise and food intake: The importance of behavior-specific self-efficacy. *Journal of the American Dietetic Association*, *101*(12), 1430–1437. https://doi.org/10.1016/S0002-8223(01)00345-5

Hoedjes, M., Berks, D., Vogel, I., Franx, A., Oenema, A., Duvekot, J. J., Habbema, J. D. F., Steegers, E. A. P., & Raat, H. (2012). Postpartum physical activity after preeclampsia.

Pregnancy Hypertension: An International Journal of Women's Cardiovascular Health, *2*(2), 143–151. https://doi.org/10.1016/j.preghy.2012.01.003

Hollman, H., Davenport, M. H., Liu, S., & Rhodes, R. E. (2026). Postpartum physical activity action control – is it impacted by the presence of pregnancy-related lumbopelvic pain? *International Journal of Sport and Exercise Psychology*, *0*(0), 1–22. https://doi.org/10.1080/1612197X.2026.2628577

Hollman, H., Sui, W., & Rhodes, R. E. (2022). A feasibility randomized controlled trial of a multi-process action control web-based intervention that targets physical activity in mothers. *Women & Health*, *62*(5), 384–401. https://doi.org/10.1080/03630242.2022.2072050

Hollman, H., Sui, W., Zhang, H., & Rhodes, R. E. (2025). A mobile health app informed by the multi-process action control framework to promote physical activity among inactive adults: Iterative usability study. *JMIR Formative Research*, *9*(1), e59477. https://doi.org/10.2196/59477

Hollman, H., Tran, S., Davenport, M. H., Liu, S., Sui, W., Ross, A., Hjartar, E., & Rhodes, R. E. (2025). A systematic review of postpartum physical activity intervention mediators. *Health Psychology*. https://doi.org/10.1037/hea0001511

Hollman, H., Updegraff, J. A., Lipkus, I. M., & Rhodes, R. E. (2022). Perceptions of physical activity and sedentary behaviour guidelines among end-users and stakeholders: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, *19*(1), Article 1. https://doi.org/10.1186/s12966-022-01245-9

Hollman, H., Vanderloo, L. M., Duncan, M. J., Faulkner, G., Lee, E.-Y., Spence, J. C., Tremblay, M. S., & Rhodes, R. E. (2025). The development of a physical activity persona profile classification for public education campaigns. *Journal of Physical Activity and Health*, *23*(2), 153–161. https://doi.org/10.1123/jpah.2025-0068

Horn, K. K., Jennings, S., Richardson, G., van Vliet, D., Hefford, C., & Abbott, J. H. (2012). The patient-specific functional scale: Psychometrics, clinimetrics, and application as a clinical outcome measure. *Journal of Orthopaedic & Sports Physical Therapy*, *42*(1), 30–42. https://doi.org/10.2519/jospt.2012.3727

Howlett, N., Trivedi, D., Troop, N. A., & Chater, A. M. (2019). Are physical activity interventions for healthy inactive adults effective in promoting behavior change and maintenance, and which behavior change techniques are effective? A systematic review and meta-analysis. *Translational Behavioral Medicine*, *9*(1), 147–157. https://doi.org/10.1093/tbm/iby010

Hughes, L. S., Clark, J., Colclough, J. A., Dale, E., & McMillan, D. (2017). Acceptance and commitment therapy (ACT) for chronic pain: A systematic review and meta-analyses. *The Clinical Journal of Pain*, *33*(6), 552. https://doi.org/10.1097/AJP.0000000000000425

International Sport and Culture Association / Centre for Economics and Business Research. (2015). *The Economic Costs of Physical Inactivity in Europe (June 2015)*. Centre for Economics and Business Research. https://inactivity-time-bomb.nowwemove.com/report

James, M. (2025). *It's not a race! A co-designed, interdisciplinary approach to return to running postpartum* [Thesis, Cardiff Metropolitan University]. https://doi.org/10.25401/cardiffmet.29604311.v1

J.C. Fairbank, Couper, J., Davies, J. B., & O'Brien, J. P. (1980). The Oswestry low back pain disability questionnaire. *Physiotherapy*, *66*, 271–273.

Jogova, M., Shaw, J., & Jamieson, T. (2019). The regulatory challenge of mobile health: Lessons for Canada. *Healthcare Policy*, *14*(3), 19–28. https://doi.org/10.12927/hcpol.2019.25795

Jones, P. A. T., Moolyk, A., Ruchat, S.-M., Ali, M. U., Fleming, K., Meyer, S., Sjwed, T. N., Wowdzia, J. B., Maier, L., Mottola, M., Sivak, A., & Davenport, M. H. (2025). Impact of postpartum physical activity on cardiometabolic health, breastfeeding, injury and infant growth and development: A systematic review and meta-analysis. *British Journal of Sports Medicine*, *59*(8), 539–549. https://doi.org/10.1136/bjsports-2024-108483

Jones, P. A. T., Ruchat, S.-M., Khan-Afridi, Z., Ali, M. U., Matenchuk, B. A., Leonard, S., Jantz, A. W., Leek, K. V., Maier, L., Osachoff, L., Hayman, M. J., Forte, M., Sivak, A., & Davenport, M. H. (2025). Impact of postpartum physical activity on maternal sleep: A systematic review and meta-analysis. *British Journal of Sports Medicine*, *59*(8), 576–583. https://doi.org/10.1136/bjsports-2024-108839

Katzenelenbogen, O., Bar-Kalifa, E., & Dunton, G. F. (2024). The moderating effect of maternal modeling on age-related decline in children's physical activity. *Journal of Family Psychology*. (2025-50880-001). https://doi.org/10.1037/fam0001284

Kaushal, N., & Rhodes, R. E. (2015). Exercise habit formation in new gym members: A longitudinal study. *Journal of Behavioral Medicine*, *38*(4), 652–663. https://doi.org/10.1007/s10865-015-9640-7

Kazemi, D. M., Borsari, B., Levine, M. J., Lamberson, K. A., & Dooley, B. (2018). REMIT: Development of a mHealth theory-based intervention to decrease heavy episodic drinking among college students. *Addiction Research & Theory*, *26*(5), 377–385. https://doi.org/10.1080/16066359.2017.1420783

Keller, C., Ainsworth, B., Records, K., Todd, M., Belyea, M., Vega-López, S., Permana, P., Coonrod, D., & Nagle-Williams, A. (2014). A comparison of a social support physical activity intervention in weight management among post-partum Latinas. *BMC Public Health*, *14*(1), Article 1. https://doi.org/10.1186/1471-2458-14-971

Keller, J., Fleig, L., Hohl, D. H., Wiedemann, A. U., Burkert, S., Luszczynska, A., & Knoll, N. (2017). Which characteristics of planning matter? Individual and dyadic physical activity plans and their effects on plan enactment. *Social Science & Medicine*, *189*, 53–62. https://doi.org/10.1016/j.socscimed.2017.07.025

Kernot, J., Lewis, L., Olds, T., & Maher, C. (2019). Effectiveness of a facebook-delivered physical activity intervention for postpartum women: A randomized controlled trial. *Journal of Physical Activity and Health*, *16*(2), 125–133. https://doi.org/10.1123/jpah.2017-0573

Khan-Afridi, Z., Ruchat, S.-M., Jones, P. A. T., Ali, M. U., Matenchuk, B. A., Leonard, S., Jantz, A. W., Leek, K. V., Maier, L. E., Osachoff, L., Hayman, M. J., Forte, M., Sivak, A., & Davenport, M. H. (2025). *Impact of sleep on postpartum health outcomes: A systematic review and meta-analysis*. https://doi.org/10.1136/bjsports-2024-109604

Khunti, K., Sukumar, N., Waheed, G., Gillies, C., Dallosso, H., Brough, C., Davies, M. J., Fitzpatrick, C., Gray, L. J., Highton, P., Rowlands, A., Schreder, S., Yates, T., & Saravanan, P. (2023). Structured group education programme and accompanying mHealth intervention to promote physical activity in women with a history of gestational diabetes: A randomised controlled trial. *Diabetic Medicine*, *40*(7), e15118. https://doi.org/10.1111/dme.15118

Kim, S.-H., Kim, H. J., & Shin, G. (2021). Self-management mobile virtual reality program for women with gestational diabetes. *International Journal of Environmental Research and Public Health*, *18*(4), Article 4. https://doi.org/10.3390/ijerph18041539

Koh, D., Miller, Y. D., Marshall, A. L., Brown, W. J., & McIntyre, D. (2010). Health-enhancing physical activity behaviour and related factors in postpartum women with recent gestational diabetes mellitus. *Journal of Science and Medicine in Sport*, *13*(1), 42–45. https://doi.org/10.1016/j.jsams.2008.10.003

Kopec, J., Esdaile, J., Abrahamowicz, M., Abenhaim, L., Wood-Dauphinee, S., Lamping, D., & Williams, J. (1995). The Quebec Back Pain Disability Scale. *Spine*, *20*(3), 341–352.

Kraemer, H. C., Wilson, G. T., Fairburn, C. G., & Agras, W. S. (2002). Mediators and moderators of treatment effects in randomized clinical trials. *Archives of General Psychiatry*, *59*(10), 877–883. https://doi.org/10.1001/archpsyc.59.10.877

Kuhl, J. (1984). Motivational aspects of achievement motivation and learned helplessness: Towards a comprehensive theory of action control. In *B.A. Maher & W.B. Maher (Eds.), Progress in experimental personality research* (pp. 99–171). Academic Press.

Kumar, S., Nilsen, W. J., Abernethy, A., Atienza, A., Patrick, K., Pavel, M., Riley, W. T., Shar, A., Spring, B., Spruijt-Metz, D., Hedeker, D., Honavar, V., Kravitz, R., Craig Lefebvre, R., Mohr, D. C., Murphy, S. A., Quinn, C., Shusterman, V., & Swendeman, D. (2013). Mobile health technology evaluation: The mhealth evidence workshop. *American Journal of Preventive Medicine*, *45*(2), 228–236. https://doi.org/10.1016/j.amepre.2013.03.017

Kuo, S.-Y., Chen, S.-R., & Tzeng, Y.-L. (2014). Depression and anxiety trajectories among women who undergo an elective cesarean section. *PLOS ONE*, *9*(1), e86653. https://doi.org/10.1371/journal.pone.0086653

Kwasnicka, D., Dombrowski, S. U., White, M., & Sniehotta, F. (2016). Theoretical explanations for maintenance of behaviour change: A systematic review of behaviour theories. *Health Psychology Review*, *10*(3), 277–296. https://doi.org/10.1080/17437199.2016.1151372

Lally, P., & Gardner, B. (2013). Promoting habit formation. *Health Psychology Review*, *7*(sup1), S137–S158. https://doi.org/10.1080/17437199.2011.603640

Laney, E. K., Hall, M. E. L., Anderson, T. L., & Willingham, M. M. (2015). Becoming a mother: The influence of motherhood on women's identity development. *Identity*, *15*(2), 126–145. https://doi.org/10.1080/15283488.2015.1023440

LaRowe, L. R., & Williams, D. M. (2022). Activity-induced pain as a predictor of physical activity behavior among individuals with chronic pain: The role of physical activity enjoyment. *Journal of Behavioral Medicine*, *45*(4), 632–642. https://doi.org/10.1007/s10865-022-00318-1

Leask, C. F., Sandlund, M., Skelton, D. A., Altenburg, T. M., Cardon, G., Chinapaw, M. J. M., De Bourdeaudhuij, I., Verloigne, M., Chastin, S. F. M., & on behalf of the GrandStand, S. S. and T. G. on the M. R. G. (2019). Framework, principles and recommendations for utilising participatory methodologies in the co-creation and evaluation of public health interventions. *Research Involvement and Engagement*, *5*(1), 2. https://doi.org/10.1186/s40900-018-0136-9

LeCheminant, J. D., Hinman, T., Pratt, K. B., Earl, N., Bailey, B. W., Thackeray, R., & Tucker, L. A. (2014). Effect of resistance training on body composition, self-efficacy, depression, and activity in postpartum women. *Scandinavian Journal of Medicine & Science in Sports*, *24*(2), 414–421.

Lee, A. S., McInnes, R. J., Hughes, A. R., Guthrie, W., & Jepson, R. (2016). The effect of the More Active MuMs in Stirling trial on body composition and psychological well-being among postnatal women. *Journal of Pregnancy*, *2016*, e4183648. https://doi.org/10.1155/2016/4183648

Lee, D., Frey, G., Cheng, A., & Shih, P. C. (2018). Puzzle Walk: A gamified mobile app to increase physical activity in adults with Autism Spectrum Disorder. *2018 10th International Conference on Virtual Worlds and Games for Serious Applications (VS-Games)*, 1–4. https://doi.org/10.1109/VS-Games.2018.8493439

Lee, R., Thain, S., Tan, L. K., Teo, T., & Tan, K. H. (2021). Asia-Pacific consensus on physical activity and exercise in pregnancy and the postpartum period. *BMJ Open Sport — Exercise Medicine*, *7*(2), e000967. https://doi.org/10.1136/bmjsem-2020-000967

Lee, S.-Y., & Lee, K. A. (2007). Early postpartum sleep and fatigue for mothers after cesarean delivery compared with vaginal delivery: An exploratory study. *The Journal of Perinatal & Neonatal Nursing*, *21*(2), 109. https://doi.org/10.1097/01.JPN.0000270627.73993.b0

Lesser, I. A., Turgeon, S., Nienhuis, C. P., & Bean, C. (2023). Examining the role of physical activity on psychological well-being and mental health postpartum. *Women in Sport and Physical Activity Journal*, *31*(1), 40–49. https://doi.org/10.1123/wspaj.2022-0057

Lesser, I., Wurz, A., Bean, C., & Hatfield, G. (2024). Exploring the feasibility, acceptability, and potential benefits of the Mom Movement Intervention (MOMmi). *Nursing for Women's Health*, *28*(4), 264–276. https://doi.org/10.1016/j.nwh.2024.01.006

Leveille, S. G., Cohen-Mansfield, J., & Guralnik, J. M. (2003). *The Impact of Chronic Musculoskeletal Pain on Exercise Attitudes, Self-Efficacy, and Physical Activity*. https://doi.org/10.1123/japa.11.2.275

Lewis, B. A., Schuver, K., Dregney, T., Terrell, C., & Stang, J. (2024). The effect of a remote physical activity intervention on postpartum depressive symptoms and stress among low income women: The healthy mom III randomized trial. *Mental Health and Physical Activity*, *27*, 100623. https://doi.org/10.1016/j.mhpa.2024.100623

Li, H., Browning, M. H. E. M., Tian, H., Huang, L., Zhang, X., Yin, M., & Liu, H. (2024). Testing the mediatory role of kinesiophobia in the association between perceived greenspace and physical activity among individuals with chronic low back pain. *Journal of Health Psychology*, 13591053241241413. https://doi.org/10.1177/13591053241241413

Liddle, S. D., & Pennick, V. (2015). Interventions for preventing and treating low-back and pelvic pain during pregnancy. *Cochrane Database of Systematic Reviews*, (9). https://doi.org/10.1002/14651858.CD001139.pub4

Lim, S., Hill, B., Pirotta, S., O'Reilly, S., & Moran, L. (2020). What are the most effective behavioural strategies in changing postpartum women's physical activity and healthy eating behaviours? A systematic review and meta-analysis. *Journal of Clinical Medicine*, *9*(1), Article 1. https://doi.org/10.3390/jcm9010237

Lim, S., Tan, A., Madden, S., & Hill, B. (2019). Health professionals' and postpartum women's perspectives on digital health interventions for lifestyle management in the postpartum period: A systematic review of qualitative studies. *Frontiers in Endocrinology*, *10*, 767. https://doi.org/10.3389/fendo.2019.00767

Lithopoulos, A., Zhang, C.-Q., Williams, D. M., & Rhodes, R. E. (2023). Development and validation of a two-component perceived control measure. *Annals of Behavioral Medicine*, *57*(2), 175–184. https://doi.org/10.1093/abm/kaac033

Liu, S., Husband, C., La, H., Juba, M., Loucks, R., Harrison, A., & Rhodes, R. E. (2019). Development of a self-guided web-based intervention to promote physical activity using the multi-process action control framework. *Internet Interventions*, *15*, 35–42. https://doi.org/10.1016/j.invent.2018.11.003

Liu, S., La, H., Willms, A., & Rhodes, R. E. (2022). A "no-code" app design platform for mobile health research: Development and usability study. *JMIR Formative Research*, *6*(8), e38737. https://doi.org/10.2196/38737

Lovelady, C. A., Bopp, M. J., Colleran, H. L., Mackie, H. K., & Wideman, L. (2009). Effect of exercise training on loss of bone mineral density during lactation. *Medicine & Science in Sports & Exercise*, *41*(10), 1902–1907. https://doi.org/10.1249/MSS.0b013e3181a5a68b

Ma, H., Wang, A., Pei, R., & Piao, M. (2023). Effects of habit formation interventions on physical activity habit strength: Meta-analysis and meta-regression. *International Journal of Behavioral Nutrition and Physical Activity*, *20*(1), Article 1. https://doi.org/10.1186/s12966-023-01493-3

Ma, J. K., Floegel, T. A., Li, L. C., Leese, J., De Vera, M. A., Beauchamp, M. R., Taunton, J., Liu-Ambrose, T., & Allen, K. D. (2021). Tailored physical activity behavior change interventions: Challenges and opportunities. *Translational Behavioral Medicine*, (ibab106). https://doi.org/10.1093/tbm/ibab106

Ma, J. K., Leese, J., Therrien, S., Hoens, A. M., Tsui, K., & Li, L. C. (2022). A scoping review of interventions to improve strength training participation. *PLOS ONE*, *17*(2), e0263218. https://doi.org/10.1371/journal.pone.0263218

MacKinnon, D. (2012). *Introduction to Statistical Mediation Analysis*. Routledge. https://doi.org/10.4324/9780203809556

MacKinnon, D. P. (2008). *Introduction to Statistical Mediation Analysis*. Lawrence Erlbaum Associates.

Mailey, E. L., & Hsu, W.-W. (2019). Is a general or specific exercise recommendation more effective for promoting physical activity among postpartum mothers? *Journal of Health Psychology*, *24*(7), 964–978. https://doi.org/10.1177/1359105316687627

Makama, M., Skouteris, H., Moran, L. J., Hill, B., Redman, L. M., & Lim, S. (2024). Co-designing a community lifestyle intervention program to reduce postpartum weight retention. *Health Expectations*, *27*(1), e13905. https://doi.org/10.1111/hex.13905

Mao, J.-Y., Vredenburg, K., Smith, P. W., & Carey, T. (2005). The state of user-centered design practice. *Communications of the ACM*, *48*(3), 105–109. https://doi.org/10.1145/1047671.1047677

Matheson, G. O., Klügl, M., Engebretsen, L., Bendiksen, F., Blair, S. N., Börjesson, M., Budgett, R., Derman, W., Erdener, U., Ioannidis, J. P. A., Khan, K. M., Martinez, R., van Mechelen, W., Mountjoy, M., Sallis, R. E., Schwellnus, M., Shultz, R., Soligard, T., Steffen, K., … Ljungqvist, A. (2013). Prevention and management of non-communicable disease: The IOC Consensus Statement, Lausanne 2013. *Sports Medicine*, *43*(11), 1075–1088. https://doi.org/10.1007/s40279-013-0104-3

Maturi, M. S., Afshary, P., & Abedi, P. (2011). Effect of physical activity intervention based on a pedometer on physical activity level and anthropometric measures after childbirth: A randomized controlled trial. *BMC Pregnancy and Childbirth*, *11*(1), 103. https://doi.org/10.1186/1471-2393-11-103

McEwan, D., Beauchamp, M. R., Kouvousis, C., Ray, C. M., Wyrough, A., & Rhodes, R. E. (2019). Examining the active ingredients of physical activity interventions underpinned by theory versus no stated theory: A meta-analysis. *Health Psychology Review*, *13*(1), 1–17. https://doi.org/10.1080/17437199.2018.1547120

McEwan, D., Rhodes, R. E., & Beauchamp, M. R. (2020). What happens when the party is over?: Sustaining physical activity behaviors after intervention cessation. *Behavioral Medicine (Washington, D.C.)*, (Journal Article), 1–9. https://doi.org/10.1080/08964289.2020.1750335

McGowan, L. J., Powell, R., & French, D. P. (2020). How can use of the Theoretical Domains Framework be optimized in qualitative research? A rapid systematic review. *British Journal of Health Psychology*, *25*(3), 677–694. https://doi.org/10.1111/bjhp.12437

McHorney, C. A., Ware, J. E., & Raczek, A. E. (1993). The MOS 36-Item Short-Form Health Survey (SF-36): II. Psychometric and clinical tests of validity in measuring physical and mental health constructs. *Medical Care*, *31*(3), 247–263.

McHugh, M. L. (2012). Interrater reliability: The kappa statistic. *Biochemia Medica*, *22*(3), 276–282.

McKenzie, J. E., & Brennan, S. E. (2019). Synthesizing and presenting findings using other methods. In *Cochrane Handbook for Systematic Reviews of Interventions* (pp. 321–347). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781119536604.ch12

McLeroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An ecological perspective on health promotion programs. *Health Education Quarterly*, *15*(4), 351–377. https://doi.org/10.1177/109019818801500401

Meade, L. B., Bearne, L. M., Sweeney, L. H., Alageel, S. H., & Godfrey, E. L. (2019). Behaviour change techniques associated with adherence to prescribed exercise in patients with persistent musculoskeletal pain: Systematic review. *British Journal of Health Psychology*, *24*(1), 10–30. https://doi.org/10.1111/bjhp.12324

Mens, J. M., Snijders, C. J., & Stam, H. J. (2000). Diagonal trunk muscle exercises in peripartum pelvic pain: A randomized clinical trial. *Physical Therapy*, *80*(12), 1164–1173. mnh (11087303).

Mesk, Z., Manaf, R. A., & Shahar, H. K. (2022). Effectiveness of theory based intervention using social media to reduce urinary incontinence among postpartum women in Hebron city hospitals: Randomized controlled trial. *Malaysian Journal of Medicine and Health Sciences*, *18*(1), 241–249.

Michie, S., Abraham, C., Whittington, C., McAteer, J., & Gupta, S. (2009). Effective techniques in healthy eating and physical activity interventions: A meta-regression. *Health Psychology*, *28*(6), 690–701. https://doi.org/10.1037/a0016136

Michie, S., Marques, M. M., Norris, E., & Johnston, M. (2018). Theories and interventions in health behavior change. In *Handbook of Health Psychology*. Routledge.

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, *6*(1), Article 1. https://doi.org/10.1186/1748-5908-6-42

Microsoft Corporation. (2024). *Microsoft Excel for Mac* (Version 16.89) [Computer software].

Mielke, G. I., Crochemore-Silva, I., Domingues, M. R., Silveira, M. F., Bertoldi, A. D., & Brown, W. J. (2021). Physical activity and sitting time from 16 to 24 weeks of pregnancy to 12, 24, and 48 months postpartum: Findings from the 2015 Pelotas (Brazil) Birth Cohort Study. *Journal of Physical Activity and Health*, *18*(5), 587–593. https://doi.org/10.1123/jpah.2020-0351

Milsom, I., Coyne, K. S., Nicholson, S., Kvasz, M., Chen, C.-I., & Wein, A. J. (2014). Global prevalence and economic burden of urgency urinary incontinence: A systematic review. *European Urology*, *65*(1), 79–95. https://doi.org/10.1016/j.eururo.2013.08.031

Mogren, I. M. (2006). BMI, pain and hyper-mobility are determinants of long-term outcome for women with low back pain and pelvic pain during pregnancy. *European Spine Journal*, *15*(7), 1093–1102. https://doi.org/10.1007/s00586-005-0004-9

Mogren, I. M. (2008). Physical activity and persistent low back pain and pelvic pain post partum. *BMC Public Health*, *8*, 417. (19102737). https://doi.org/10.1186/1471-2458-8-417

Moheboleslam, Z., Mohammad Rahimi, N., & Aminzadeh, R. (2022). A systematic review and meta-analysis of randomized controlled trials of stabilizing exercises for lumbopelvic region impact in postpartum women with low back and pelvic pain. *Biological Research For Nursing*, 10998004221081083. https://doi.org/10.1177/10998004221081083

Mönninghoff, A., Kramer, J. N., Hess, A. J., Ismailova, K., Teepe, G. W., Car, L. T., Müller-Riemenschneider, F., & Kowatsch, T. (2021). Long-term effectiveness of mhealth physical activity interventions: Systematic review and meta-analysis of randomized controlled trials. *Journal of Medical Internet Research*, *23*(4), e26699. https://doi.org/10.2196/26699

Moore, I. S., James, M. L., Brockwell, E., Perkins, J., Jones, A. L., & Donnelly, G. M. (2021). Multidisciplinary, biopsychosocial factors contributing to return to running and running related stress urinary incontinence in postpartum women. *British Journal of Sports Medicine*, *55*(22), 1286–1292. https://doi.org/10.1136/bjsports-2021-104168

Mota, P., & Bø, K. (2021). ACOG Committee Opinion No. 804: Physical activity and exercise during pregnancy and the postpartum period. *Obstetrics & Gynecology*, *137*(2), 376. https://doi.org/10.1097/AOG.0000000000004267

Mukkannavar, P., Desai, B. R., Mohanty, U., Kulkarni, S., Parvatikar, V., & Daiwajna, S. (2014). Pelvic girdle pain in Indian postpartum women: A cross-sectional study. *Physiotherapy Theory & Practice*, *30*(2), 123–130. ccm. https://doi.org/10.3109/09593985.2013.816399

Mummah, S. A., Robinson, T. N., King, A. C., Gardner, C. D., & Sutton, S. (2016). IDEAS (Integrate, Design, Assess, and Share): A framework and toolkit of strategies for the development of more effective digital interventions to change health behavior. *Journal of Medical Internet Research*, *18*(12), e317. https://doi.org/10.2196/jmir.5927

Murray-Davis, B., Grenier, L., Atkinson, S. A., Mottola, M. F., Wahoush, O., Thabane, L., Xie, F., Vickers-Manzin, J., Moore, C., & Hutton, E. K. (2019). Experiences regarding nutrition and exercise among women during early postpartum: A qualitative grounded theory study. *Bmc Pregnancy and Childbirth*, *19*(1), 368. https://doi.org/10.1186/s12884-019-2508-z

Napolitano, M. A., Harrington, C. B., Patchen, L., Ellis, L. P., Ma, T., Chang, K., Gaminian, A., Bailey, C. P., & Evans, W. D. (2021). Feasibility of a digital intervention to promote healthy weight management among postpartum African American/Black women. *International Journal of Environmental Research and Public Health*, *18*(4), Article 4. https://doi.org/10.3390/ijerph18042178

National Health Service. (2021, August 4). *Physical activity guidelines for adults aged 19 to 64*. https://www.nhs.uk/live-well/exercise/

Nicklas, J. M., Leiferman, J. A., Lockhart, S., Daly, K. M., Bull, S. S., & Barbour, L. A. (2020). Development and modification of a mobile health program to promote postpartum weight loss in women at elevated risk for cardiometabolic disease: Single-arm pilot study. *JMIR Formative Research*, *4*(4), e16151. https://doi.org/10.2196/16151

Nicklas, J. M., Zera, C. A., England, L. J., Rosner, B. A., Horton, E., Levkoff, S. E., & Seely, E. W. (2014). A web-based lifestyle intervention for women with recent gestational diabetes mellitus: A randomized controlled trial. *Obstetrics & Gynecology*, *124*(3), 563. https://doi.org/10.1097/AOG.0000000000000420

Nielsen, J. (1994). *Usability Engineering*. Morgan Kaufmann.

Nomura, Y., & Araki, T. (2022). Factors influencing physical activity in postpartum women during the COVID-19 pandemic: A cross-sectional survey in Japan. *BMC Women's Health*, *22*, 371. https://doi.org/10.1186/s12905-022-01959-9

Nomura, Y., Fukano, M., Kashiwabara, K., & Haruna, M. (2026). Effects of remote group-based exercise on physical activity and well-being in postpartum women: A randomized controlled trial. *International Journal of Behavioral Nutrition and Physical Activity*, *23*(1), 33. https://doi.org/10.1186/s12966-026-01897-x

Norman, E., Sherburn, M., Osborne, R. H., & Galea, M. P. (2010). An exercise and education program improves well-being of new mothers: A randomized controlled trial. *Physical Therapy*, *90*(3), 348–355. https://doi.org/10.2522/ptj.20090139

O'Brien, H. L., & Toms, E. G. (2008). What is user engagement? A conceptual framework for defining user engagement with technology. *Journal of the American Society for Information Science and Technology*, *59*(6), 938–955. https://doi.org/10.1002/asi.20801

Ogollah, R., Bishop, A., Lewis, M., Grotle, M., & Foster, N. E. (2019). Responsiveness and minimal important change for pain and disability outcome measures in pregnancy-related low back and pelvic girdle pain. *Physical Therapy*, *99*(11), 1551–1561. https://doi.org/10.1093/ptj/pzz107

O'Reilly, S. L., Dunbar, J. A., Versace, V., Janus, E., Best, J. D., Carter, R., Oats, J. J. N., Skinner, T., Ackland, M., Phillips, P. A., Ebeling, P. R., Reynolds, J., Shih, S. T. F., Hagger, V., Coates, M., Wildey, C., & Group, M. S. (2016). Mothers after gestational diabetes in Australia (MAGDA): A randomised controlled trial of a postnatal diabetes prevention program. *PLOS Medicine*, *13*(7), e1002092. https://doi.org/10.1371/journal.pmed.1002092

Østbye, T., Krause, K. M., Lovelady, C. A., Morey, M. C., Bastian, L. A., Peterson, B. L., Swamy, G. K., Brouwer, R. J. N., & McBride, C. M. (2009). Active mothers postpartum: A randomized controlled weight-loss intervention trial. *American Journal of Preventive Medicine*, *37*(3), 173–180. https://doi.org/10.1016/j.amepre.2009.05.016

Ostgaard, H. C., Zetherström, G., & Roos-Hansson, E. (1997). Back pain in relation to pregnancy: A 6-year follow-up. *Spine*, *22*(24), 2945–2950. https://doi.org/10.1097/00007632-199712150-00018

O'Sullivan, P. B., Caneiro, J. P., O'Keeffe, M., Smith, A., Dankaerts, W., Fersum, K., & O'Sullivan, K. (2018). Cognitive functional therapy: An integrated behavioral approach for the targeted management of disabling low back pain. *Physical Therapy*, *98*(5), 408–423. https://doi.org/10.1093/ptj/pzy022

O'Sullivan, R., Kiernan, D., & Malone, A. (2016). Run kinematics with and without a jogging stroller. *Gait & Posture*, *43*, 220–224. https://doi.org/10.1016/j.gaitpost.2015.10.001

Özyurt, F., Üzelpasacı, E., Tayfur, A., & Akbayrak, T. (2025). Effectiveness of physical therapy on pain, disability and quality of life in women with lumbopelvic pain in postpartum period: A systematic review with evidence gap map and meta-analysis. *BMC Women's Health*, *25*(1), 318. https://doi.org/10.1186/s12905-025-03881-2

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, n71. https://doi.org/10.1136/bmj.n71

Palermo, M., & Rancourt, D. (2021). Understanding athletic and exercise identity in relation to disordered eating behaviors. *Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity*, *26*(7), 2301–2308. https://doi.org/10.1007/s40519-020-01092-2

Pallant, J. (2020). *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using IBM SPSS* (7th ed.). Routledge. https://doi.org/10.4324/9781003117452

Palmer, F. R., & Leberman, S. I. (2009). Elite athletes as mothers: Managing multiple identities. *Sport Management Review, Gender and Sport Management*, *12*(4), 241–254. https://doi.org/10.1016/j.smr.2009.03.001

Palsson, T. S., Gibson, W., Darlow, B., Bunzli, S., Lehman, G., Rabey, M., Moloney, N., Vaegter, H. B., Bagg, M. K., & Travers, M. (2019). Changing the narrative in diagnosis and management of pain in the sacroiliac joint area. *Physical Therapy*, *99*(11), 1511–1519. https://doi.org/10.1093/ptj/pzz108

Paschali, M., Lazaridou, A., Sadora, J., Papianou, L., Garland, E. L., Zgierska, A. E., & Edwards, R. R. (2024). Mindfulness-based interventions for chronic low back ain: A systematic review and meta-analysis. *The Clinical Journal of Pain*, *40*(2), 105. https://doi.org/10.1097/AJP.0000000000001173

Pears, S., & Sutton, S. (2021). Effectiveness of Acceptance and Commitment Therapy (ACT) interventions for promoting physical activity: A systematic review and meta-analysis. *Health Psychology Review*, *15*(1), 159–184. https://doi.org/10.1080/17437199.2020.1727759

Peloton IQ: Your AI-powered personalized workout planner & tracker. (2025). https://www.onepeloton.com/en-CA/peloton-iq

Pelvic, Obstetric and Gynaecological Physiotherapy. (2024, October 2). *Fit for the Future*. https://thepogp.co.uk/Resources/119/fitforthefuture/

Peralta, L. R., Cotton, W. G., Dudley, D. A., Hardy, L. L., Yager, Z., & Prichard, I. (2021). Group-based physical activity interventions for postpartum women with children aged 0–5 years old: A systematic review of randomized controlled trials. *BMC Women's Health*, *21*(1), Article 1. https://doi.org/10.1186/s12905-021-01581-1

Pereira, M. A., Rifas-Shiman, S. L., Kleinman, K. P., Rich-Edwards, J. W., Peterson, K. E., & Gillman, M. W. (2007). Predictors of change in physical activity during and after pregnancy: Project viva. *American Journal of Preventive Medicine*, *32*(4), 312–319. https://doi.org/10.1016/j.amepre.2006.12.017

Piercy, K. L., Troiano, R. P., Ballard, R. M., Carlson, S. A., Fulton, J. E., Galuska, D. A., George, S. M., & Olson, R. D. (2018). The physical activity guidelines for Americans. *JAMA*, *320*(19), 2020. https://doi.org/10.1001/jama.2018.14854

Plotnikoff, R. C., Hotz, S. B., Birkett, N. J., & Courneya, K. S. (2001). Exercise and the transtheoretical model: A longitudinal test of a population sample. *Preventive Medicine*, *33*(5), 441–452. https://doi.org/10.1006/pmed.2001.0914

Porter, A. K., Rodríguez, D. A., Frizzelle, B. G., & Evenson, K. R. (2019). The association between neighborhood environments and physical activity from pregnancy to postpartum: A prospective cohort study. *Journal of Urban Health : Bulletin of the New York Academy of Medicine*, *96*(5), 703–719. (31342403). https://doi.org/10.1007/s11524-019-00376-y

Preacher, K. J., & Hayes, A. F. (2004). SPSS and SAS procedures for estimating indirect effects in simple mediation models. *Behavior Research Methods, Instruments, & Computers*, *36*(4), 717–731. https://doi.org/10.3758/BF03206553

Prioreschi, A., Brage, S., Westgate, K., & Micklesfield, L. K. (2018). Describing the diurnal relationships between objectively measured mother and infant physical activity. *International Journal of Behavioral Nutrition and Physical Activity*, *15*(1), 59. https://doi.org/10.1186/s12966-018-0692-2

Prochaska, J. O., & DiClemente, C. C. (1982). Transtheoretical therapy: Toward a more integrative model of change. *Psychotherapy: Theory, Research & Practice*, *19*(3), 276–288. https://doi.org/10.1037/h0088437

Pulsifer, J., Britnell, S., Sim, A., Adaszynski, J., & Dufour, S. (2022). Reframing beliefs and instiling facts for contemporary management of pregnancy-related pelvic girdle pain. *British Journal of Sports Medicine*. https://doi.org/10.1136/bjsports-2022-105724

Quinlan, A., Rhodes, R. E., Beauchamp, M. R., Symons Downs, D., Warburton, D. E. R., & Blanchard, C. M. (2017). Evaluation of a physical activity intervention for new parents:

Protocol paper for a randomized trial. *BMC Public Health*, *17*(1), 875–875. https://doi.org/10.1186/s12889-017-4874-7

Racey, M., Alliston, P., Sherifali, D., Sriskandarajah, A., Sushko, K., & Lipscombe, L. (2025). Co-Designing a postpartum diabetes prevention program after gestational diabetes mellitus: A MoSCoW prioritization workshop exercise. *Diabetes Research and Clinical Practice*, *225*, 112269. https://doi.org/10.1016/j.diabres.2025.112269

Reaves, J. (2016). *Design Thinking Meets Systems Thinking*. https://www.lc-global-us.com/change-talk/design-thinking-meets-systems-thinking

Rebar, A. L. (2017, June 28). *Automatic Regulation Used in Sport and Exercise Research*. Oxford Research Encyclopedia of Psychology. https://doi.org/10.1093/acrefore/9780190236557.013.231

Remus, A., Smith, V., Gutke, A., Mena, J. J. S., Mørkved, S., Wikmar, L. N., Öberg, B., Olsson, C., Robinson, H. S., Stuge, B., & Wuytack, F. (2021). A core outcome set for research and clinical practice in women with pelvic girdle pain: PGP-COS. *PLOS ONE*, *16*(2), e0247466. https://doi.org/10.1371/journal.pone.0247466

Resnick, B., & Jenkins, L. S. (2000). Testing the reliability and validity of the self-efficacy for exercise scale. *Nursing Research*, *49*(3), 154.

Rhodes, R. E. (2017). The evolving understanding of physical activity behavior. In *Advances in Motivation Science* (Vol. 4, pp. 171–205). Elsevier. https://doi.org/10.1016/bs.adms.2016.11.001

Rhodes, R. E. (2021). Multi-process action control in physical activity: A primer. *Frontiers in Psychology*, *12*, 797484. https://doi.org/10.3389/fpsyg.2021.797484

Rhodes, R. E., Barton, J., Hough, S., & Wierts, C. M. (2025). Emotion regulation interventions on physical activity: A systematic review and meta-analysis. *International Review of Sport and Exercise Psychology*, *Advance Online Publication*, 1–25.

Rhodes, R. E., Beauchamp, M. R., Quinlan, A., Symons Downs, D., Warburton, D. E. R., & Blanchard, C. M. (2021). Predicting the physical activity of new parents who participated in a physical activity intervention. *Social Science & Medicine*, *284*, 114221. https://doi.org/10.1016/j.socscimed.2021.114221

Rhodes, R. E., Blanchard, C. M., Hartson, K. R., Symons Downs, D., Warburton, D. E. R., & Beauchamp, M. R. (2023). Affective response to exercise and affective judgments as predictors of physical activity intention and behavior among new mothers in their first 6-months postpartum. *Annals of Behavioral Medicine*, *57*(4), 344–353. https://doi.org/10.1093/abm/kaac067

Rhodes, R. E., Blanchard, C. M., & Matheson, D. H. (2006). A multicomponent model of the theory of planned behaviour. *British Journal of Health Psychology*, *11*(1), 119–137. https://doi.org/10.1348/135910705X52633

Rhodes, R. E., Blanchard, C. M., Quinlan, A., Symons Downs, D., Warburton, D. E. R., & Beauchamp, M. R. (2021). Couple-based physical activity planning for new parents: A randomized trial. *American Journal of Preventive Medicine*, *61*(4), 518–528. https://doi.org/10.1016/j.amepre.2021.04.020

Rhodes, R. E., Boudreau, P., Josefsson, K. W., & Ivarsson, A. (2021). Mediators of physical activity behaviour change interventions among adults: A systematic review and meta-analysis. *Health Psychology Review*, *15*(2), 272–286. https://doi.org/10.1080/17437199.2019.1706614

Rhodes, R. E., & Courneya, K. S. (2003). Investigating multiple components of attitude, subjective norm, and perceived control: An examination of the theory of planned behaviour in the exercise domain. *British Journal of Social Psychology*, *42*(1), 129–146. https://doi.org/10.1348/014466603763276162

Rhodes, R. E., Cox, A., & Sayar, R. (2022). What predicts the physical activity intention–behavior gap? A systematic review. *Annals of Behavioral Medicine*, *56*(1), 1–20. https://doi.org/10.1093/abm/kaab044

Rhodes, R. E., & de Bruijn, G. J. (2013). What predicts intention-behavior discordance? A review of the action control framework. *Exercise and Sport Sciences Reviews*, *41*(4), 201–207. https://doi.org/10.1097/jes.0b013e3182a4e6ed

Rhodes, R. E., Grant, S., & De Bruijn, G. J. (2020). Planning and implementation intention interventions. In *In M.S. Hagger, L.D. Cameron, K. Hamilton, N. Hankonen, & T. Lintunen (Eds.). Handbook of behavior change* (pp. 572–585). Cambridge University Press.

Rhodes, R. E., Gray ,Samantha M., & and Husband, C. (2019). Experimental manipulation of affective judgments about physical activity: A systematic review and meta-analysis of adults. *Health Psychology Review*, *13*(1), 18–34. https://doi.org/10.1080/17437199.2018.1530067

Rhodes, R. E., Guerrero, M. D., Vanderloo, L. M., Barbeau, K., Birken, C. S., Chaput, J.-P., Faulkner, G., Janssen, I., Madigan, S., Mâsse, L. C., McHugh, T.-L., Perdew, M., Stone, K., Shelley, J., Spinks, N., Tamminen, K. A., Tomasone, J. R., Ward, H., Welsh, F., & Tremblay, M. S. (2020). Development of a consensus statement on the role of the family in the physical activity, sedentary, and sleep behaviours of children and youth.

International Journal of Behavioral Nutrition and Physical Activity, *17*(1), 74. https://doi.org/10.1186/s12966-020-00973-0

Rhodes, R. E., & Kates, A. (2015). Can the affective response to exercise predict future motives and physical activity nehavior? A systematic review of published evidence. *Annals of Behavioral Medicine*, *49*(5), 715–731. https://doi.org/10.1007/s12160-015-9704-5

Rhodes, R. E., Kaushal, N., & Quinlan, A. (2016). Is physical activity a part of who I am? A review and meta-analysis of identity, schema and physical activity. *Health Psychology Review*, *10*(2), 204–225. https://doi.org/10.1080/17437199.2016.1143334

Rhodes, R. E., La, H., Quinlan, A., & Grant, S. J. (2021). Enacting physical activity intention: Multi-process action control. In *Motivation and Self-Regulation in Sport and Exercise* (pp. 8–20). Taylor & Francis.

Rhodes, R. E., & Lithopoulos, A. (2022). Understanding action control of resistance training among adults. *Psychology of Sport and Exercise*, *59*, 102108. https://doi.org/10.1016/j.psychsport.2021.102108

Rhodes, R. E., & Lithopoulos, A. (2023). The Physical Activity Regulation Scale: Development and validity testing. *Health Psychology*, *42*(6), 378–387. https://doi.org/10.1037/hea0001283

Rhodes, R. E., McEwan, D., & Rebar, A. L. (2019a). Theories of physical activity behaviour change: A history and synthesis of approaches. *Psychology of Sport and Exercise, 50 Years of FEPSAC: Current and Future Directions to Sport and Exercise Psychology Research*, *42*, 100–109. https://doi.org/10.1016/j.psychsport.2018.11.010

Rhodes, R. E., McEwan, D., & Rebar, A. L. (2019b). Theories of physical activity behaviour change: A history and synthesis of approaches. *Psychology of Sport and Exercise*, *42*(Journal Article), 100–109. https://doi.org/10.1016/j.psychsport.2018.11.010

Rhodes, R. E., & Plotnikoff, R. C. (2005). Can current physical activity act as a reasonable proxy measure of future physical activity? Evaluating cross-sectional and passive prospective designs with the use of social cognition models. *Preventive Medicine*, *40*(5), 547–555. https://doi.org/10.1016/j.ypmed.2004.07.016

Rhodes, R. E., & Rebar, A. L. (2017). Conceptualizing and defining the intention construct for future physical activity research. *Exercise and Sport Sciences Reviews*, *45*(4), 209. https://doi.org/10.1249/JES.0000000000000127

Rhodes, R. E., & Rebar, A. L. (2018). Physical Activity Habit: Complexities and Controversies. In B. Verplanken (Ed.), *The Psychology of Habit* (pp. 91–109). Springer International Publishing. https://doi.org/10.1007/978-3-319-97529-0_6

Rhodes, R. E., Rebar, A. L., & Strachan, S. (2025). Physical activity identity as an axis of dual process motivation and self-regulation processes: Current evidence and future research directions. *Psychology of Sport and Exercise*, *80*, 102923. https://doi.org/10.1016/j.psychsport.2025.102923

Rhodes, R. E., & Sui, W. (2021). Physical activity maintenance: A critical narrative review and directions for future research. *Frontiers in Psychology*, *12*, Article 725671.

Rhodes, R. E., Wierts, C. M., Kullman, S., Magel, E., & Strachan, S. (2025). Intervention effects on physical activity identity: A systematic review and meta-analysis. *Health Psychology Review*, *19*(1), 123–144. https://doi.org/10.1080/17437199.2024.2412996

Rhodes, R. E., & Yao, C. A. (2015). Models accounting for intention-behavior discordance in the physical activity domain: A user's guide, content overview, and review of current evidence. *The International Journal of Behavioral Nutrition and Physical Activity*, *12*(1), 9–9. https://doi.org/10.1186/s12966-015-0168-6

Rhodes, R. E., Zhang, R., & Zhang, C.-Q. (2020). Direct and indirect relationships between the built environment and individual-level perceptions of physical activity: A systematic review. *Annals of Behavioral Medicine*, *54*(7), 495–509. https://doi.org/10.1093/abm/kaz068

Richardsen, K. R., Mdala, I., Berntsen, S., Ommundsen, Y., Martinsen, E. W., Sletner, L., & Jenum, A. K. (2016). Objectively recorded physical activity in pregnancy and postpartum in a multi-ethnic cohort: Association with access to recreational areas in the neighbourhood. *International Journal of Behavioral Nutrition and Physical Activity*, *13*, 78. https://doi.org/10.1186/s12966-016-0401-y

Rintala, A., Rantalainen, R., Kaksonen, A., Luomajoki, H., & Kauranen, K. (2022). mHealth apps for low back pain self-management: Scoping review. *JMIR mHealth and uHealth*, *10*(8), e39682. https://doi.org/10.2196/39682

Ritondo, T., Bean, C., & Lesser, I. (2024). 'I didn't know who to ask about how it should feel': Postpartum women navigating the return to physically active leisure. *Leisure/Loisir*, *48*(3), 475–504. https://doi.org/10.1080/14927713.2023.2224344

Roberts, A. (2023). The biopsychosocial model: Its use and abuse. *Medicine, Health Care and Philosophy*, *26*(3), 367–384. https://doi.org/10.1007/s11019-023-10150-2

Robinson, H. S., Vøllestad, N. K., Bennetter, K. E., Waage, C. W., Jenum, A. K., & Richardsen, K. R. (2024). Pelvic girdle pain in pregnancy and early postpartum – prevalence and risk factors in a multi-ethnic cohort. *BMC Musculoskeletal Disorders*, *25*(1), 21. https://doi.org/10.1186/s12891-023-07135-w

Rogers, R. W., & Prentice-Dunn, S. (1997). Protection motivation theory. In *Handbook of health behavior research 1: Personal and social determinants* (pp. 113–132). Plenum Press.

Roland, M., & Fairbank, J. (2000). The Roland–Morris Disability Questionnaire and the Oswestry Disability Questionnaire. *Spine*, *25*(24), 3115.

Rooney, B. L., Schauberger, C. W., & Mathiason, M. A. (2005). Impact of perinatal weight change on long-term obesity and obesity-related illnesses. *Obstetrics and Gynecology*, *106*(6), 1349–1356. https://doi.org/10.1097/01.aog.0000185480.09068.4a

Roozbahani, N., Ghofranipour, F., Eftekhar Ardabili, H., & Hajizadeh, E. (2014). Factors influencing physical activity among postpartum Iranian women. *Health Education Journal*, *73*(4), 466–476. https://doi.org/10.1177/0017896913490511

Rosenberg, D. E., Bull, F. C., Marshall, A. L., Sallis, J. F., & Bauman, A. E. (2008). Assessment of sedentary behavior with the International Physical Activity Questionnaire. *Journal of Physical Activity and Health*, *5*(s1), S30–S44. https://doi.org/10.1123/jpah.5.s1.s30

Ross, R., Chaput, J.-P., Giangregorio, L. M., Janssen, I., Saunders, T. J., Kho, M. E., Poitras, V. J., Tomasone, J. R., El-Kotob, R., McLaughlin, E. C., Duggan, M., Carrier, J., Carson, V., Chastin, S. F., Latimer-Cheung, A. E., Chulak-Bozzer, T., Faulkner, G., Flood, S. M., Gazendam, M. K., … Tremblay, M. S. (2020). Canadian 24-hour movement guidelines for adults aged 18–64 years and adults aged 65 years or older: An integration of physical activity, sedentary behaviour, and sleep. *Applied Physiology, Nutrition, and Metabolism*, *45*(10), S57–S102. https://doi.org/10.1139/apnm-2020-0467

RStudio Team. (2021). *RStudio: Integrated Development for R* (Version 1.4.1717) [Computer software]. PBC. http://www.rstudio.com/

Ruchat, S.-M., Beamish, N., Pellerin, S., Usman, M., Dufour, S., Meyer, S., Sivak, A., & Davenport, M. H. (2025). Impact of exercise on musculoskeletal pain and disability in the postpartum period: A systematic review and meta-analysis. *British Journal of Sports Medicine*. https://doi.org/10.1136/bjsports-2024-108488

Ruissen, G. R., Beauchamp, M. R., Puterman, E., Zumbo, B. D., Rhodes, R. E., Hives, B. A., Sharpe, B. M., Vega, J., Low, C. A., & Wright, A. G. C. (2022). Continuous-time modeling of the bidirectional relationship between incidental affect and physical activity. *Annals of Behavioral Medicine*, *56*(12), 1284–1299. https://doi.org/10.1093/abm/kaac024

Sakamoto, A., Nakagawa, H., Nakagawa, H., & Gamada, K. (2018). Effects of exercises with a pelvic realignment device on low-back and pelvic girdle pain after childbirth: A randomized control study. *Journal of Rehabilitation Medicine*, *50*(10), 914–919. https://doi.org/10.2340/16501977-2487

Salen, B. A., SpangfortÅke L.^Nygren, E. V., & Nordemar, R. (1994). The disability rating index: An instrument for the assessment of disability in clinical settings. *Journal of Clinical Epidemiology*, *47*(12), 1423–1435. https://doi.org/10.1016/0895-4356(94)90086-8

Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents: *Medicine & Science in Sports & Exercise*, 963–975. https://doi.org/10.1097/00005768-200005000-00014

Sanda, B., Vistad, I., Sagedal, L. R., Haakstad, L. A. H., Lohne-Seiler, H., & Torstveit, M. K. (2017). Effect of a prenatal lifestyle intervention on physical activity level in late pregnancy and the first year postpartum. *PLOS ONE*, *12*(11), e0188102. https://doi.org/10.1371/journal.pone.0188102

Sandbakk, Ø., Perl, R., Holmberg, H.-C., & Steiner, T. (2020). Energetic cost and kinematics of pushing a stroller on flat and uphill terrain. *Frontiers in Physiology*, *11*. https://www.frontiersin.org/articles/10.3389/fphys.2020.00574

Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign*, *4*(1), 5–18. https://doi.org/10.1080/15710880701875068

Sheeran, P. (2002). Intention-behaviour relations: A conceptual and empirical review. In M. Hewstone & W. Stroebe (Eds.), *European Review of Social Psychology* (Vol. 12, pp. 1–36). John Wiley & Sons.

Sheeran, P., & Webb, T. L. (2016). The intention-behavior gap. *Social and Personality Psychology Compass*, *10*(9), 503–518. https://doi.org/10.1111/spc3.12265

Sherifali, D., Nerenberg, K. A., Wilson, S., Semeniuk, K., Ali, M. U., Redman, L. M., & Adamo, K. B. (2017). The effectiveness of eHealth technologies on weight management in pregnant and postpartum women: Systematic review and meta-analysis. *Journal of Medical Internet Research*, *19*(10), e337. https://doi.org/10.2196/jmir.8006

Silva, M. F., Leão, A. L. F., O'Connor, Á., Hallal, P. C., Ding, D., Hinckson, E., Benmarhnia, T., & Reis, R. S. (2024). Understanding the relationships between physical activity and climate change: An umbrella review. *Journal of Physical Activity and Health*, *21*(12), 1263–1275. https://doi.org/10.1123/jpah.2024-0284

Simonds, A. H., Abraham, K., & Spitznagle, T. (2022). Clinical practice guidelines for pelvic girdle pain in the postpartum population. *Journal of Women's Health Physical Therapy*, *46*(1), E1. https://doi.org/10.1097/JWH.0000000000000236

Singh, B., Olds, T., Curtis, R., Dumuid, D., Virgara, R., Watson, A., Szeto, K., O'Connor, E., Ferguson, T., Eglitis, E., Miatke, A., Simpson, C. E., & Maher, C. (2023). Effectiveness of physical activity interventions for improving depression, anxiety and distress: An overview of systematic reviews. *British Journal of Sports Medicine*, *57*(18), 1203–1209. https://doi.org/10.1136/bjsports-2022-106195

Skivington, K., Matthews, L., Simpson, S. A., Craig, P., Baird, J., Blazeby, J. M., Boyd, K. A., Craig, N., French, D. P., McIntosh, E., Petticrew, M., Rycroft-Malone, J., White, M., & Moore, L. (2021). A new framework for developing and evaluating complex interventions: Update of Medical Research Council guidance. *BMJ*, n2061. https://doi.org/10.1136/bmj.n2061

Slattery, P., Saeri, A. K., & Bragge, P. (2020). Research co-design in health: A rapid overview of reviews. *Health Research Policy and Systems*, *18*(1), 17. https://doi.org/10.1186/s12961-020-0528-9

Smith, B. J., Cheung, N. W., Bauman, A. E., Zehle, K., & McLean, M. (2005). Postpartum physical activity and related psychosocial factors among women With recent gestational diabetes mellitus. *Diabetes Care*, *28*(11), 2650–2654. https://doi.org/10.2337/diacare.28.11.2650

Smith, N., & Liu, S. (2020). A systematic review of the dose-response relationship between usage and outcomes of online physical activity weight-loss interventions. *Internet Interventions*, *22*, 100344. https://doi.org/10.1016/j.invent.2020.100344

Sobel, M. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. In S. Leinhardt (Ed.), *Sociology methodology* (pp. 290–312). American Sociological Association.

Sperstad, J. B., Tennfjord, M. K., Hilde, G., Ellström-Engh, M., & Bø, K. (2016). Diastasis recti abdominis during pregnancy and 12 months after childbirth: Prevalence, risk factors and report of lumbopelvic pain. *British Journal of Sports Medicine*, *50*(17), 1092–1096. https://doi.org/10.1136/bjsports-2016-096065

Staniszewska, S., Brett, J., Simera, I., Seers, K., Mockford, C., Goodlad, S., Altman, D. G., Moher, D., Barber, R., Denegri, S., Entwistle, A., Littlejohns, P., Morris, C., Suleman, R., Thomas, V., & Tysall, C. (2017). GRIPP2 reporting checklists: Tools to improve reporting of patient and public involvement in research. *BMJ*, *358*, j3453. https://doi.org/10.1136/bmj.j3453

Statistics Canada. (2025, October 17). *The Daily — Directly measured physical activity and sedentary time in Canada: New results from the Canadian Health Measures Survey, 2022 to 2024*. https://www150.statcan.gc.ca/n1/daily-quotidien/251017/dq251017b-eng.htm

Stoyanov, S. R., Hides, L., Kavanagh, D. J., Zelenko, O., Tjondronegoro, D., & Mani, M. (2015). Mobile app rating scale: A new tool for assessing the quality of health mobile apps. *JMIR mHealth and uHealth*, *3*(1), e27. https://doi.org/10.2196/mhealth.3422

Strachan, S. M., Kullman, S. M., & Rhodes, R. E. (2025). Building and strengthening physical activity identity: A theory-informed user-guide. *Health Psychology Review*, *0*(0), 1–25. https://doi.org/10.1080/17437199.2025.2550359

Strain, T., Flaxman, S., Guthold, R., Semenova, E., Cowan, M., Riley, L. M., Bull, F. C., & Stevens, G. A. (2024). National, regional, and global trends in insufficient physical activity among adults from 2000 to 2022: A pooled analysis of 507 population-based surveys with 5·7 million participants. *The Lancet Global Health*, *12*(8), e1232–e1243. https://doi.org/10.1016/S2214-109X(24)00150-5

Strava | Running, Cycling & Hiking App—Train, Track & Share. (2026). Strava. https://www.strava.com/

Stryker, S., & Burke, P. J. (2000). The past, present, and future of an identity theory. *Social Psychology Quarterly*, *63*(4), 284–297. https://doi.org/10.2307/2695840

Stuge, B., Garratt, A., Krogstad Jenssen, H., & Grotle, M. (2011). The pelvic girdle questionnaire: A condition-specific instrument for assessing activity limitations and symptoms in people with pelvic girdle pain. *Physical Therapy*, *91*(7), 1096–1108. (21596959). https://doi.org/10.2522/ptj.20100357

Stuge, B., Laerum, E., Kirkesola, G., & Vøllestad, N. (2004). The efficacy of a treatment program focusing on specific stabilizing exercises for pelvic girdle pain after pregnancy: A randomized controlled trial. *Spine*, *29*(4), 351–359. mnh (15094530). https://doi.org/10.1097/01.brs.0000090827.16926.1d

Stuge, B., Veierød, M. B., Lærum, E., & Vøllestad, N. (2004). The efficacy of a treatment program focusing on specific stabilizing exercises for pelvic girdle pain after pregnancy: A two-year follow-up of a randomized clinical trial. *Spine*, *29*(10), E197.

Sui, W., Hollman, H., Magel, E., & Rhodes, R. E. (2024). Increasing physical activity among adults affected by COVID-19 social distancing restrictions: A feasibility trial of an online intervention. *Journal of Behavioral Medicine*, *47*(5), 886–899.

Summerfield, P. (2025). *Cellphone adoption in Canada at nearly 100%: Survey*. https://mediaincanada.com/2025/09/02/mtm-cellphone-use-canada/

SurveyMonkey Inc. (2025). [Computer software]. www.surveymonkey.com

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Pearson.

Taut, D., Pintea, S., & Baban, A. (2016). Effectiveness of behaviour change strategies for pelvic floor muscle training in urinary incontinence: A meta-analysis. *European Health Psychologist*, 683–683.

Teixeira, P. J., Carraça, E. V., Markland, D., Silva, M. N., & Ryan, R. M. (2012). Exercise, physical activity, and self-determination theory: A systematic review. *The International Journal of Behavioral Nutrition and Physical Activity*, *9*(1), 78–78. https://doi.org/10.1186/1479-5868-9-78

Teixeira, P. J., Carraça, E. V., Marques, M. M., Rutter, H., Oppert, J.-M., De Bourdeaudhuij, I., Lakerveld, J., & Brug, J. (2015). Successful behavior change in obesity interventions in adults: A systematic review of self-regulation mediators. *BMC Medicine*, *13*, 84. https://doi.org/10.1186/s12916-015-0323-6

Teulings, N. E. W. D., Masconi, K. L., Ozanne, S. E., Aiken, C. E., & Wood, A. M. (2019). Effect of interpregnancy weight change on perinatal outcomes: Systematic review and meta-analysis. *BMC Pregnancy and Childbirth*, *19*(1), Article 1. https://doi.org/10.1186/s12884-019-2566-2

Teychenne, M., Abbott, G., Stephens, L. D., Opie, R. S., Olander, E. K., Brennan, L., van der Pligt, P., Apostolopoulos, M., & Ball, K. (2021). Mums on the Move: A pilot randomised controlled trial of a home-based physical activity intervention for mothers at risk of postnatal depression. *Midwifery*, *93*, 102898. https://doi.org/10.1016/j.midw.2020.102898

Teychenne, M., van der Pligt, P., Abbott, G., Brennan, L., & Olander, E. K. (2018). Feasibility and acceptability of a home-based physical activity program for postnatal women with depressive symptoms: A pilot study. *Mental Health and Physical Activity*, *14*, 82–89. https://doi.org/10.1016/j.mhpa.2018.02.007

Teymuri, Z., Hosseinifar, M., & Sirousi, M. (2018). The effect of stabilization exercises on pain, disability, and pelvic floor muscle function in postpartum lumbopelvic pain: A randomized controlled trial. *Journal of Physical Medicine*, *97*(12), 885–891. https://doi.org/10.1097/PHM.0000000000000993

Thom, D. H., & Rortveit, G. (2010). Prevalence of postpartum urinary incontinence: A systematic review. *Acta Obstetricia et Gynecologica Scandinavica*, *89*(12), 1511–1522. https://doi.org/10.3109/00016349.2010.526188

Thomas, K. A., & Foreman, S. W. (2005). Infant sleep and feeding pattern: Effects on maternal sleep. *Journal of Midwifery & Women's Health*, *50*(5), 399–404. https://doi.org/10.1016/j.jmwh.2005.04.010

Thompson, D. A., Haemer, M. A., Krebs, N. F., Pereira, R. I., Moss, A., Furniss, A. L., Bonczynski, J., & Nicklas, J. M. (2023). A WIC-based behavior change intervention for postpartum women with overweight and obesity: A pilot feasibility randomized trial. *Health Promotion Practice*, 15248399231173704. https://doi.org/10.1177/15248399231173704

Thomson, J. L., Tussing-Humphreys, L. M., Goodman, M. H., & Landry, A. S. (2018). Enhanced curriculum intervention did not result in increased postnatal physical activity in rural, southern, primarily African American Women. *American Journal of Health Promotion*, *32*(2), 464–472. https://doi.org/10.1177/0890117117736090

Tinius, R. A., Blankenship, M. M., Colao, A. M., Hawk, G. S., Perera, M., & Schoenberg, N. E. (2022). A pilot study on the impact of the BumptUp® mobile app on physical activity during and after pregnancy. *Sustainability*, *14*(19), Article 19. https://doi.org/10.3390/su141912801

Tinius, R. A., Polston, M., Bradshaw, H., Greene, A., & Parker, A. N. (2021). An assessment of mobile applications designed to address physical activity during pregnancy and postpartum. *International Journal of Exercise Science*, *14*(7), 382–399.

Tinius, R., Duchette, C., Beasley, S., Blankenship, M., & Schoenberg, N. (2021). Obstetric patients and healthcare providers perspectives to inform mobile app design for physical activity and weight control during pregnancy and postpartum in a rural setting. *International Journal of Women's Health*, *13*, 405–432. https://doi.org/10.2147/IJWH.S296310

Tkachuk, G. A., & Harris, C. A. (2012). Psychometric properties of the Tampa Scale for Kinesiophobia-11 (TSK-11). *The Journal of Pain*, *13*(10), 970–977. https://doi.org/10.1016/j.jpain.2012.07.001

To, W. W. K., & Wong, M. W. N. (2003). Factors associated with back pain symptoms in pregnancy and the persistence of pain 2 years after pregnancy. *Acta Obstetricia et Gynecologica Scandinavica*, *82*(12), 1086–1091. https://doi.org/https://doi.org/10.1046/j.1600-0412.2003.00235.x

Toelle, T. R., Utpadel-Fischler, D. A., Haas, K.-K., & Priebe, J. A. (2019). App-based multidisciplinary back pain treatment versus combined physiotherapy plus online education: A randomized controlled trial. *Npj Digital Medicine*, *2*(1), Article 1. https://doi.org/10.1038/s41746-019-0109-x

Tong, A., Sainsbury, P., & Craig, J. (2007). Consolidated criteria for reporting qualitative research (COREQ): A 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*, *19*(6), 349–357. https://doi.org/10.1093/intqhc/mzm042

Tornquist, L., Tornquist, D., Mielke, G. I., Silveira, M. F. da, Hallal, P. C., & Domingues, M. R. (2023). Maternal physical activity patterns in the 2015 Pelotas birth cohort: From preconception to postpartum. *Journal of Physical Activity and Health*, *20*(9), 868–877. https://doi.org/10.1123/jpah.2022-0609

Tseng, P.-C., Puthussery, S., Pappas, Y., & Gau, M.-L. (2015). A systematic review of randomised controlled trials on the effectiveness of exercise programs on lumbo pelvic pain among postnatal women. *BMC Pregnancy and Childbirth*, *15*, 316. mnh (26612732). https://doi.org/10.1186/s12884-015-0736-4

Tufanaru, C., Munn, Z., Aromataris, E., Campbell, J., & Hopp, L. (2020). Chapter 3: Systematic reviews of effectiveness. In *Aromataris, E., Munn, Z. (Eds.) JBI Manual for Evidence Synthesis.* JBI. https://synthesismanual.jbi.global

Turner, J., Clanchy, K., & Vincze, L. (2023). Telehealth interventions for physical activity and exercise participation in postpartum women: A quantitative systematic review. *Preventive Medicine*, *167*, 107413. https://doi.org/10.1016/j.ypmed.2022.107413

Unsgaard-Tøndel, M., Vasseljen, O., Woodhouse, A., & Mørkved, S. (2016). Exercises for women with persistent pelvic and low back pain after pregnancy. *Global Journal of Health Science*, *8*(9), 107–120. https://doi.org/10.5539/gjhs.v8n9p107

U.S. Department of Health and Human Services. (2018). *Physical Activity Guidelines for Americans (2nd ed.)*. U.S. Department of Health and Human Services.

van de Pol, G., de Leeuw, J. R. J., van Brummen, H. J., Bruinse, H. W., Heintz, A. P. M., & van der Vaart, C. H. (2006). The Pregnancy Mobility Index: A mobility scale during and after pregnancy. *Acta Obstetricia et Gynecologica Scandinavica*, *85*(7), 786–791. https://doi.org/10.1080/00016340500456373 van der Pligt, P. (2015). *Opportunities to promote healthy maternal weight during and following pregnancy*. Deakin University.

van der Pligt, P., Ball, K., Hesketh, K. D., Teychenne, M., Crawford, D., Morgan, P. J., Collins, C. E., & Campbell, K. J. (2018). A pilot intervention to reduce postpartum weight retention and central adiposity in first-time mothers: Results from the mums OnLiNE (Online, Lifestyle, Nutrition & Exercise) study. *Journal of Human Nutrition and Dietetics*, *31*(3), 314–328. https://doi.org/10.1111/jhn.12521

van der Pligt, P., Olander, E. K., Ball, K., Crawford, D., Hesketh, K. D., Teychenne, M., & Campbell, K. (2016a). Maternal dietary intake and physical activity habits during the postpartum period: Associations with clinician advice in a sample of Australian first time mothers. *BMC Pregnancy and Childbirth*, *16*(1), 27. https://doi.org/10.1186/s12884-016-0812-4

van der Pligt, P., Olander, E. K., Ball, K., Crawford, D., Hesketh, K. D., Teychenne, M., & Campbell, K. (2016b). Maternal dietary intake and physical activity habits during the postpartum period: Associations with clinician advice in a sample of Australian first time mothers. *BMC Pregnancy and Childbirth*, *16*(1), 27. https://doi.org/10.1186/s12884-016-0812-4

VanWiel, L., Conway, G. V., Carr, L. J., Gorzelitz, J., Story, W. T., & Whitaker, K. M. (2025). Associations of urinary incontinence with postpartum physical activity: A cross-sectional study. *Midwifery*, *148*, 104535. https://doi.org/10.1016/j.midw.2025.104535

Veritas Health Innovation. (2023). *Covidence systematic review software* [Computer software]. www.covidence.org

Vernon, M. M., Young-Hyman, D., & Looney, S. W. (2010). Maternal stress, physical activity, and body mass index during new mothers' first year postpartum. *Women & Health*, *50*(6), 544–562. https://doi.org/10.1080/03630242.2010.516692

Verplanken, B., & Orbell, S. (2003). Reflections on Past Behavior: A Self-Report Index of Habit Strength1. *Journal of Applied Social Psychology*, *33*(6), 1313–1330. https://doi.org/10.1111/j.1559-1816.2003.tb01951.x

Vesentini, G., Prior, J., Ferreira, P. H., Hodges, P. W., Rudge, M., & Ferreira, M. L. (2020). Pelvic floor muscle training for women with lumbopelvic pain: A systematic review and meta-analysis. *European Journal of Pain*, *24*(10), 1865–1879. https://doi.org/10.1002/ejp.1636

Vesting, S., Gutke, A., Fagevik Olsén, M., Rembeck, G., & Larsson, M. E. H. (2024). The impact of exercising on pelvic symptom severity, pelvic floor muscle strength, and diastasis recti abdominis after pregnancy: A longitudinal prospective cohort study. *Physical Therapy*, *104*(4), pzad171. https://doi.org/10.1093/ptj/pzad171

Video Conferencing, Web Conferencing, Webinars, Screen Sharing. (2025). Zoom. https://uvic.zoom.us/meeting/88909122295

Vladutiu, C. J., Evenson, K. R., Borodulin, K., Deng, Y., & Dole, N. (2014). The Association between physical activity and maternal sleep during the postpartum period. *Maternal and Child Health Journal*, *18*(9), 2106–2114. https://doi.org/10.1007/s10995-014-1458-3

Vladutiu, C. J., Evenson, K. R., Jukic, A. M., & Herring, A. H. (2015). Correlates of self-reported physical activity at 3- and 12-months postpartum. *Journal of Physical Activity & Health*, *12*(6), 814–822. https://doi.org/10.1123/jpah.2014-0147

Vleeming, A., Albert, H. B., Östgaard, H. C., Sturesson, B., & Stuge, B. (2008). European guidelines for the diagnosis and treatment of pelvic girdle pain. *European Spine Journal*, *17*(6), 794–819. https://doi.org/10.1007/s00586-008-0602-4

Vleeming, A., Schuenke, M. D., Masi, A. T., Carreiro, J. E., Danneels, L., & Willard, F. H. (2012). The sacroiliac joint: An overview of its anatomy, function and potential clinical implications. *Journal of Anatomy*, *221*(6), 537–567. https://doi.org/10.1111/j.1469-7580.2012.01564.x

Vora, A. J., Doerr, K. D., & Wolfer, L. R. (2010). Functional anatomy and pathophysiology of axial low back pain: Disc, posterior elements, sacroiliac joint, and associated pain generators. *Physical Medicine and Rehabilitation Clinics*, *21*(4), 679–709. https://doi.org/10.1016/j.pmr.2010.07.005

Waddell, G., Newton, M., Henderson, I., Somerville, D., & Main, C. J. (1993). A Fear-Avoidance Beliefs Questionnaire (FABQ) and the role of fear-avoidance beliefs in chronic low back pain and disability. *PAIN*, *52*(2), 157. https://doi.org/10.1016/0304-3959(93)90127-B

Wang, E., Otamendi, T., Li, L. C., Hoens, A. M., Wilhelm, L., Bubber, V., PausJenssen, E., McKinnon, A., McQuitty, S., English, K., Silva, A. S., Leese, J., Zarin, W., Tricco, A. C., & Hamilton, C. B. (2023). Researcher-patient partnership generated actionable recommendations, using quantitative evaluation and deliberative dialogue, to improve meaningful engagement. *Journal of Clinical Epidemiology*, *159*, 49–57. https://doi.org/10.1016/j.jclinepi.2023.05.004

Wang, J., Gu, R., Wu, L., Ji, Y., Tu, X., Xie, Y., & Wang, X. (2024). Trajectory of pelvic floor muscle training adherence in Chinese women with postpartum stress urinary incontinence and its related factors: A longitudinal study. *Women and Children Nursing*, *2*(3), 62–67. https://doi.org/10.1016/j.wcn.2024.07.003

Wang, Y., Fadhil, A., Lange, J.-P., & Reiterer, H. (2019). Integrating taxonomies into theory-based digital health interventions for behavior change: A holistic framework. *JMIR Research Protocols*, *8*(1), e8055. https://doi.org/10.2196/resprot.8055

Watson, N., Milat, A. J., Thomas, M., & Currie, J. (2005). The feasibility and effectiveness of pram walking groups for postpartum women in western Sydney. *Health Promotion Journal of Australia*, *16*(2), 93–99. https://doi.org/10.1071/HE05093

Wei, Y., Zheng, P., Deng, H., Wang, X., Li, X., & Fu, H. (2020). Design features for improving mobile health intervention user engagement: Systematic review and thematic analysis. *Journal of Medical Internet Research*, *22*(12), e21687. https://doi.org/10.2196/21687

Weis, C. A., Pohlman, K., Barrett, J., Clinton, S., da Silva-Oolup, S., Draper, C., Lee, J., Kumar, R., O'Beirne, M., Stuber, K., & Hawk, C. (2021). Best-practice recommendations for chiropractic care for pregnant and postpartum patients: Results of a consensus process. *Journal of Manipulative and Physiological Therapeutics*. https://doi.org/10.1016/j.jmpt.2021.03.002

Weis, C. A., Pohlman, K., Draper, C., da Silva-Oolup, S., Stuber, K., & Hawk, C. (2020). Chiropractic care of adults with postpartum-related low back, pelvic girdle, or combination pain: A systematic review. *Journal of Manipulative and Physiological Therapeutics*, *43*(7), 732–743. https://doi.org/10.1016/j.jmpt.2020.05.006

Whittaker, R., Merry, S., Dorey, E., & Maddison, R. (2012). A development and evaluation process for mHealth interventions: Examples from New Zealand. *Journal of Health Communication*, *17*(sup1), 11–21. https://doi.org/10.1080/10810730.2011.649103

Wicks, P., Richards, T., Denegri, S., & Godlee, F. (2018). Patients' roles and rights in research. *BMJ (Clinical Research Ed.)*, *362*, k3193. https://doi.org/10.1136/bmj.k3193

Wilkinson, S. A., Guyatt, S., & Willcox, J. C. (2023). Informing a healthy eating and physical activity program to decrease postnatal weight retention: What are women experiencing and what type of program do they want? *Health Promotion Journal of Australia*, *34*(1), 111–122. https://doi.org/10.1002/hpja.668

Williams, D. M., Dunsiger, S., Jennings, E. G., & Marcus, B. H. (2012). Does affective valence during and immediately following a 10-Min walk predict concurrent and future physical activity? *Annals of Behavioral Medicine*, *44*(1), 43–51. https://doi.org/10.1007/s12160-012-9362-9

Williams, S. L., & French, D. P. (2011). What are the most effective intervention techniques for changing physical activity self-efficacy and physical activity behaviour—And are they the same? *Health Education Research*, *26*(2), 308–322. https://doi.org/10.1093/her/cyr005

Willms, A., Rhodes, R. E., & Liu, S. (2023a). Effects of mobile-based financial incentive interventions for adults at risk of developing hypertension: Feasibility randomized controlled trial. *JMIR Formative Research*, *7*(1), e36562. https://doi.org/10.2196/36562

Willms, A., Rhodes, R. E., & Liu, S. (2023b). The development of a hypertension prevention and financial-incentive mhealth program using a "no-code" mobile app builder: Development and usability study. *JMIR Formative Research*, *7*(1), e43823. https://doi.org/10.2196/43823

Wilson, P. M., & Muon, S. (2008). Psychometric properties of the exercise identity scale in a university sample. *International Journal of Sport and Exercise Psychology*, *6*(2), 115–131. https://doi.org/10.1080/1612197X.2008.9671857

Woby, S. R., Roach, N. K., Urmston, M., & Watson, P. J. (2005). Psychometric properties of the TSK-11: A shortened version of the Tampa Scale for Kinesiophobia. *PAIN*, *117*(1), 137–144. https://doi.org/10.1016/j.pain.2005.05.029

World Health Organization. (2013). *Global Action Plan for the Prevention and Control of Noncommunicable Diseases 2013-2020.* World Health Organization. https://apps.who.int/iris/bitstream/handle/10665/94384/9789241506236_eng.pdf?sequence=1.Archived

World Health Organization. (2016). *Monitoring and evaluating digital health interventions: A practical guide to conducting research and assessment*. World Health Organization. https://apps.who.int/iris/handle/10665/252183

World Health Organization. (2019). *Global Action Plan on Physical Activity 2018-2030: More Active People for a Healthier World*. World Health Organization.

Wright, C. E., Rhodes, R. E., Ruggiero, E. W., & Sheeran, P. (2021). Benchmarking the effectiveness of interventions to promote physical activity: A metasynthesis. *Health Psychology*, *40*, 811–821. https://doi.org/10.1037/hea0001118

Wu, W. H., Meijer, O. G., Uegaki, K., Mens, J. M. A., van Dieën, J. H., Wuisman, P. I. J. M., & Östgaard, H. C. (2004). Pregnancy-related pelvic girdle pain (PPP), I: Terminology, clinical presentation, and prevalence. *European Spine Journal*, *13*(7), 575–589. https://doi.org/10.1007/s00586-003-0615-y

Wuytack, F., Gutke, A., Stuge, B., Mørkved, S., Olsson, C., Robinson, H. S., Vøllestad, N. K., Öberg, B., Wikmar, L. N., Mena, J. J. S., & Smith, V. (2018). Protocol for the development of a core outcome set for pelvic girdle pain, including methods for measuring the outcomes: The PGP-COS study. *BMC Medical Research Methodology*, *18*(1), 158. https://doi.org/10.1186/s12874-018-0624-5

Wuytack, F., & O'Donovan, M. (2019). Outcomes and outcomes measurements used in intervention studies of pelvic girdle pain and lumbopelvic pain: A systematic review. *Chiropractic & Manual Therapies*, *27*(1), N.PAG-N.PAG. https://doi.org/10.1186/s12998-019-0279-2

Xu, Y., Song, Y., Sun, D., Fekete, G., & Gu, Y. (2020). Effect of multi-modal therapies for kinesiophobia caused by musculoskeletal disorders: A systematic review and meta-analysis. *International Journal of Environmental Research and Public Health*, *17*(24), Article 24. https://doi.org/10.3390/ijerph17249439

Yao, C. A., & Rhodes, R. E. (2015). Parental correlates in child and adolescent physical activity: A meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, *12*(1), 10. https://doi.org/10.1186/s12966-015-0163-y

Yardley, L., Morrison, L., Bradbury, K., & Muller, I. (2015). The person-based approach to intervention development: Application to digital health-related behavior change interventions. *Journal of Medical Internet Research*, *17*(1), e4055. https://doi.org/10.2196/jmir.4055

Appendices

Appendix A

Supplemental Material for Study 1

Supplemental Material 1 Theoretical Domains Framework

The Theoretical Domains Framework (TDF) includes 14 domains (Atkins et al., 2017):

1) Knowledge
2) Skills
3) Social/professional role and identity
4) Beliefs about capabilities
5) Optimism
6) Beliefs about Consequences*
7) Reinforcement
8) Intentions
9) Goals
10) Memory, attention and decision processes
11) Environmental context and resources
12) Social influences
13) Emotion**
14) Behavioural regulation

* We modified this domain to include fear of movement

** We modified this domain, as per Rhodes and colleagues (2021) to include affective beliefs

Supplemental Material 2 Search Strategy

<u>MEDLINE (OVID)</u>

(physical* activ* OR physical training OR walk* OR exercis* OR fitness OR aerobics OR aerobic* training OR aerobic* activit* OR running OR jogging OR athletics OR cycling OR bike* OR biking OR bicycl* OR swim* OR rollerblading OR roller-blading OR rollerskat* OR roller-skat* OR skating OR physical exertion* OR active transport* OR circuit training OR strength training OR calisthenics OR sport* OR resistance training OR weight training OR endurance training OR pilates OR yoga OR kegel*).tw,kf

OR (pelvi* adj5 rehab*).tw,kf

OR (pelvi* adj4 (train* OR muscle*)).tw,kf OR

Exp Exercise/ OR exp Exercise Movement Techniques/ OR exp Exercise Therapy/ OR exp Sports/ OR Physical Exertion/

AND

(intervention* OR controlled clinical trial* OR placebo OR randomly OR trial OR quasi-experiment* OR pre test OR pretest OR post test OR posttest OR controlled stud* OR time series).tw,kf OR

OR (randomi?ed adj3 trial*).tw,kf

OR (before adj3 after).tw,kf

exp Randomized Controlled Trial/ OR controlled before-after studies/ OR historically controlled study/ OR interrupted time series analysis/ OR case-control studies/

AND

(postpartum OR post-partum OR postnatal OR post-natal OR perinatal* OR peri natal* OR after childbirth OR after pregnanc* OR post pregnanc* OR puerper* OR new mother* OR new moms).tw,kf OR
Peripartum Period/ OR Postpartum Period/

SCOPUS

((TITLE (("physical* activ*" OR "physical
training" OR walk* OR exercis* OR fitness OR aerobics OR "aerobic* training" OR "aerobic* activit*" OR running OR jogging OR athletics OR cycling OR bike* OR biking OR bicycl* OR swim* OR rollerblading OR roller-blading OR rollerskat* OR roller-
skat* OR skating OR "physical exertion*" OR "active transport*" OR "circuit
training" OR "strength training" OR calisthenics OR sport* OR "resistance training" OR "weight training" OR "endurance
training" OR pilates OR yoga OR kegel* OR (pelvi* W/5 rehab*) OR (pelvi* W/4 (train* OR m uscle*)))) OR ABS (("physical* activ*" OR "physical
training" OR walk* OR exercis* OR fitness OR aerobics OR "aerobic* training" OR "aerobic* activit*" OR running OR jogging OR athletics OR cycling OR bike* OR biking OR bicycl* OR swim* OR rollerblading OR roller-blading OR rollerskat* OR roller-
skat* OR skating OR "physical exertion*" OR "active transport*" OR "circuit
training" OR "strength training" OR calisthenics OR sport* OR "resistance training" OR "weight

training" OR "endurance

training" OR pilates OR yoga OR kegel* OR (pelvi* W/5 rehab*) OR (pelvi* W/4 (train* OR m

uscle*)))))) AND ((TITLE((intervention* OR "controlled clinical

trial*" OR placebo OR randomly OR trial OR quasi-experiment* OR "pre

test" OR pretest OR "post test" OR posttest OR "controlled stud*" OR "time

series" OR (randomi?ed W/3 trial*) OR "before and

after")) OR ABS((intervention* OR "controlled clinical

trial*" OR placebo OR randomly OR trial OR quasi-experiment* OR "pre

test" OR pretest OR "post test" OR posttest OR "controlled stud*" OR "time

series" OR (randomi?ed W/3 trial*) OR "before and after")))) AND ((TITLE

((postpartum OR "post-partum" OR postnatal OR "post-natal" OR perinatal* OR "peri

natal*" OR "after childbirth" OR "after pregnanc*" OR "post pregnanc*" OR puerper* OR “new

mother*” OR “new moms”)) OR ABS ((postpartum OR "post-partum" OR postnatal OR "post-

natal" OR perinatal* OR "peri natal*" OR "after childbirth" OR "after pregnanc*" OR "post

pregnanc*" OR puerper* OR “new mother*” OR “new moms”))))

APA PsycInfo (EBSCO)

(“physical* activ*” OR “physical training” OR walk* OR exercis* OR fitness OR aerobics OR “aerobic* training” OR “aerobic* activit*” OR running OR jogging OR athletics OR cycling OR bike* OR biking OR bicycl* OR swim* OR rollerblading OR roller-blading OR rollerskat* OR roller-skat* OR skating OR “physical exertion*” OR “active transport*” OR “circuit training” OR “strength training” OR calisthenics OR sport* OR “resistance training” OR “weight training”

OR “endurance training” OR pilates OR yoga OR kegel* OR “pelvi* W/5 rehab*” OR “pelvi* W/4 (train* OR muscle*)”)

OR (DE "physical activity" OR DE "exercise" OR DE "sports" OR DE "weightlifting” OR DE "running" OR DE "walking" OR DE "Swimming" OR DE "Athletic Training")

AND

(intervention* OR “controlled clinical trial*” OR placebo OR randomly OR trial OR quasi-experiment* OR “pre test” OR pretest OR “post test” OR posttest OR “controlled stud*” OR “time series” OR “randomi?ed W/3 trial*” OR “before and after”)

OR (DE "intervention" OR DE "randomized controlled trials")

AND

(postpartum OR post-partum OR postnatal OR post-natal OR perinatal* OR “peri natal*” OR “after childbirth” OR “after pregnanc*” OR “post pregnanc*” OR puerper* OR “new mother*” OR “new moms”)

OR (DE "postnatal period" OR DE "perinatal period”)

<u>SPORTDiscus (EBSCO)</u>

(“physical* activ*” OR “physical training” OR walk* OR exercis* OR fitness OR aerobics OR “aerobic* training” OR “aerobic* activit*” OR running OR jogging OR athletics OR cycling OR bike* OR biking OR bicycl* OR swim* OR rollerblading OR roller-blading OR rollerskat* OR roller-skat* OR skating OR “physical exertion*” OR “active transport*” OR “circuit training” OR “strength training” OR calisthenics OR sport* OR “resistance training” OR “weight training” OR “endurance training” OR pilates OR yoga OR kegel* OR “pelvi* W/5 rehab*” OR “pelvi* W/4 (train* OR muscle*)”)
OR (DE "physical activity" OR DE "exercise" OR DE "physical fitness" OR DE "postnatal exercise" OR DE “pelvic floor” OR DE “PHYSICAL training & conditioning” OR DE “EXERCISE therapy” OR DE “AEROBIC exercises” OR DE “Yoga” OR DE "SPORTS" OR DE "RUNNING" OR DE "AEROBIC exercises" OR DE "JOGGING")

AND

(intervention* OR “controlled clinical trial*” OR placebo OR randomly OR trial OR quasi-experiment* OR “pre test” OR pretest OR “post test” OR posttest OR “controlled stud*” OR “time series” OR “randomi?ed W/3 trial*” OR “before and after”)
OR (DE "randomized controlled trials" OR DE “CLINICAL trials” OR DE “PRE-tests & post-tests”)

AND

(postpartum OR post-partum OR postnatal OR post-natal OR perinatal* OR “peri natal*” OR “after childbirth” OR “after pregnanc*” OR “post pregnanc*” OR puerper* OR “new mother*” OR “new moms”)
OR (DE "postnatal care" OR DE "postnatal exercise" OR DE "PUERPERIUM" OR DE "PUERPERAL disorders")

<u>CINAHL (EBSCO)</u>

(“physical* activ*” OR “physical training” OR walk* OR exercis* OR fitness OR aerobics OR “aerobic* training” OR “aerobic* activit*” OR running OR jogging OR athletics OR cycling OR bike* OR biking OR bicycl* OR swim* OR rollerblading OR roller-blading OR rollerskat* OR roller-skat* OR skating OR “physical exertion*” OR “active transport*” OR “circuit training” OR “strength training” OR calisthenics OR sport* OR “resistance training” OR “weight training” OR “endurance training” OR pilates OR yoga OR kegel* OR “pelvi* W/5 rehab*” OR “pelvi* W/4 (train* OR muscle*)”)
OR MH "physical activity" OR MH "exercise" OR "MH "exercise intensity" OR MH “Muscle Strengthening” OR MH “sports” OR MH “kegel exercises” OR MH "Walking+" OR MH "Running+" OR MH "Aquatic Exercises" OR MH "Aerobic Exercises+" OR MH "Callisthenics" OR MH "Endurance Training" OR MH "Core Exercises" OR MH "Abdominal Exercises" OR MH "Muscle Strengthening+" OR MH "Pilates" OR MH "Therapeutic Exercise"

AND

(intervention* OR “controlled clinical trial*” OR placebo OR randomly OR trial OR quasi-experiment* OR “pre test” OR pretest OR “post test” OR posttest OR “controlled stud*” OR “time series” OR “randomi?ed W/3 trial*” OR “before and after”)
OR (MH "random assignment" OR MH "clinical trials" OR MH “experimental studies”)

AND

(postpartum OR post-partum OR postnatal OR post-natal OR perinatal* OR “peri natal*” OR “after childbirth” OR “after pregnanc*” OR “post pregnanc*” OR puerper* OR “new mother*” OR “new moms”)
OR (MH "postnatal period" OR MH "postnatal care")

Web of Science

Topic search (title, abstract, keywords)

(“physical* activ*” OR “physical training” OR walk* OR exercis* OR fitness OR aerobics OR “aerobic* training” OR “aerobic* activit*” OR running OR jogging OR athletics OR cycling OR bike* OR biking OR bicycl* OR swim* OR rollerblading OR roller-blading OR rollerskat* OR roller-skat* OR skating OR “physical exertion*” OR “active transport*” OR “circuit training” OR “strength training” OR calisthenics OR sport* OR “resistance training” OR “weight training” OR “endurance training” OR pilates OR yoga OR kegel* OR (pelvi* NEAR/5 rehab*) OR (pelvi* NEAR/4 (train* OR muscle*)))

AND

(intervention* OR “controlled clinical trial*” OR placebo OR randomly OR trial OR quasi-experiment* OR “pre test” OR pretest OR “post test” OR posttest OR “controlled stud*” OR “time series” OR (randomi?ed NEAR/3 trial*) OR “before and after”)

AND

(postpartum OR post-partum OR postnatal OR post-natal OR perinatal* OR “peri natal*” OR “after childbirth” OR “after pregnanc*” OR “post pregnanc*” OR puerper* OR “new mother*” OR “new moms”)

Gray Literature

Cochrane Central Register of Controlled Trials

(physical* activ* OR physical training OR walk* OR exercis* OR fitness OR aerobics OR aerobic* training OR aerobic* activit* OR running OR jogging OR athletics OR cycling OR bike* OR biking OR bicycl* OR swim* OR rollerblading OR roller-blading OR rollerskat* OR roller-skat* OR skating OR physical exertion* OR active transport* OR circuit training OR strength training OR calisthenics OR sport* OR resistance training OR weight training OR endurance training OR pilates OR yoga OR kegel*).tw,kw

OR (pelvi* adj5 rehab*).tw,kw

OR (pelvi* adj4 (train* OR muscle*)).tw,kw OR

Exp Exercise/ OR exp Exercise Movement Techniques/ OR exp Exercise Therapy/ OR exp Sports/ OR Physical Exertion/

AND

(intervention* OR controlled clinical trial* OR placebo OR randomly OR trial OR quasi-experiment* OR pre test OR pretest OR post test OR posttest OR controlled stud* OR time series).tw,kw OR

OR (randomi?ed adj3 trial*).tw,kw

OR (before adj3 after).tw,kw

exp Randomized Controlled Trial/ OR controlled before-after studies/ OR historically controlled study/ OR interrupted time series analysis/ OR case-control studies/

AND

(postpartum OR post-partum OR postnatal OR post-natal OR perinatal* OR peri natal* OR after childbirth OR after pregnanc* OR post pregnanc* OR puerper* OR new mother* OR new moms).tw,kw OR

Peripartum Period/ OR Postpartum Period/

Supplemental Material 3 Study Extraction

Supplemental Table 1

Extraction Table

Authors, Date	Country	Sample Size and Characteristics	Study Design and Intervention	Intervention Theory	Physical Activity Outcome Measure	Putative Mediator Outcome Measures	Path A	Path C	Paths B, AB, C’	ROB
(Albright et al., 2019)	USA	Total n = 311; TTCW n = 154, SWO n = 157 *M*Age (years): TTCW = 31.4(5.5), SWO = 31.7(5.8) *M*BMI (kg/m^2): TTCW = 28.3(5.5), SWO = 27.4(5.0) Race: TTCW = 30.4% Asian, 5.1% Japanese, 13.8% Filipino, 11.6% mixed Asian/other Asian, 34.1% Native Hawaiian/Pacific Islander, 13.8% White, 18.8% Mixed race, 2.9% other (Black, Native American) = 2.9%; SWO = 32.4% Asian, 10.1% Japanese, 8.6% Filipino, 13.7% Mixed Asian/Other Asian, 32.4% Native Hawaiian/Pacific Islander, 17.3% White, 15.1% Mixed race, 2.9% Other (Black,	**Randomized trial with longitudinal analysis** Duration: 12-months Time of assessments: Baseline, 3, 6, and 12-months Intervention: TTCW = Tailored Telephone Counseling plus Website Website included resources tailored to new mothers in Hawaii. Personalized counseling delivered via 17 telephone calls. Physical activity information included location/names of stroller friendly parks, tips for giving physical activity support to a new partner, staying on track even during bad weather, setting step goals using a pedometer, keeping physical activity goals when baby is sick/fussy. Website had a calendar with community classes that were updated monthly, links to local postpartum physical activity groups, and programs participants	Social Cognitive Theory BCTs: N/A	*Self-report:* Active Australia Survey (AAS) measures frequency, intensity, and duration of activities performed for at least 10 minutes in the last week: walking for recreation, exercise, or to get from place to place, moderate intensity physical activity, vigorous physical activity. Total minutes of MVPA per week was the sum of minutes of walking, moderate and vigorous physical activity, with the latter weighted by two. *Device-measured:* Participants wore accelerometers however a large proportion of inactive participants appeared physically active based on baseline accelerometry levels due to reactivity.	From Albright et al., (2012) *Self-efficacy (Beliefs about Capabilities):* 23 items to assess self-confidence to overcome barriers to physical activity. Some questions were specific to mothers: self-efficacy to exercise when no one is available to care for her infant/children or to exercise when the infant/children are sick. (Range 0-10) *Perceived benefits (Beliefs about Consequences)*: Perceived benefits to physical activity. Included questions specific to new mothers such as sleeping better at night and having fun with baby/children while exercising. Two subscales: 1) physiological benefits,	Social Support: Intervention to mediator 12-months, parameter estimate (SE): .04(.09), p = .62 Barriers: Intervention to mediator 12-months, parameter estimate (SE): .02(.04), p = .67 Self-Efficacy: Intervention to mediator 12-monhts, parameter estimate (SE): .20(.17), p = .22 Benefits: Intervention to mediator 12-monhts, parameter estimate (SE): 0(.08), p = 1	*Self-report:* MVPA (volume min/week): TTCW Mean(95% CI): Baseline = 44(42, 46), SD~6.35; 6-months = 117(107, 127), 12-months = 247(222, 273); p for trend < .001 SWO Mean(95% CI): Baseline = 45(42, 48), SD~12.12; 6-months = 89(82, 97), 12-months = 155(139, 172); p for trend <.001; p for interaction = .022 Baseline to 12-month (post-intervention) effect size: Cohen's d = .36; r = .18; p = .03	*Social Support:* Path B: Mediator 6-months to MVPA 6-months to 12-months,coefficient (SE): .19(.09), p = .04 Path AB: Indirect effect, (95% CI): .05(-.003, .118) Path C': Intervention to MVPA 12-months, coefficient(SE): .29(.15), p = .05 *Barriers:* Path B: Mediator 6-months to MVPA 6-months to 12-months,coefficient (SE): -.33(.14), p = .02 Path AB: Indirect effect, (95% CI): -.01(-.05, .04) Path C': Intervention to MVPA 12-months, coefficient(SE): .33(.15), p = .03 *Self-Efficacy:*	3/13 (Low)

		Native American) = 2.9% Time postpartum: 2-12 months; mean = 5.7(2.9) months Baseline activity status: Inactive (reported 30 minutes or less of leisure-time MVPA over the last week) Sample parity: TTCW: Primiparous = 38.4%, two children = 35.5%, three or more children = 26.1% SWO: Primiparous = 37.1%, two children = 42.1%, three or more children = 20.7% Concomitant health issue: N/A	could use to map their walking route. Telephone counselors using motivational interviewing for problem solving, overcoming physical activity barriers, highlighting benefits of MVPA, enlisting social support for physical activity from family/friends, setting MVPA goals in reference to type of activity, duration, intensity, and location. *Prescribed Frequency, Intensity, Time, and Type (FITT) of PA:* Participants were informed the ultimate goal was to reach 30 minutes a day of MVPA, 5 days per week (150 minutes MVPA per week) by 12-months. All forms of physical activity were encouraged. They focused on pushing baby in stroller since this is moderate intensity physical activity. Participants received incentives Control: SWO = Standard Website Only Website provided links to standard information on strategies for increasing physical activity from credible national online physical activity resources. Information addressed the benefits of physical activity, goal setting, advice and resources. Information targeted adults of any age and didn't			2) psychological benefits (Heesch, Masse, & Dunn, 2006) (Range 1-5) *Barriers (Environmental context and resources):* Perceived barriers to physical activity (Sallis et al., 1999). Included exercising when baby/children were sick and living in a neighborhood that had no sidewalks to accommodate a stroller. (Range 1-5) *Social support (Social Influences):* An adapted version of the Sallis family/friend support for participation in exercise scale (Sallis et al., 1987). Scored on 5-point Likert scale (1 = never, 5 = very often). Modified to include items such as providing childcare so mother could exercise. (Range 1-5)			Path B: Mediator 6-months to MVPA 6-months to 12-months,coefficient (SE): .09(.05), p = .11 Path AB: Indirect effect, (95% CI): .01(-.02, .06) Path C': Intervention to MVPA 12-months, coefficient(SE): .31(.15), p = .04 *Benefits:* Path B: Mediator 6-months to MVPA 6-months to 12-months,coefficient (SE): .01(.05), p = .80 Path AB: Indirect effect, (95% CI): .01(-.02, .04) Path C': Intervention to MVPA 12-months, coefficient(SE): .32(.15), p = .04	

			address issues related to children or infants. Participants received incentives.							
(Bashirian et al., 2020)	Iran	Total n = 68; intervention n = 33, control n = 35 Age (years): intervention = 6.1% (15-20), 27.3% (21-25), 39.4% (26-30), 18.2% (31-35), 9.1% (36 and up); Control = 5.7% (15-20), 34.3% (21-25), 22.9% (26-30), 22.9% (31-35), 14.3% (36 and up) Time postpartum: 6-weeks to 6-months postpartum Age of children: Intervention = 48.5% <2 months, 15.2% 2-4 months, 36.4% >4 months: Control = 28.6% <2 months, 34.3% 2-4 months, 37.1% >4 months Baseline activity status: Intervention group: 97% performed light PA and 3% performed medium/heavy PA; control group: 94.3% performed light PA	**Quasi-experimental study** Duration: 4-weeks Time of assessment: baseline, 6-weeks, post-intervention Intervention: Both groups received pedometers. Intervention participants also received classes based on the BASNEF model. There were five theoretical sessions, lasting 45-50min, and one to two sessions per week. Educational sessions involved lectures, question and answer; educational tools included computer, booklet, whiteboard, and educational pamphlet. Topics included benefits of exercise on health and life. Appropriate time, intensity, and number of exercise sessions. Features of a regular PA program, the role of exercise in preventing the disease, time management, the physical activity pyramid, tips on walking, and types of physical activity appropriate for postpartum. Material was based on guidelines from the Ministry of Health and Medical Education. At the end of sessions, participants were asked two questions and	BASNEF model BCTS: N/A	*Self-report:* The International Physical Activity Questionnaire (IPAQ) was used to measure the intensity of physical activity over the past 7-days. If there was a combination of moderate and intense activity or walking during the past 5-day of at least 600 met-min/week, the PA intensity was moderate. If there total energy consumed was at least 1500 met-min/week during at least 3 of the last 7 days or walking reached at least 3000 met-min/week, PA intensity was severe. *Device-measured:* Pedometers measured steps	*Knowledge (Knowledge):* 8-questions with three options (correct = 1, wrong = 0, and I don't know = 0) *Attitudes (Beliefs about Consequences):* 8-questions of attitudes towards regular physical activity. Likert scale of 5 = strongly agree, 4 = agree, 3 = no idea, 2 = disagree, 1 = strongly disagree. Total varied between 8 and 40. *Subjective norms (Social Influences):* 8-questions Same Likert scale as attitudes. Score total varied between 8 and 40. *Behavioural Intention (Intentions):* 4-questions. Likert scale (5 = very high, 4 = high, 3 = no idea, 2 = low, 1 = very low). Total varied between 4 and 20.	*Knowledge:* Intervention, mean(SD): Baseline = 4.61(1.50); 6-weeks post-intervention = 6.24(1.30) Control, mean(SD): Baseline = 4.54(1.50); 6-weeks post-intervention = 4.17(1.50) Baseline t-test = .869 6-weeks t-test = .001 Paired t-test: intervention = .001; control = .306 Baseline to 6-weeks (post-intervention) effect size: Cohen's d = 1.33, r = .55 *Attitudes:* Intervention, mean(SD): Baseline = 36.64(3.20) ; 6-weeks post-intervention = 38.06(2.20) Control, mean(SD): Baseline = 36.49(3.10); 6-weeks post-intervention = 36.33(2.80) Baseline t-test = .846 6-weeks t-test = .015 Paired t-test: intervention = .001; control = .862 Baseline to 6-weeks (post-intervention) effect size: Cohen's d = .50, r = .24 *Subjective Norms:* Intervention, mean(SD): Baseline = 26.70(2.80); 6-weeks post-intervention = 28.12(2.10)	*Self-report:* MVPA (Intensity; %) Intervention, n(%): Baseline = 32(97.0%) light, 1(3.0%) medium/heavy; 6-weeks post-intervention = 23(69.7%) light, 10(30.3%) medium/heavy Control, n(%): Baseline = 33(94.3%) light, 2(5.7%) medium/heavy; 6-weeks post-intervention = 35(100.0%) light, 0(0.0%) medium/heavy No difference between groups at baseline (p = .590) Significant difference between groups at 6-weeks post-intervention (p = .001) The intensity of physical activity was significant at 6-weeks post intervention in the intervention group (p = .001), but not in the control group (p = .236) *Device-measured:* Walking (Pedometer steps) At baseline, there was no significant difference between groups regarding the mean number of steps based on the pedometer index (p = .058). 6-weeks post-intervention, the intervention group had significantly greater steps than the control group (p = .001).	N/A	3/9 (Low)

		and 5.7% performed medium/heavy PA Sample parity: N/A Concomitant health issue: N/A	awards were given to those who answered correctly. *Prescribed FITT of PA:* PA recommendations were based on guidelines from the Ministry of Health and Medical Education. No specific information on FITT prescribed. Control: Participants were given pedometers			*Enabling Factors (Environmental Context and Resources):* 7-questions. Likert scale 5 = strongly agree, 4 = agree, 3 = no idea, 2 = disagree, 1 = strongly disagree. Total score varied from 7 to 35.	Control, mean(SD): Baseline = 25.91(4.10); 6-weeks post-intervention = 26.09(3.30) Baseline t-test = .362 6-weeks t-test = .004 Paired t-test: intervention = .001; control = .778 Baseline to 6-weeks (post-intervention) effect size: Cohen's d = .35, r = .17 *Behavioural Intention:* Intervention, mean(SD): Baseline = 11.73(2.70); 6-weeks post-intervention = 13.17(3.40) Control, mean(SD): Baseline = 12.77(3.40); 6-weeks post-intervention = 12.65(3.35) Baseline t-test = .119 6-weeks t-test = .001 Paired t-test: intervention = .001; control = .251 Baseline to 6-weeks (post-intervention) effect size: Cohen's d = .51, r = .25 *Enabling factors:* Intervention, mean(SD): Baseline = 16.01(4.01); 6-weeks post-intervention = 24.03(4.33) Control, mean(SD): Baseline = 16.71(4.63); 6-weeks post-intervention = 16.11(4.53) Baseline t-test = .500 6-weeks t-test = .001 Paired t-test: intervention = .001; control = .286 Baseline to 6-weeks (post-intervention) effect size: Cohen's d = 1.99, r = .71	Paired t-tests demonstrated significantly improved steps in the intervention group 6 weeks after intervention (p = .001), but not in the control group (p = .552). Inadequate data to calculate effect sizes		

(Berry et al., 2016)	USA	Total n = 100 women; intervention n = 50, control n = 50 *M*Age (years): Total = 30.16(6.26); intervention = 30.28(6.59), control = 30.04(5.98) Race: intervention = 12% American Indian/Alaska, 44% Black/African-American, 42% White, 2% other; 6% American Indian/Alaska, 4% Asian, 60% Black/African-American, 20% White, 8% more than one race, 2% other Time postpartum: First class was in pregnancy and second class started at 6-weeks postpartum Baseline activity status: Intervention mean score: 1.91; Baseline mean score: 2.01; on average they indicate performing PA "sometimes" Sample parity: N/A	**Cluster randomized controlled pilot study** Duration: 14-weeks plus 3-months (~7-months) Time of assessments: 6-weeks postpartum, 4-months, 7-months, 10-months Intervention: Phase 1: 14 classes each 60-min. The first class was during pregnancy on the benefits of breastfeeding. Classes resumed at 6-weeks postpartum and delivered weekly with a focus on reinforcing knowledge about recurrent GDM and progression to type 2 diabetes, importance of daily exercise, understanding calories, proteins, carbohydrates, fats, normal-size portions and portion control strategies, making innovative, healthy substitutions for foods routinely eaten, healthy foods when eating out, cognitive restructuring and role-playing to encourage exercise, social problem-solving skills to improve nutrition and exercise behaviours, assertiveness training for positive motivation, using social problem solving to understand common barriers to healthy choices, getting back on track after relapse, working through conflict using conflict resolution, combining the techniques.	Social cognitive theory BCTs: N/A	*Self-report:* Not clear whether the outcome was Accelerometry or the Exercise subscale of the Health Promoting Lifestyle Profile II	*Self-efficacy (Beliefs about Capabilities):* Exercise Self-Efficacy Scale	*Self-efficacy:* Intervention, mean(SE): 6-weeks = 39.13(2.32), 10-months = 44.69(3.18) Control, mean(SE): 6-weeks = 41.67(2.40), 10-months = 39.56(3.13) 6-weeks to 10-months (post-intervention follow-up) effect size: Cohen's d = .52, r = .25 6-weeks to 10-months (post-intervention follow-up) effect size: Cohen's d = .52, p = .02	*Self-report:* Total PA: Intervention, mean(SE): 6-weeks = 1.91(.09), 10-months = 2.33(.10) Control, mean(SE): 6-weeks = 2.01(.09), 10-months = 2.09(.10) 6-weeks to 10-months (post-intervention follow-up) effect size: Cohen's d = .61, r = .29 10-months: intervention M = 2.33(SE =.10), control M = 2.09(SE = .10), p = .094	N/A	7/13 (High)

		Concomitant health issue: Gestational Diabetes Mellitus	Participants also attended a 60-minute weekly exercise class and received weekly text messages that reflected the information from the classes to increase motivation. Phase 2: 3 monthly classes each 60-min. Facilitated group discussions to assist women with problems related to breastfeeding, nutrition, or exercises. Missed classes couldn't be made up but participants were given a call to see how they were doing. They also received monthly educational and motivational text messages, *Prescribed FITT of PA*: Participants were encouraged to increase their exercise to at least 30 minutes most days of the week (intensity not described). Examples of exercise were walking, stroller walking, exercise DVDs and websites. Control: Participants received usual care and were offered Phase 1 classes 2-14 once they were at 10-months postpartum.							
(Bick et al., 2020)	UK	Total n = 193; intervention = 98, control = 95 *M*Age (years): Total = 32(5.2), intervention = 32.44(5.10), control = 33.06(5.37) *M*BMI (kg/m^2): Total = 30.51(5.4),	**Randomized feasibility trial** Duration: 14-weeks allowing 2-week holiday Time of assessments: baseline, 6-months, 12-months Intervention:	Social cognitive theory BCTs: goal setting, social support, positive reinforcement.	*Self-Report:* International Physical Activity Short Form	*Self-Esteem (Beliefs about Capabilities):* Rosenberg Self Esteem Scale	*Self-Esteem:* Intervention, mean (SD): Baseline = 32.34(4.13). 6-months = 32.84(4.77), 12-months = 32.77(4.48) Control, mean(SD): Baseline = 32.74(3.71), 6-months = 33.81(4.84), 12-months = 33.06(4.84)	*Self-report:* MVPA (volume; min/day) Intervention, mean(SD) : Baseline = 57.68(28.22), 6-months = 37.62(23.05), 12-months = 57.37(43.85) Control, mean(SD) : Baseline = 18.10(17.58), 6-months =	N/A	4/13 (Low)

		Intervention = 31.18(6.47), control = 29.83(4.11) Ethnicity: intervention = 38.8% White, 40.8% Black, 6.1% Asian, 14.3% Other; control = 42.1% White, 37.9% Black, 2.1% Asian, 17.9% Other Time postpartum: 8-16 weeks postpartum Baseline activity status: Intervention mean MVPA: 57.68(28.22)min/week; Control mean MVPA: 18.10(17.58) Sample parity: not reported Concomitant health issue: BMI ≥25 at 26-weeks gestation	Participants were provided standard care plus lifestyle information leaflet with evidence-informed guidance on breastfeeding, diet, smoking cessation, reducing alcohol and managing sleep, and access to a commercial weight management programme (Slimming World) for 12 weekly sessions. Participants could choose which group they attended and when they started - infants could be brought with them. *Prescribed FITT of PA*: No information provided. Control: Participants received standard NHS maternity care to 6-8 weeks postpartum, including routine midwife, health visitor and general practitioner contacts.				Baseline to 12-months effect size: Cohen's d = .03, r = .02 No evidence of differences, p-values not provided.	55.86(58.27), 12-months = 48.43(36.83) Baseline to 12-months effect size: Cohen's d = -1.30, r = -.55 No evidence of differences, p-values not provided. Total PA (volume; min/day): Intervention, mean(SD) : Baseline = 512.57(210.01), 6-months = 393.11(189.19), 12-months = 542.64(381.87) Control, mean(SD) : Baseline = 239.23(159.05), 6-months = 464.01(388.57), 12-months = 577.19(357.65) Baseline to 12-months effect size: Cohen's d = -1.65, r = -.64 No evidence of differences, p-values not provided. Walking (volume; min/day): Intervention, mean(SD) : Baseline = 59.26(49.56), 6-months = 60.13(48.66), 12-months = 59.41(47.72) Control, mean(SD) : Baseline = 58.70(50.21), 6-months = 70.08(52.67), 12-months = 66.76(52.25) Baseline to 12-months effect size: Cohen's d = -1.10, r = -.48 No evidence of differences, p-values not provided.		

(Burkart et al., 2020)	USA	Total n = 204; lifestyle intervention = 100, health & wellness intervention = 104 *M*age (years) = 27.7(5.7) years; lifestyle intervention = 7% (16-19), 18% (20-24), 39% (25-29), 25% (30-34), 11% (35-45) *M*BMI (kg/m^2) = 31.0(7.7); lifestyle intervention = 2% <18.5, 23% 18.5-<25, 26% 25-<30, 49%>=30; health & wellness intervention = 22% 18.5-<25, 36% 25-<30, 39%>=30 Time postpartum: Introductory phase: 29 weeks gestation; Active phase 6 weeks and 6 months postpartum; Maintenance phase: 6 months and 1 year postpartum Baseline activity status: The majority of women in the sample were not active - 36.6% of the lifestyle intervention and 31.7% Health and Wellness Group met the ACOG guidelines for exercise in pregnancy	**Randomized controlled trial** Duration: 12-months Time of assessments: baseline, 6-weeks postpartum, 6-months postpartum, 1-year postpartum Lifestyle intervention: Introductory phase (29-weeks gestation to the time of birth). During this phase, participants were encouraged to shift from pre-contemplation for physical activity to contemplation and preparation for the postpartum activity intervention phase. Active phase (6-weeks postpartum to 6-months postpartum). The goal of this phase was to achieve ACOG guidelines for postpartum physical activity. They could choose activities they felt were safe, enjoyable, and easy to incorporate into daily lives. They were given pedometers and activity logs to help track weekly physical activity. Maintenance phase (6 months to 1 year postpartum). Introductory phase and active phase were in person session followed by biweekly and monthly telephone booster calls and mailings. Tailoring questionnaires administered at 6 weeks, 6 months and one year postpartum - used to inform culturally tailored and motivational and individually tailored feedback.	Social cognitive theory and transtheoretical model BCTs: N/A	*Self-Report:* The Pregnancy Physical Activity Questionnaire - used to measure pregnancy and postpartum PA. PPAQ is a semi-quantitative instrument. The number of minutes spent in each reported activity was multiplied by its metabolic equivalent of task (MET) level and summed to arrive at an estimate of average weekly MET hours/week	*Self-efficacy (Beliefs about Capabilities):* 5-item scale Self efficacy for physical activity questionnaire	*Self-efficacy:* From 6-weeks to 6-months postpartum, the intervention group had a significantly improved mean change in t-score = 2.57, p = .04 while the control group had a non-significant decrease (mean change in t-score = -.96, p = .38). There was no greater improvement in the intervention group compared to the control group (p = .31). Baseline to 12-months effect size: No summary data to calculate effect size	*Self-report:* MVPA (volume; MET hours/week) Difference in LS means = -17.66, 95% CI = -42.76, 7.43, SE = 12.70, p-value = .17 Baseline to 12-months effect size: Cohen's d = .05, r = .03 Total PA (volume; MET hours/week) Difference in LS means = -18.85, 95% CI = -56.91, 19.22, SE = 19.26, p-value = .33 Baseline to 12-months effect size: Cohen's d = -.01, r = -.01 Light PA (volume; MET hours/week) Difference in LS means = -5.60, 95% CI = -26.49, 15.38, SE = 10.62, p-value = .60 Baseline to 12-months effect size: Cohen's d = -.02, r = -.01	N/A	5/13 (High)

		Sample parity: Lifestyle intervention: 0 = 31.0%, 2 to 3 = 54.0%, 3 or more = 15.0% Health & Wellness Intervention: 0 = 22.1%, 2 to 3 = 59.6%, 3 or more = 18.3% Concomitant health issue: Type 2 diabetes - elevated risk for developing type 2 diabetes (>135mg/dL) on GDM screen	Health and wellness intervention: served as the comparison group and received the same number of in-person sessions, telephone calls, and mailings at the same time points as the lifestyle intervention group. Content included general information available to the public from the American academy of pediatrics. *Prescribed FITT of PA*: Recommended to achieve ACOG guidelines of 150-minutes of MVPA per week. They could choose activities they felt were safe, enjoyable, and easy to incorporate into daily lives.							
(Cramp & Brawley, 2006)	Canada	Total n = 57; GMCB = 26, SE = 31 *M*age (years): GMCB = 31.23, SE = 31.74 Time postpartum: 6-52 weeks postnatal Baseline activity status: Sedentary (less than a daily accumulation of mild to moderate physical activity two or fewer days per week) for the past six months Sample parity: GMCB = 1.62 children, SE = 1.58 children	**Randomized controlled trial** Duration: 8-weeks Time of assessments : baseline, post-4-week intensive phase, post-4-week home-based phase Intervention: *GMCB = group-mediated cognitive behaviour training Phase 1: 4-week supervised centre-based intensive exercise training phase (2x/week). Pre-choreographed fitness class. Participants also self-monitored PA by recording type, duration and intensity of daily PA into logbook. GMCB: 6x 20 min GMCB training sessions immediately following exercise. Focused on developing	Social cognitive theory and group dynamics BCTs: N/A	*Self-Report:* 7-day Physical Activity Recall (PAR) questionnaire was utilized to assess self-reported PA - participants were asked to recall specific activities and estimate the mean frequency and minutes spent doing PA per week (over 4 weeks).	*Outcome expectations (Beliefs about Consequences):* Measured using an outcome expectancy measure (Rodgers & Brawley, 1991) with examples of weight control, increased fitness, energy, alleviation of bodily pain. 9-point Likert scale (1 = very unlikely, 9 = vert likely) *Self-efficacy (Beliefs about Capabilities):* Barrier efficacy = 17 item modified version of Garcia and King's barrier efficacy scale -	*Barrier efficacy:* change in mean barrier efficacy = significant treatment effect, F(1,53) = 10.59, p < .05 (eta square = .17). 2. SE condition experienced a decline in barrier efficacy from baseline to post intensive assessment. 3. GMCB condition experienced a small increase in barrier efficacy GMCB mean(SD): Baseline = 6.03(1.20), 4-weeks = 6.18(1.49) SE mean(SD): Baseline = 5.47(5.36), 4-weeks = 5.36(1.28) Baseline to 4-weeks: Cohen's d = .07, r = .04 *Outcome expectations:* Mean total proximal physical outcome expectations = significant	*Self-report:* MVPA (volume; min/week) Intervention, mean(SD): baseline = 126.34(152.56), 4-weeks = 444.15(218.54), 8-weeks = 400.38(288.64) Control, mean(SD): baseline = 125.32(131.25), 4-weeks = 279.67(147.50), 8-weeks = 222.24(177.37) Baseline to 8-weeks: Cohen's d = 1.24, r = .53 There was a significant treatment effect for mean total volume of MVPA (F(1,52) = 8.36, p < .01, eta squared = .14	N/A	8/13 (High)

		Concomitant health issue: N/A	self-regulatory skills for self-management of PA. Included topics: brainstorming realistic expectations, learning how to self-monitor daily activity, setting goals, scheduling PA, goal setting, backup PA plan. Activity assignments from GMCB sessions. Total contact time for GMCB: 55 min exercise + 20 min GMCB) = 75 min. Phase 2: 4 week home-based phase *Prescribed FITT of PA:* During Phase 1, twice a week for 4-weeks supervised fitness class which included warm up, cardiovascular (aerobic) and strength training, and a cool down/flexibility. They were encouraged to exercise with moderate to vigorous-intensity outside of the classes as well. (frequency, time, type not provided for outside activity). During Phase 2, participants were encouraged to continue performing moderate to vigorous-intensity exercise either the ones that they had learned in the classes or the ones they liked (frequency and time not provided). Control: *SE = standard exercise training / usual care Same 2 phases, with same pre-choreographed fitness classes with same instructors. Total contact time for SE: 75 min exercise training			address barriers and confidence. Six new items in the modified scale addressed barriers specific to postnatal women. Efficacy scale ranged from 0 to 100%, increasing in 10 pt increments. 0 = absolutely not confident, 100 = absolutely confident.	treatment effect, $F(1.56) = 11.32$, $p<0.01$ (eta squared = 0.17). 2. GMCB = significantly greater changes in proximal outcome expectations vs SE participants. GMCB mean(SD): Baseline = 7.36(.99), 4-weeks = 7.57(.71) SE mean(SD): Baseline = 7.16(1.24), 4-weeks = 6.56(1.45) Baseline to 4-weeks: Cohen's d = .72, r = .34			

(Cramp & Brawley, 2009)	Canada	SAA	SAA	SAA	SAA	*Outcome expectancies (Beliefs about Consequences):* 1. psychological outcome expectations (OEs): 4-item measure, using a 9-point Likert response scale 2. intervention-specific OE: researcher developed, also using 9-point Likert response scale *Behavioural regulation:* Self-regulatory efficacy: 2 scales used - scheduling efficacy and planning efficacy	*Psychological proximal outcome expectancy:* Significant treatment effect for proximal psychological OEs, F(1,54)=7.83, p < .01 (eta squared = .13) during intensive phase. No change for GMCB group expectations of likelihood of achieving proximal outcomes, while those of SE group decreased. GMCB, n = 26, mean(SE): Baseline = 7.51(.17), SD~.87; 4-weeks = 7.64(.17) SE, n = 31, mean(SE): Baseline = 7.49(.20), SD~1.11; 4-weeks = 6.99(.17) (p < .02) Baseline to 4-weeks effect size: Cohen's d = .63, r = .30 Intervention outcome expectancies: Significant treatment effect for intervention OEs, F(1,54) = 12.57, p <.01 (eta squared = .19). GMCB participants increased OEs for specific self-regulatory skill outcomes targeted by the intervention while SE participant scores declined. GMCB, n = 26, mean(SE): Baseline = 7.19(.25), SD~1.27; 4-weeks = 7.46(.21) SE, n = 31, mean(SE): Baseline = 7.17(.20), SD~1.11; 4-weeks = 6.43(.19) (p < .02) Baseline to 4-weeks effect size: Cohen's d = .85, r = .39 *Self-regulatory efficacy:*	*SAA*	Post-intensive (4-weeks) SRE and psychological OEs were tested as mediators between the intervention condition and post-home based physical activity (in the 8-weeks) SRE was found to partially mediate the relationship between intervention condition and post home-based phase PAR. Intervention condition predicted post home-based phase physical activity with 7.8% variance (R2 adjusted = .078, β = .307, p < .05) (Path C = .307) When SRE was controlled for, intervention condition only accounted for 3.4% (R2delta = .034, B = .193). (Path C' = .193) Sobel test indicated that SRE was a significant mediator, influencing the intervention condition on physical activity (z = 2.90, p < .05)	8/13 (High)

							Significant treatment effect for SRE $F(1,54) = 6.31$, $p = .015$ (eta squared = .10). Mean SRE in GMCB group was stable while mean SRE in SE group declined during intensive phase. GMCB, n = 26, mean(SE): Baseline = 7.34(.24), SD~1.23; 4-weeks = 7.13(.26) SE, n = 31, mean(SE): Baseline = 7.13(.30), SD~1.67; 4-weeks = 6.25(.24) ($p < .02$) Baseline to 4-weeks effect size: Cohen's d = .46, r = .22			
(Daley et al., 2015)	UK	Total n = 94; exercise = 47, usual care = 47 *M*Age (years): exercise = 31.7(5.3), usual care = 29.3(5.7) Ethnicity: exercise = 57% white, 6% mixed, 6% Indian, 15% Pakistani, 2% Bangladeshi, 4% Black-African, 0% Black-Caribbean, 2% Chinese, 6% other; usual care = 68% white, 4% mixed, 6% Indian, 11% Pakistani, 0% Bangladeshi, 2% Black-African, 2% Black-Caribbean, 0% Chinese, 6% other Time postpartum: 6-months	**Randomized controlled trial** Duration: 6-months Time of assessments: baseline, 6-months, 12-months Intervention: 2 x 1:1 personalized exercise consultations (months 1 and 2; 40-60 min each), telephone calls (months 3 and 4; 15-20 min each). Leaflets are mailed out from months 3-6 (4 total) - to encourage and prompt participation in exercise. First consultation focused on exercise uptake, motivation, self-efficacy, overcoming barriers and goal setting. Pedometer given for motivation. Walk and talk incorporated to assess perceived exertion monitoring and exercise safety. Includes discussion of local opportunities/groups. Second consultation focused on preventing relapse to sedentary lifestyle and	N/A BCTs: N/A	*Self-report:* IPAQ *Device-measured:* Actiheart device	*Depression (Emotions):* EPDS *Social support (Social Influences):* social support and exercise (scores for with family participation, family rewards, friends participation components) *Self-efficacy (Beliefs about Capabilities):* Exercise confidence (scores for sticking to it and making time for it)	*Depression:* Exercise: Baseline =17.3(3.0), 6-months = 12.51(5.46), 12-months = 12.02(5.29) Usual care: Baseline = 17.5(3.7), 6-months = 14.67(4.86), 12-months = 12.55(5.17) Baseline to 12-months effect size: Cohen's d = -.68, r = -.32 12-month mean diff (95% CI)**: -1.39(-3.69 to .92), $p = .24$ *Social support:* Family participation, mean(SD): Exercise: Baseline = 15.1(6.5), 6-months = 16.87(7.44), 12-months = 16.88(7.87) Usual care: Baseline = 14.9(5.4), 6-months = 15.48(6.54), 12-months = 18.67(9.53) Baseline to 12-months effect size: Cohen's d = -.33, r = -.16	*Self-report:* Unable to calculate effect sizes with data provided MPA (volume; MET-min/week) Exercise, median(IQR): 6-months = 0(-120 to 360), 12-months = 0(-280 to 0) Usual care, median(IQR): 6-months = 0(0 to 480), 12-months = 0(0 to 160) 12-months difference in adjusted medians (95% CI) = 0(-95 to 95); $p = .99$ No statistically significant changes VPA (volume; MET-min/week) Exercise, median(IQR): 6-months = 0(0 to 640), 12-months = 0(0 to 480) Usual care, median(IQR): 6-months = 0(0 to 720), 12-months = 0(0 to 0)	N/A	5/13 (High)

		Baseline activity status: Sedentary (<150 min of moderate intensity PA per week in previous 7 d) Sample parity: Exercise = 2.2(1.2) Usual care = 2.2(1.4) Concomitant health issue: Had ICD-10 diagnosis of a major depressive episode (or mixed anxiety/depression diagnosis)	maintenance of active lifestyle. Telephone calls focus on the same as 2nd consultation. *Prescribed FITT of PA*: Over 12-weeks, they were encouraged to progress to 30-min of moderate intensity exercise 3 days per week. During weeks 13-24 they were encouraged to progress to 30-min moderate intensity exercise 3-5days per week. No information on type but participants were provided a pedometer. Control: "Looking after yourself" leaflet at baseline and exercise is not further encouraged beyond this single leaflet. Participants are offered exercise consultations at the end of their involvement in the study.				12-month mean diff (95% CI)**: -.88(-4.30 to 2.54) p = .62 Family rewards and punishment, mean(SD): Exercise: Baseline = 3.4(1.2), 6-months = 3.60(1.68), 12-months = 3.46(1.47) Usual care: Baseline = 3.2(.8), 6-months = 3.55(1.30), 12-months = 4.03(1.65) Baseline to 12-months effect size: Cohen's d = -.76, r = -.36 12-month mean diff (95% CI)**: -.42(-.96 to .11) p = .12 Friends participation, mean(SD): Exercise: Baseline = 13.0(5.6), 6-months = 16.57(9.08), 12-months = 14.55(and 7.13) Usual care: Baseline = 12.8(4.3), 6-months = 14.75(8.11), 12-months = 16.73(8.36) Baseline to 12-months effect size: Cohen's d = -.48, r = -.23 12-month mean diff (95% CI)**: -2.30(-5.15 to .55) p = .11 *Self-efficacy:* All differences were non-significant Sticking to it: Exercise: Baseline = 20.9(5.9), 6-months = 22.09(7.93), 12-months = 23.29(8.54)	12-months difference in adjusted medians (95% CI) = 0(-561 to 561); p = .99 No statistically significant changes Total PA (volume; MET-min/week) Exercise, median(IQR): 6-months = 24(-460 to 594), 12-months = -33(-306 to 594) Usual care, median(IQR): 6-months = 655(66.5 to 1656), 12-months = 132(-247 to 777) 12-months difference in adjusted medians (95% CI) = -151(-656 to 354); p = .55 Walking (volume; MET-min/week) Exercise, median(IQR): 6-months = 0(-412.5 to 445.5), 12-months = -66(-297 to 297) Usual care, median(IQR): 6-months = 0(-379.5 to 594), 12-months = 0(-330 to 396) 12-months difference in adjusted medians (95% CI) = -246(-557 to 65); p = .12 *Device-measured:* 8 participants (8.5%) wore the Actiheart and provided usable data at 6- and 12-months. Data not reported since they don't provide reliable information.		

							Usual care: Baseline = 19.7(4.8), 6-months = 20.22(6.89), 12-months = 22.03(8.24) Baseline to 12-months effect size: Cohen's d = .01, r = .01 12-month mean diff (95% CI)**: 2.03(-2.52 to 6.57) p = .38 Making time for it: Exercise: Baseline = 13.0(3.4), 6-months = 12.21(4.26), 12-months = 12.81(3.79) Usual care: Baseline = 11.8(2.8), 6-months = 11.07(3.38), 12-months = 12.15(4.35) Baseline to 12-months effect size: Cohen's d = -.17, r = -.09 12-month mean diff (95% CI)** = 1.32(-1.03, 3.68), p = .27			
(Daley et al., 2020)	UK	Total n = 28; intervention = 16, usual care = 12 *M*Age (years): Total = 32.1(5.7), intervention = 32.9(6.1), usual care = 31.0(5.3) Ethnicity: Total = 46% white, 11% Pakistani, 11% Other Asian, 3% Black Caribbean, 11% Black African, 18% Other; intervention = 31% white, 19% Pakistani, 19% Other Asian, 0% Black Caribbean, 6% Black African, 25% Other; usual care = 67%	**Randomized controlled cluster feasibility trial** Duration: 6-months Times of assessment: baseline, 3-months Intervention: After baseline home visit, intervention delivered during child immunization appointments (months 2, 3, 4). Intervention involved nurses encouraging patients to make healthier lifestyle choices through self-monitoring weight and POWeR (online weight management programme) for support. Participants weighed themselves weekly and recorded in	N/A BCTs: N/A	*Self-report:* PPAQ (Pregnancy PA questionnaire) - highly skewed so used median scores with interquartile ranges. Unadjusted differences between the medians in each group reported with 95% CI. No p values presented.	*Depression (Emotions):* HADS Depression. *Anxiety (Emotions):* HADS Anxiety.	*Depression:* Intervention group had higher depression scores (adjusted mean difference = 0.5 [95% CI: -1.9,2.9]) Intervention, mean(SD): baseline = 5.9(4.9), 3-months = 6.3(4.0) Usual care, mean(SD): baseline = 5.0(3.0), 3-months = 5.5(2.5) Baseline to 3-months effect size: Cohen's d = -.02, r = -.01 *Anxiety:* Intervention group had significantly higher anxiety scores (adjusted mean difference = 3.7, [95% CI: 0.6,6.4]).	*Self-report:* Unable to calculate effect size due to inadequate data. *LPA (volume; MET hours/week)* Baseline, median [IQR]: Intervention = 119.2[87.7, 154.9], Usual Care = 154.9[135.5, 166.1] 3-months, median [IQR]: Intervention = 110.8[81.2, 178.0], Usual Care = 130.4[107.8, 183.9] Intervention group had less light intensity PA (difference -19.6 MET hrs/week: [95% CI: -84.9, 45.7]) at follow up *MPA (volume; MET hours/week)Baseline,* median [IQR]: Intervention = 116.4[58.5,	N/A	4/13 (Low)

		white, 0% Pakistani, 0% Other Asian, 8% Black Caribbean, 17% Black African, 8% Other *M*BMI (kg/m^2): Total = 31.8(6.9), Intervention = 31.6(6.1), Usual care = 32.1(8.0) Time postpartum: at least 4 weeks postpartum when received invitation letter. Baseline home visits at 6-7 weeks postnatal (before 1st child immunization visit at month 2) Baseline activity status: Moderate-intensity, median [IQR]: Intervention = 116.4[58.5, 168.6], usual care = 0[0,0] Vigorous intensity, median [IQR]: intervention = 0 [0, 5.8], usual care = 0 [0,0] Sample parity: 43% had given birth to 2 children.	a card attached to child's health record. Nurses provided encouragement and external accountability but no counselling on diet/PA. POWeR (Positive Online Weight Reduction) programme for self-guided weight loss support, goal setting, action planning, implementation, diet plan, encouraged to increase PA levels. Programme focused on active cognitive and behavioral self-regulation techniques, and personalized advice/feedback/encouragement. *Prescribed FITT of PA:* No information of than they were encouraged to increase their physical activity levels. Control: Usual care group received brief written information about healthy lifestyles at baseline home visit.				Intervention, mean(SD): baseline = 6.1(3.8), 3-months = 8.4(4.1) Usual care, mean(SD): baseline = 6.3(3.7), 3-months = 5.2(3.6) Baseline to 3-months effect size: Cohen's d = .91, r = .41	168.6], Usual care = 141.5[70.8, 188.7] 3-months, median [IQR]: Intervention = 150.8[82.3, 199.4], usual care = 128.5[56.5,167.0] Intervention group: higher moderate intensity PA at follow up (difference = 22.3 MET hrs/week: [95% CI: -71.4,116.0]) *VPA (volume; MET hours/week)* Vigorous-intensity, median [IQR]: Baseline, median [IQR]: Intervention = 0[0,5.8], Usual care = 0[0,0] 3-months, median [IQR]: intervention = 1.6[0,9.8], usual care = 3.3[0, 7.5] Intervention group had less vigorous intensity PA (difference = -1.6 MET hrs/week: [95% CI: 8.2, 4.9] than usual care at follow up		

		# children given birth to: Total = 25% 1, 433% 2, 32% ≥3
		Intervention = 37% 1, 44% 2, 19% ≥3, Usual care = 8% 1, 42% 2, 50% ≥3
		
		Concomitant health issue:
		Overweight/obese
		Inclusion criteria included BMI ≥25kg/m^2								

(Daley et al., 2008)	UK	Total n = 38; exercise group n = 20, usual care n = 18. Age (years): exercise = 55.5% (21-30), 44.5% (31-40), 0% >40; usual care = 50.0% (21-30), 45.0% (31-40), 5.0% >40 BMI (kg/m^2): exercise = 61.1% under/normal weight (<=25), 22.2% overweight (>25 to >=30), 5.6% obese (>30 to <=40); usual care = 50.0% under/normal weight (<=25), 35.0% overweight (>25 to >=30), 15.0% obese (>30 to <=40)	**Randomized feasibility trial** Duration: 12-weeks Time of assessments: baseline, 12-weeks Intervention: 2x 1:1 exercise consultations over 12 weeks. Consultations lasted 1 hr. First consult focused on uptake of exercise, motivation, self-efficacy, overcoming barriers, developing appropriate goals. Given pedometer. Short walk and talk during consultation. 4 weeks later, Second consultation: prevention of relapse back to sedentary behavior. Follow up support calls (10min) during weeks 3 and 9. *Prescribed FITT of PA*: Moderate-intensity activities for at least 30-mins per day, 5 days per week.	N/A BCTs: N/A	*Self-report:* Godin Leisure Exercise Questionnaire Measured participation in mild, moderate, vigorous intensity exercise	*Self-efficacy (Beliefs about Capabilities):* Self-efficacy for exercise questionnaire. Asked participants' confidence in exercising in different situations such as when tired, in a bad mood, when lacking time. *Depression (Emotions):* EPDS	*Self-efficacy:* Significantly higher adjusted mean self-efficacy for exercise scores vs. usual care (p = .002). Usual care, mean(SD): Baseline = 11.3(3.8), 12-weekss = 9.5(3.1) Exercise, mean(SD): Baseline = 10.5(3.2), 12-weeks = 13.6(3.2) Mean difference (95% CI) = 4.1(1.6 to 6.4) significant Baseline to 12-weeks effect size: Cohen's d = 1.39, r = .57 *Depression:* No difference for EPDS scores. Usual care, mean(SD): Baseline = 19.2(4.7), 12-weeks = 14.3(5.4) Exercise, mean(SD): Baseline = 17.7(5.2), 12-weeks = 13.1(5.2) Mean difference(95% CI) = 1.2(-5.2 to 2.8) nonsignificant Baseline to 12-weeks effect size: Cohen's d = .06, r = .03	*Self-report:* MPA (frequency, times/week) Usual care, mean(SD): Baseline = 0.8(1.4), 12-weeks = 1.8(3.0) Exercise, mean(SD): Baseline = 1.8(2.9), 12-weeks = 3.4(3.2) Mean difference(95% CI) = 1.6(-.8 to 4.0) nonsignificant Baseline to 12-weeks effect size: Cohen's d = .26, r = .13 LPA (frequency, times/week) Usual care, mean(SD): Baseline = 2.3(2.0), 12-weeks = 2.4(1.9) Exercise, mean(SD): Baseline = 1.9(1.4), 12-weeks = 3.1(2.0) Mean difference(95% CI) = .7(-.8 to 2.3) Baseline to 12-weeks effect size: Cohen's d = .64, r = .31 VPA (frequency, times/week) Usual care, mean(SD): Baseline = .6(1.0), 12-weeks = .7(1.2)	N/A	7/13 (High)

		Ethnicity: exercise = 66.6% white, usual care = 80% white Time postpartum: < 12-months postpartum Baseline activity status: Sedentary (excluded women who were already active = exercise 3+ times per week for at least 30 mins / session, for more than 3 months) Sample parity: 1-2 children 66.6% usual care and 80% exercise group. 3-4 children 33.3% usual care and 20% exercise group. Concomitant health issue: Depression based on clinical judgement by GP, psychiatrists, health visitors or self-referral with >12 on EPDS	Participants were encouraged walk in the form of "pram pushing" and they also discussed opportunities for exercising without the baby. Control: Asked not to change their current exercise patterns. Offered an exercise consultation at the end of their involvement in the study.					Exercise, mean(SD): Baseline = .3(.8), 12-weeks = .6(1.2) Mean difference(95% CI) = .06(-.9 to .7) Baseline to 12-weeks effect size: Cohen's d = .22, r = .11		
(deRosset et al., 2013)	USA	Total n = 24; intervention n = 13, control n = 11 *M*Age (years): Total = 29.3(4.8) *M*BMI (kg/m²): intervention = 33.3(5.03), control = 28.4(2.97)	**Randomized feasibility trial** Duration: 12-weeks Time of assessments: baseline, 3-months Participants received 12 x 60min weekly group classes (in Spanish) on nutrition and exercise education	N/A BCTs: N/A	*Self-report:* Health Promoting Lifestyle Profile II was used and it has a subscale for exercise. 4-point Likert scale (1 = never, 2 = sometimes, 3 = often, 4 = routinely)	*Exercise Self-Efficacy (Beliefs about Capabilities):* Exercise Self-Efficacy scale (Bandura, 1997) measured efficacy beliefs for exercising. 18-questions on a 100-point scale from 0 =	*Exercise Self-Efficacy:* Intervention, mean(SD): Baseline = 57.7(14.04), 3-months = 62.6(21.87) Control, mean(SD): Baseline = 51.3(15.54), 3-months = 51.4(22.53) Cohen's d = .53, p = .35	*Self-report:* Total PA Intervention, mean(SD): Baseline = .5(.27), 3-months = .9(.49) Control, mean(SD): Baseline = .5(.49), 3-months = .7(.59) Cohen's d = .32, p = .45 Baseline to 3-months effect size: Cohen's d = .51, r = .25	N/A	6/13 (High)

		Ethnicity: Self-identified as Hispanic Time postpartum: 6-weeks Baseline activity status: Intervention, mean(SD): .5(.27); Control, mean(SD): .5(.49); these scores indicate on average never exercising Sample parity: N/A Concomitant health issue: Overweight or obese (self-report of height and weight) prior to current pregnancy	and coping skills. They were encouraged to develop walking groups on their own. Classes 1-5 focused on nutrition and exercise Classes 6-11 focused on coping skills Class 12 was a review of previous classes and time for questions. At the end of each class, participants were asked to set a nutrition or exercise goal for the coming week. They received phone call reminders of the classes. Childcare, a light healthy snack, and transportation vouchers were available. Attendance was taken. *Prescribed FITT of PA:* They were encouraged to walk daily with infants in a stroller, starting at 30-min and working up to 60-min per day. No information about intensity. Control: Participants received usual medical care and were offered the intervention upon completion.			cannot do at all, 50 = moderately certain can do, 100 = certain can do. Scores are added and divided by 18 for a total score. Higher scores indicate higher self-efficacy. *Stress (Emotions):* A subscale of the Health Promoting Lifestyle Profile II	Baseline to 3-months effect size: Cohen's d = .32, r = .16 *Stress:* Intervention, mean(SD): Baseline = .8(.39), 3-months = 1.3(.48) Control, mean(SD): Baseline = 1.2(.44), 3-months = 1.2(.35) Cohen's d = .21, p = .70 Baseline to 3-months effect size: Cohen's d = 1.20, r = .51			
(Fjeldsoe et al., 2013)	Australia	Total n = 88; intervention n = 45, control n = 43 *M*Age (years): Intervention = 28(6), control = 31(6)	**Randomized controlled trial** (secondary analysis) From Fjeldsoe et a. (2010): Duration: 12-weeks Times of assessment: baseline, 6-weeks, 13-weeks	Social cognitive theory BCTs: N/A	*Self-report:* Australian Women's Activity Survey (AWAS): walking for exercise frequency (days per week). Includes frequency/duration of sitting, light-intensity, brisk walking, moderate-intensity and vigorous-	*Self-efficacy (Beliefs about Capabilities):* Barrier self-efficacy: 5 point Likert scale (from 1 "not at all confident" to 5 "very confident"), using 12 item tool. 2 additional items for	Concurrent mediation is change in mediators and behavioural outcomes (Frequency of walking or MVPA in days per week) from baseline to 13-weeks. Longitudinal mediation is change in mediators from baseline to 6-weeks and changes in behavioural	*Self-report:* MVPA frequency, time and walking frequency, time all reported in Fjeldsoe et al. (2010) There was a significant time x group interaction effect for MVPA frequency (F(2,85) = 4.46,	Walking Frequency *Self-efficacy:* Path B, coefficient(SE): Concurrent = .26(.19) p > .05; Longitudinal = -.14(.25) p > .05	5/13 (High)

		*M*BMI (kg/m^2): Intervention = 27(5), Control = 27(6) Time postpartum: <12-months Baseline activity status: MVPA frequency (days/week), median (IQR): Intervention = 2(3), Control = 1(1) MVPA duration (min/week), median(IQR): Intervention = 120(220), Control = 60(150) Sample parity: One child only: Intervention = 53% Control = 32% Concomitant health issue: N/A	Intervention: Same PA pamphlet as control, plus 2 PA consultations with behavioral counselor (1 in person 20-30 mins, 1 telephone at 6 weeks 15-20 mins). During consultations: set goals for number of days per week for 30 min MVPA of their choice, received goal setting magnet (planning and self-monitoring), and instructed to nominate a social support person to help them reach their goals. Also received 42 personal SMS messages with behavioral and cognitive strategies for behavior change. 5 SMS each week for first 2 weeks, 4 SMS/week in the next 2 weeks, and 3 SMS/week for remaining 8 weeks of program. In addition to these, 11 goal check SMS sent each Monday (weeks 2-12), and based on answer, participants received a tailored response. The nominated social support person received 2 SMS/week for 12 weeks and was given suggestions on how to support the participants as well as updates on the participant's progress. *Prescribed FITT of PA:* Participants set individual goals for number of days per week for 30 min MVPA of their choice.		intensity activities across 5 activity domains (planned activity, employment, childcare, domestic responsibilities, transport) - Moderate to Vigorous PA (MVPA) frequency assessed from a single question: "how many days per week do you usually exercise for at least 30 mins?"	postnatal: I could exercise even when "I don't have anyone to look after the kids" and "I have housework to do". *Goal setting (Goals):* 5 point Likert scale, using 10 item Exercise Goal Setting Scale (EGS) *Outcome Expectancy (Beliefs about Consequences):* outcome likelihood (10 point scale), outcome value (9 point scale) for 7 physical activity outcomes *Social support (Social Influences):* Social support from partner and family/friends on 5 point Likert scale, using Social Support for Exercise Scale. Added "offered to mind the kids so I could be more physically active". *Perceived environmental opportunity for exercise (Environmental Context/Resources):*	outcomes from 6-weeks to 13-weeks. *MVPA Frequency:* *Self-efficacy:* Path A, coefficient(SE): Concurrent = .40(.20), p < .05; Longitudinal = .66(.19), p < .001 *Goal Setting Skills:* Path A, coefficient(SE): Concurrent = .45(.19), p < .05; Longitudinal = .61(.18), p < .001 *Outcome expectancy:* Path A, coefficient(SE): Concurrent = .03(.19), p > .05; Longitudinal = .07(.18), p > .05 *Social Support from MobileMums support person:* Path A, coefficient(SE): Concurrent = .42(.17), p < .05; Longitudinal = .30(.17), p > .05 *Perceived environmental opportunity for physical activity:* Path A, coefficient(SE): Concurrent = .14(.08), p > .05; Longitudinal = .01(.08), p > .05 *Walking Frequency:* *Self-efficacy:* Path A, coefficient(SE): Concurrent = .38(.19), p <.001; Longitudinal = .65(.19) p<.001 *Goal Setting Skills*	p = .04, partial n^2 = .05) but the effect was not significant for duration. There was a significant time x group interaction effect for walking frequency (F(2,85) = 5.38, p = .02, partial n^2 = .06) but the effect was not significant for duration. MVPA (frequency; days/week): Intervention, mean(SE): Baseline = 1.80(.22), SD~1.56; change to 13-weeks (adjusted for baseline values as covariates) = 1.82(.18), p-value (time) = .656, partial n^2 = .02 Control, mean(SE): Baseline = 1.70(.22), SD~1.44; change to 13-weeks (adjusted for baseline values as covariates) = .24(.18), p-value (group) = .001, partial n^2 = .36, p-value (group x time) = .038, partial n^2 = .05 Baseline to 13-weeks effect size: Cohen's d = 1.05, r = .47 Walking (frequency; days/week) Intervention, mean(SE): Baseline = 1.56(.28), SD~1.97; change to 13-weeks (adjusted for baseline values as covariates) = 1.08(.24) Control, mean(SE): Baseline = 1.12(.28), SD~1.85; change to 13-weeks (adjusted for baseline values as covariates) = .73(.25) Baseline to 13-weeks effect size: Cohen's d = .18, r = .09	Path AB, coefficient(95% CI): Concurrent = .10(-.07, .33); Longitudinal = -.09(-.41, .21) *Goal Setting Skills:* Path B, coefficient(SE): Concurrent = .20(.20) p >.05; Longitudinal = -.36(.27), p >.05 Path AB, coefficient(95% CI): Concurrent = .08(-.13, .29); Longitudinal = -.21(-.59, .11) *Outcome expectancy :* Path B, coefficient(SE): Concurrent = .45(.19), p < .05; Longitudinal = -.03(.26), p > .05 Path AB, coefficient(95% CI): Concurrent = .01(-.19, .20); Longitudinal = -.01(-.12, .15) *Social Support from MobileMums support person :* Path B, coefficient(SE): Concurrent = .28(.23), p > .05; Longitudinal = -.24(.28), p > .05 Path AB, coefficient(95% CI): Concurrent = .12(-.06, .33); Longitudinal = -.07(-.35, .11)	

			Control: One face-to-face consultation with behavioral counselor, 15 mins long. Given physical activity pamphlet, maps for local opportunities, and vouchers.			5 point Likert scale. Added 2 items: "There are footpaths wide enough to fit prams in my neighborhood" and "unattended dogs make it unsafe to walk in my neighborhood"	Path A, coefficient(SE): Concurrent = .42(.19), p <.001; Longitudinal = .59(.17), p < .001 *Outcome expectancy* *Path A, coefficient(SE): Concurrent = .02(.19), p >.05; Longitudinal = .06(.19), p >.05* *Social Support from MobileMums support person* Path A, coefficient(SE): Concurrent = .44(.17), p < .001; Longitudinal = .32(.17), p >.05 *Perceived environmental opportunity for physical activity* Path A, coefficient(SE): Concurrent = .14(.08), p >.05; Longitudinal = .01(.08), p > .05		*Perceived environmental opportunity for PA:* Path B, coefficient(SE): Concurrent = .03(.46), p > .05; Longitudinal = .62(.59), p > .05 Path AB, coefficient(95% CI): Concurrent = .01(-.24, .18); Longitudinal = -.01(-.15, .21) MVPA Frequency *Self-efficacy:* Path B, coefficient(SE): Concurrent = .36(.13), p < .05; Longitudinal = -.29(.17), p > .05 Path AB, coefficient(95% CI): Concurrent = .14(-.01, .35); Longitudinal = -.19(-.47, .03) *Goal Setting Skills:* Path B, coefficient(SE): Concurrent = .19(.14), p > .05; Longitudinal = -.22(.18), p > .05 Path AB, coefficient(95% CI): Concurrent = .09(-.05, .32); Longitudinal = -.14(-.44, .09) *Outcome expectancy :*	

									Path B, coefficient(SE): Concurrent = .46(.13), p < .001; Longitudinal = -.01(.17), p > .05 Path AB, coefficient(95% CI): Concurrent = .02(-.17, .2); Longitudinal = -.01(-.05, .08) *Social Support from MobileMums support person :* Path B, coefficient(SE): Concurrent = .25(.16), p > .05; Longitudinal = -.45(.18), p < .05 Path AB, coefficient(95% CI): Concurrent = .11(-.03, .26); Longitudinal = -.13(-.38, .01) *Perceived environmental opportunity for PA:* Path B, coefficient(SE): Concurrent = .01(.32), p > .05; Longitudinal = .58(.39), p > .05 Path AB, coefficient(95% CI): Concurrent = .01(-.14, .15); Longitudinal = -.01(-.15, .11)	
(C. Keller et al., 2014)	USA	Total n = 139; intervention n = 71, control n = 68 *M*Age (years)= 28.3(5.59)	**Randomized controlled trial** Duration: 12-weeks	N/A BCTs: N/A	*Self-report:* Self-report paper and pencil questionnaires (Stanford Brief Activity Survey (SBAS))	*Depression (Emotions):* EPDS *Social Support (Social Influences):*	*Depression:* Intervention, mean(SD): Baseline = 8.21(5.22), 6-months = 7.05(5.36), 12-months = 7.00(5.69)	*Device-measured (pedometers):* Aerobic Walking Time (volume; minutes/day): Control, mean(SD): Baseline = 3.59(6.27), 6-months =	N/A	8/13 (High)

		BMI (kg/m²) = 25-35 kg/m2 Ethnicity: All Latina Time postpartum: 6-weeks to 6-months Baseline activity status: habitually sedentary (<2.5 hrs of moderate-intensity PA a week), able to participate in moderate-intensity walking Sample parity: 20.1% women: 1st pregnancy, 79.9% reporting 2-6 live births Concomitant health issue: N/A	Time of assessments: baseline, 3-monhts, 6-months, 9-months, 12-months Intervention: 12-weeks intervention: weekly walking session. Each woman is required to walk with the Promotora (peer counselor/lay health educator) at least 1x/week, during which they set goals for steps/day and bouts/day and self-monitor their progress. Pedometer is used to record steps, number of bouts and minutes walked per day. Participants also received health newsletters and follow up phone calls. *Prescribed FITT of PA:* Participants encouraged to meet 30 min of brisk walking (moderate PA) per day, 5 days a week. They are required to walk once a week with a *Promotora* (peer counselor or lay health educator). Done over 12-weeks. Women are trained towards walking a 20-min mile. Control: Attention-control group: monthly newsletters with information about health issues that were not related to PA. weekly phone calls to answer questions about postpartum/newborn concerns		*Device-measured:* Accelerometers and pedometers	Social Support for Exercise (9-item self-report questionnaire adapted from the Social Support and Exercise Survey) General Social Support (19-item self-reported Medical Outcomes Study: Social Support Scale)	Control, mean(SD): Baseline = 8.69(4.71), 6-months = 7.80(5.05), 12-months = 6.98(4.29) Group x time effect, F(2, 137): p = .8361 Baseline to 12-months effect size: Cohen's d = -.05, r = -.03 *Social Support:* Social Support for Exercise: Intervention, mean(SD): Baseline = 1.75(.54), 6-months = 2.05(.51), 12-months = 1.72(.53) Control, mean(SD): Baseline = 1.73(.53), 6-months = 1.81(.55), 12-months = 1.83(.57) Group effect: F(1,137) = .4938, p = .0022 Group x time effect, F(2, 137): p = .0037 Baseline to 12-months effect size: Cohen's d = -.24, r = -.12 Overall Social Support: Intervention, mean(SD): Baseline = 3.87(.98), 6-months = 3.61(.99), 12-months = 3.73(.95) Control, mean(SD): Baseline = 3.95(.81), 6-months = 3.97(.86), 12-months = 4.06(.84) Group effect: F(1,137) = .0636, p = .4512 Group x time: F(2, 137): p = .2854 Baseline to 12-months effect size: Cohen's d = -.28, r = -.14	5.22(9.13), 12-months = 5.92(10.03) Intervention, mean(SD): Baseline = 4.15(7.75), 6-months = 19.52(14.97), 12-months = 12.72(13.19) Baseline to 6-months effect size: Cohen's d = 1.95, r = .70 Baseline to 12-months effect size: Cohen's d = .89, r = .41 Group x time effect: p <.0001 *Device-measured (accelerometer):* LPA (volume; minutes/day): Attention control, mean(SD): Baseline = 248.53 (53.76), 6-months = 255.99 (66.76), 12-months = 278.35 (76.52) Intervention, mean(SD): Baseline = 235.77 (47.18), 6-months = 241.75 (49.43), 12-months = 271.08 (79.14) Baseline to 6-months effect size: Cohen's d = -.03, r = -.02 Baseline to 12-months effect size: Cohen's d = .11, r = .06 Group x time effect: p = .9125 MPA (moderate walking activity; volume; minutes/day): Attention control, mean(SD): Baseline = 15.33 (12.28), 6-months = 20.62 (16.87), 12-months = 23.61 Intervention, mean(SD): Baseline = 17.67 (14.94), 6-months = 34.18 (24.62), 12-months = 38.97 (38.10)		

								Baseline to 6-months effect size: Cohen's d = .82, r = .38 Baseline to 12-months effect size: Cohen's d = .95, r = .43 Group x time effect: p = .0239 VPA (volume; minutes/day): Attention control, mean (SD): Baseline = 0.16 (0.64), 6-months = 0.66 (2.38), 12-months = 0.39 (1.33) Intervention, mean(SD): Baseline = 0.57 (1.95), 6-months = 1.01 (3.43), 12-months = 0.63 (1.71) Baseline to 6-months effect size: Cohen's d = -.04, r = -.02 Baseline to 12-months effect size: Cohen'		
(Kernot et al., 2019)	Australia	Total n = 120; MSIU = 41, Pedometer = 39, Control = 40 *M*Age (years): Total = 31.8(31.6 to 32.4), MSIU = 32.5(31.6 to 33.5), Pedometer = 32.4(31.1 to 33.7), Control = 30.7(29.2 to 32.2) Time postpartum: <12-months Baseline activity status: Accelerometer MVPA (volume; min/week) MSIU, mean(95% CI) = 147(109 to 185);	**3-arm Cluster Randomized Controlled Trial** Duration: 8-weeks Time of assessments: baseline, 6-weeks, 6-months MSIU (Mums Step It Up) condition: accessed MSIU Facebook App and given pedometer. 50 day walking challenge - encouraged to achieve half a million steps per person. Different tabs in app for information, log steps/time, team tally boards, achievements, compare groups etc. Provided daily tips and timed email reminders. Pedometer only (alternate condition): given a pedometer and	Theory of planned behaviour and fun theory BCTs: N/A	*Self-report:* Active Australia Survey (AAS) - recall PA over 7 d *Device-Measured:* Accelerometer-derived MVPA (walking time, total activity)	*Depression (Emotions):* EPDS	*Depression:* No group by time differences for depression MSIU, mean(95% CI): Baseline = 5.4 (4.4 to 6.4), SD~3.23; 6-weeks = 5.5 (4.2 to 6.8); 6-months = 4.1 (3.1 to 5.1) Control, mean(95% CI): Baseline = 4.8 (3.7 to 5.9), SD~3.59; 6-weeks = 3.8(2.9 to 4.7); 6-months = 3.9(3.0 to 4.8) Baseline to 6-months effect size: Cohen's d = -.12, r = -.06 *Group X time interaction, 6-months, F = .22, p = .80*	*Device-measured:* Accelerometer MVPA (volume; min/week) MSIU, mean(95% CI): Baseline = 147(109 to 185), SD ~122.75; 6-weeks = 189(158 to 221), 6-months = 173(142 to 204) Pedometer, mean(95% CI): Baseline = 195(142 to 248), 6-weeks = 220 (169 to 271), 6-months = 227(184 to 270) Control, mean(95% CI): Baseline = 137(102 to 173), SD~116.03 6-weeks = 150 (119 to 181), 6-months = 160(136 to 184) Baseline to 6-months effect size: Cohen's d = .03, r = .02 Condition by time interaction results showed that none of the differences in MVPA were statistically significant. (6-weeks:	N/A	5/13 (High)

		Pedometer, mean(95% CI) = 195(142 to 248); Control, mean(95% CI) = 137(102 to 173) Sample parity: 72.5% 1st child; 27.5% more than 1 child Concomitant health issue: N/A	printed logbook to record daily steps over 50 days. No team component. *Prescribed FITT of PA:* Participants were recommended 10,000 steps per day, leading up to 500,000 steps over 50 days. No information of intensity provided. Participants could also log time spent in other PA types other than steps. Control: Written Advice condition (through email): given advice on increase PA and placed on waiting list to join MSIU. No team component.					F =.21, p = .81; 6-months: F = .10, p = .91) There were no group by time differences in total PA (6-weeks: F = 1.71, p = .18; 6-months: F = .68, p = .51) Self-report: Walking (volume; min/week) MSIU, mean(95% CI): Baseline = 171(121 to 221), SD ~ 161.43; 6-weeks = 297(225 to 369), 6-months = 188(156 to 221) Control, mean(95% CI): Baseline = 186(127 to 245), SD ~ 192.7; 6-weeks = 235(165 to 305); 6-months = 192(139 to 245) Baseline to 6-months effect size: Cohen's d = .06, r = .03 Self-reported walking: no significant increases in time walking for all three conditions (time effect: F = 1.91, p = .15). Condition by time interaction results showed that none of the differences were statistically significant (6-weeks: F = .61, p = .55; 6-months: F = .15, p = .90) MVPA (volume; min/week) MSIU, mean(95% CI): Baseline = 299(202 to 396), SD~313.00; 6-weeks = 451(334 to 568); 6-months = 375(272 to 478) Control, mean(95% CI): Baseline = 336(219 to 453), SD~382.23; 6-weeks = 366(262 to 470); 6-months = 388(265 to 511)		

								Baseline to 6-months effect size: Cohen's d = .07, r = .04 There were no group by time differences in self-report MVPA (6-weeks: 1.71. p = .18; 6-months = .70, p = .51)		
(Kim et al., 2021)	Korea	Total n = 119; experimental group n = 57, control n = 62. Age (years): Total = 47.90% over 35, 52.10% below 35; experimental group = 45.61% over 35, 54.39% below 35; control group = 50.0% over 35, 50.0% below 35 Time postpartum: started from delivery (0 weeks postpartum) ; 12 week intervention Baseline activity status: Experimental = 2.61 +/- .80 Control = 2.56 +/-.68; these scores on average indicate between sometimes and often performing PA Sample parity: 67.2% primiparous	**Quasi-experimental study** Duration: 12-weeks Time of assessment: baseline, 13-weeks Intervention: Mobile virtual reality (VR) group: download and install program day before or day after delivery. Given supporting education content for mobile VR program. 12-week long program after childbirth. Assessed 1-week after intervention. Program included exercise routine, dietary recording; assigned a health trainer, clinical nutritionist, and medical staff. Exercise program included 123 types of exercises that ranged from light stretching to strength training and could be selected by participants. *Prescribed FITT of PA:* The program included 123 types of exercises ranging from light stretching to strength training. Unknown intensity, frequency, or time. Control:	N/A BCTs: N/A	*Self-report:* Health-promoting lifestyle profile (exercise dimension)	*Stress:* Parenting stress (23 items on 5 point scale). *Social support (Social Influences): Interpersonal relations was measured with nine questions on the Health-Promoting Lifestyle Profile. Score on a scale from 1 = Never (N), 2 = Sometimes (S), 3 = Often (O), 4 = Routinely (R)* *Emotion regulation (Behavioural Regulation):* Stress management was measured with eight questions on the Health-Promoting Lifestyle Profile. Score on a scale from 1 = Never (N), 2 = Sometimes (S), 3 = Often (O), 4 = Routinely (R)	*Stress:* No significant difference in the change of parenting stress from baseline between the experimental group (mean difference = .02, SD = .60) and control group (mean difference = .10, SD = .81), t-test = .71, p = .482 Baseline to 13-weeks effect size: Cohen's d = -.18, r = - .09 *Social support:* Significant difference in the change of interpersonal relationships from baseline between the experimental group (mean difference = 1.19, SD = .87) and control group (mean difference = .02, SD = .94), t-test = 7.19, p < .001 Baseline to 13-weeks effect size: Cohen's d = 1.46, r = .59 *Emotion regulation:* No significant difference in the change of stress management from baseline between the experimental group (mean difference = -.42, SD = .93) and control group (mean difference = -.12, SD = .95), t-test = -1.72. p = .088 Baseline to 13-weeks effect size: Cohen's d = -.46, r = -.22	*Self-report:* Total PA Experimental group: Mean difference 0.89(SD = 0.91); control group: mean difference 0.23 (SD = 0.91), t-test -3.84 (P<0.001). Baseline to 13-weeks effect size: Cohen's d = .89, r = .41	N/A	2/9 (Low)

		Concomitant health issue: N/A	Given written educational materials on GDM							
(LeCheminant et al., 2014)	USA	Total n = 60; RT group n = 30, FT group n = 30 *M*Age: RT group = 29.9(5.1); FT group = 25.9(4.4) *M*BMI: RT group = 26.1(3.7); FT group = 27.0(4.1) Ethnicity: 90% Caucasian, 8.3% Hispanic, 1.7% Asian Time postpartum: Between 6 weeks and 8 months postpartum RT group = 3.6(1.6) months postpartum FT group = 3.9(1.8) months postpartum Baseline activity status: Participants weren't engaging in RT two or more times per week within the last 6-months or participating in a weight-loss program. Sample parity: mean = 1.9(1.2) children (45% primiparous, 55% multiparous) Concomitant health issue: >2.27 kg above	**Randomized controlled trial** Duration: 4-months Time of assessments: baseline, 2-months, 4-months Intervention: Participants were provided a 4-month membership to a physical therapy clinic with resistance training equipment. They were prescribed a progressive resistance training protocol with nine exercises targeting upper body, lower body, and core. During the first session, they were supervised by a trained supervisor who helped them gauge the weight based on what they felt they could accomplish for 8-12 repetitions. They completed 1-3 sets per exercise with 90-s rest in between sets, 8-12 repetitions per set on two non-consecutive days per week. All sessions were supervised during the first month. During months 2-4, at least one session per week was supervised. Non-supervised sessions were verified with exercise record. *Prescribed FITT of PA:* Two days per week; Resistance training	N/A BCTs: N/A	*Device-measured:* Actigraph GT1M accelerometers were worn for 7 consecutive days and set at 60-s epochs. MVPA was the sum of moderate-intensity and vigorous-intensity time.	*Exercise Self-Efficacy (Beliefs about Capabilities):* Exercise self-efficacy was measured with a 5-item survey (Marcus et al., 1992). Items began with the stem, "I am confident I can participate in regular exercise when … ," and were followed by "I am tired," "I am in a bad mood," "I feel I don't have the time," "I am on vacation," or "it is raining or snowing." Choices included, "Does not apply to me" or a scale of 1–11, with 1 being "not at all confident" and 11 being "very confident" *Depression (Emotions):* Center for Epidemiological Studies Depression Scale (CES-D). A score of 16 or greater indicates depression.	*Device-measured:* MVPA (volume; min/day): RT group, mean(SD): Baseline = 15(11), 2-months = 17(12), 4-months = 18(13) FT group, mean(SD): Baseline = 15(11), 2-months = 19(11), 4-months = 16(13) Completers group x time interaction: F = 1.42, p = .241 Intention-to-treat group x time interaction: p = .236 Baseline to 4-months effect size: Cohen's d = .18, r = .09 Total PA (counts/day) RT group, mean(SD): Baseline = 215,908(48,222), 2-months = 238,113(64,120), 4-months = 252,172(82,975) FT groups, mean(SD): Baseline = 239,665(68,159), 2-months = 257,667(61,727), 4-months = 241,311(76,788) Completers group x time interaction: F = 3.53, p = .068 Intention-to-treat group x time interaction: p = .071 Baseline to 4-months effect size: Cohen's d = .57, r = .27 Light PA (volume; min/day)	*Exercise Self-Efficacy:* (mean, SD scores not provided) Completers group x time interaction: F = 5.33, p = .026 Intention-to-treat group x time interaction: F = 4.27, p = .045 The RT group exhibited better exercise self-efficacy than the FT group *Depression:* RT group: Baseline = 9.5(6.3), 4-months = 6.4(4.1) FT group: scores no provided Completers group x time interaction: F = 1.33, p = .255 Intention-to-treat group x time interaction: F = 2.81, p = .101 Unable to calculate effect sizes	N/A	6/13 (High)

		their self-reported pre-pregnancy weight	including 1-3 sets of 8-12 repetitions with 90-seconds rest. Control: Participants were provided instructions to perform a static stretching program. There were four stretches per major muscle group, holding 10-30seconds. None of the sessions were supervised but they were provided written descriptions of the stretches, they recorded their progress on a stretching record, and had the option to participate in a group stretching session once per week.				RT group, mean(SD): Baseline = 214(44), 2-months = 221(42), 4-months = 234(42) FT groups, mean(SD): Baseline = 234(55), 2-months = 250(45), 4-months = 242(46) Completers group x time interaction: F = 5.55, p = .023 Intention-to-treat group x time interaction: p = .042 Baseline to 4-months effect size: Cohen's d = .24, r = .12			
(Gilinsky, 2014; A. S. Lee et al., 2016)	Scotland	Total n = 65; intervention group n = 33, control group n = 32 *M*Age (years): intervention = 33.1 (SD = 4.1); control = 33.8 (SD = 5.4) *M*BMI: intervention = 27 (SD = 4.2); control = 25.5 (SD = 3.9) Time postpartum: 6-weeks to 1-year Baseline activity status: Participants were insufficiently active, defined in relation to their self-reported PA stage of change, which assessed their current	**Randomized controlled trial** Duration: 10-weeks Time of assessments: baseline, 3-months, 6-months Intervention: 10-week group pram walking program (once a week). Face-to-face consultation with health psychologist given at the start and end of the program. The consultations were informed primarily by the Transtheoretical model. Participants had a workbook to structure their activity plan (e.g., goal setting, planning, self-monitoring sheets). They also received a pedometer to monitor steps.	Transtheoretical model (mainly), theory of planned behaviour, social cognitive theory, health action process approach, relapse prevention theory BCTs: Provide information on benefits of behaviour in general Provide information on benefits of behaviour to the individual Self-re-evaluation Consciousness raising Environmental re-evaluation Goal setting (behaviour)	From Gilinsky et al. 2014: *Self-report:* The 7-Day PAR questionnaire was used to capture self-report physical activity from the previous week. *Device measured:* Participants wore a GT3X/GT3X+ accelerometer during waking hours (excluding bathing and swimming) for seven consecutive days. Participants' data at each measurement point was taken provided they had at least 4 days of monitoring, regardless of whether that included a weekend day.	*From Gilinsky et al.:* *Intentions* Intentions: Intentions were measured with one item: "During the next three months do you intend to be regularly physically activity?" 7-point Likert scale *Outcome expectancies (Beliefs about Consequences):* Outcome expectancies were measured using an adapted version of the decisional balance scale (Marcus et al., 1992). Physical, social and self-evaluative domains were assessed	*Device-measured (Accelerometry):* MVPA (volume; min/day) There was no significant change in MVPA minutes/day in the intervention group (median=-0.70, IQR -9.86, 8.36) or the control group (median=1.65, IQR -4.79, 8.21). There were no statistically significant between-groups differences from baseline and 3-months (U(65)=585, p=0.43; r=0.10) using the full dataset or the per protocol analysis (U(52)=383.50, p=0.23). From 3- to 6-months were no change in MVPA minutes/day in the intervention groups (median=0, IQR -1.13, 1.10) or among controls (median=0, IQR -9.86, 8.23). There were no differences between the groups using the full dataset (U (65) =504, p=0.75, r=0.09) or the	*Unable to calculate effect sizes because SDs not provided, only IQR* *Outcome expectancies:* There were no significant between-groups difference in change (U(65) = 474.00, p = 0.48, r = -0.09). There was a decrease in outcome expectancies between 3-6 months in the intervention group and small increase in controls. This between groups difference was significant with a small effect size (U(65) = 688.50, p = 0.03, r = 0.26). Baseline to 3-months effect size: U(65) = 474.00, p = .48, r = -.09 3-months to 6-months effect size: U(65) = 688.50, p = .03, r = .26 *Intentions:*	N/A	4/13 (Low)

		PA in relation to PA guidelines. Sample parity: Median # children (range): intervention = 1(1-4), control = 1(1-5) Concomitant health issue: N/A	*Prescribed FITT of PA:* Group walks once a week of moderate-intensity (e.g., brisk pace) between 30-55 minutes per session. Both groups provided information on PA guidelines from Scotland (unknown what specific FIT included in those guidelines). Suitable types of activities were brisk walking and swimming. Control: Received a leaflet "Active Living during and after Pregnancy" which is an NHS Health Scotland publication with information on physical activity guidelines and advice on implementation	Self-liberation Provide information on opportunities for where and when to perform the behaviour Plan social support for changes Environmental restructuring Social liberation Helping relationships Provide instruction on how to perform the behaviour Model/demonstrate the behaviour Set graded tasks Action planning Teach to use prompt/cues Counterconditioning Barrier identification/Problem solving Stimulus control Prompt self-monitoring of behaviour Prompt review of behavioural goals Provide rewards contingent on effort or progress towards behaviour Provide feedback on performance Reinforcement management		*Self-efficacy (Beliefs about Capabilities):* Self-efficacy was measured with an adapted version of the Physical Activity self-efficacy scale, which measure confidence in being active despite experiencing barriers (Marcus et al., 1992). 7-point Likert scale was used. *Action planning (Behavioural Regulation):* Action planning was measured with four items from Sniehotta, Schwarzer , Scholz, & Schuz (2005b) pertaining to a plan of how/when/where/how often. Coping planning was measured with three items for example, planning for when things get in the way of physical activity (Sniehotta et al., 2005a, 2005b) *Self-regulation (Behavioural Regulation):* Self-regulator effort was measured with six items adapted from the	per protocol analysis (U (52) =302, p=0.74). *Baseline to 3-months effect size: U(65) = 585, p = .43; r = .10* *3-months to 6-months effects size: U(65) = 504, p = .75, r = .09* *Self-report:* MVPA (volume; min/day) There was a median decrease in weekly self-reported MVPA of 15 minutes (IQ range -111, 15) in the intervention group and an increase of 30 minutes (IQ range –68, 75) among the control group. Analysis of the difference between the groups from baseline to 3-months found this was non-significant but was associated with a small effect size (U (65) =665, p=0.71, r=0.22). During the period from 3 to 6 months there was no change in median weekly self-reported MVPA minutes (i.e. 0, IQ range -26, 71) in the intervention group. The control group showed a median decrease of 53 minutes (IQ range -41,-101). This difference from 3 to 6-months (due to decrease among the control group) was significant between the groups and associated with a small effect size (U (65) =371, p = .04, r = .26). Baseline to 3-months effect size: U(65) = 665, p = .71, r = .22 3-months to 6-months effect size (due to decrease in control group): U(65) = 371, p = .04, r = .26	Intentions were high at baseline in both groups. There was no significant difference in intentions to be active between groups from baseline to 3-months (U(65)=389.00, p=0.06, r=-0.24). The small effect size reflects the small drop in intentions to be active in the control group. From 3 to 6 months follow-up (U(65)=551.00, p=0.74, r=0.04) there was no between-groups difference in scores. The control group's intentions remained lower at 6-months. Baseline to 3-months effect size: U(65) = 389.00, p = .06, r = -.24 3-months to 6-months effect size: U(65) = 551.00, p = .74, r = .04 *Self-efficacy:* There was an increase in self-efficacy from baseline to 3-months in the intervention group and a small decrease among controls (U(65)=357.50, p = .03, r = -.27). From 3-6 months the intervention group's improved self-efficacy score was maintained but the control groups self-efficacy dropped further. The between groups difference in self-efficacy from 3 to 6 months was not significant (U(65) = 537.00, p = .91, r = .01). Baseline to 3-months effect size: U(65) = 357.50, p = .03, r = -.27 3-months to 6-months effect size: U(65) = 537.00, p = .91, r = .01		

				Relapse prevention/Coping planning Prompt self-monitoring of behaviour Stimulus control		action control questionnaire Sniehotta et al. (2005b).	Unable to calculate effect sizes because SDs not provided, only IQR	*Action planning:* The intervention groups' median action planning score increased, while the control groups' decreased from baseline to 3-months. The increase was maintained in the intervention group and showed an increase in the control group from 3 to 6 months. There were significant between group difference in change between baseline and 3-months ($U(65) = 320.50$, $p < .01$, $r = -.34$) favouring the intervention group. Between 3-6 months the significant between-groups difference ($U(65) = 793.50$, $p < .01$, $r = .39$) favoured the control group. Baseline to 3-months effect size: $U(65) = 320.50$, $p < .01$, $r = -.34$ 3-months to 6-months effect size: $U(65) = 793.50$, $p < .01$, $r = .39$ *Coping planning:* Both groups improved over time. There was a significant between groups difference from baseline to 3-months ($U(65)=798.50$, $p<0.01$, $r=0.44$) and from 3 to 6 months ($U(65)=813.00$, $p<0.01$, $r=0.41$) due to significantly greater improvements in the intervention group. Baseline to 3-months effect size: $U(65) = 798.50$, $p < .01$, $r = .44$ 3-months to 6-months effect size: $U(65) = 813.00$, $p < .01$, $r = .41$		

(Mailey & Hsu, 2019)	USA	Total n = 49; Specific Recommendation Intervention (SRI) n = 25, General Recommendation Intervention (GRI) = 24 *M*Age (years) = 32.3 Ethnicity: 87.8% = white Time postpartum: 6-weeks to 12-months Baseline activity status: Participants were not meeting current PA recommendation of 150-minutes of moderate-intensity activity per week. Sample parity: N/A Concomitant health issue: N/A	**Randomized controlled trial** Duration: 2-months Time of assessments: baseline, 2-months, 8-months General Recommendation Intervention (GRI): All participants invited to attend three workshop sessions (physical activity interventions). Each session lasted ~1.5 hours. sessions scheduled 1 month apart. intervention lasted 2 months. at the end of the sessions, participants received an accelerometer and were asked to wear the accelerometer and complete the questionnaires online. Six months after post-intervention data collection, participants were asked to follow up. GRI group did not specifically receive exercise recommendations - they were instead encouraged to accumulate PA in any way that suited their current lifestyle. Core goal was to support autonomy. Advised to broaden their definitions of exercise - include any enjoyable and feasible forms of PA. "some is better than none". Specific Recommendation Intervention (SRI): Participated in the same workshop as the GRI group. SRI received recommended exercise protocol that emphasized gradual	Health Action Process Approach BCTs: Goal setting, Identifying physical activity benefits Developing strategies for overcoming key barriers (i.e., problem solving/coping planning) Discussing relapse prevention strategies	*Self-report:* Self-reported leisure time PA was measured using the Godin Leisure Time Exercise Questionnaire (GLTEQ). *Device-measured:* ActiGraph accelerometers (model GT3X+) 2. Daily log indicating times exact times they started and stopped wearing the monitor each day.	*Barriers (Environmental Context and Resources):* Exercise Barriers Scale measured six commonly endorsed barriers to exercise among parents: lack of time, lack of motivation, feeling guilty, feeling too tired, lack of enjoyment, and too busy with other responsibilities. Participants asked to rate the extent to which each barrier interferes with the physical activity routine. Scale from 1 (not at all) to 5 (always) Score range: 6-30 *Self-efficacy (Beliefs about Capabilities):* Barriers Self-Efficacy Scale, McAuley et al., 2012 Modified to include two barriers specific to parents (lack of childcare and feeling guilty about spending time apart from children) 13-items. 100-point percentage scale ranging from 0% = not at all confident to 100% = highly confident	*Self-report:* No significant differences between groups at baseline. Significant main effect for self-reported physical activity (F(2,35) = 20.50, p<0.001, n^2 = .54). Both groups reported significant increases in physical activity immediately following the intervention (p<0.001), and small but nonsignificant declines in physical activity during the follow up period (p = 0.28). Physical activity increased more across the 8- months study period in the GRI condition (p = 0.004) vs SRI condition (p = 0.13). MVPA (frequency) Baseline to 2-months (post-intervention) effect size, GRI vs SRI: Cohen's d = .84, r = .39 Baseline to 8-months (6-months post-intervention effect size), GRI vs SRI: Cohen's d = .73, r = .34 *Device-measured:* MVPA (volume; min/day) Accelerometer measured MVPA exhibited a non-significant quadratic effect (F(2,36) = 2.91, p = .07, n^2 = .14) and a nonsignificant interaction effect (F(2,36) - 0.44, p = .65, n^2= .02). Baseline to 2-months (post-intervention) effect size, GRI vs SRI: Cohen's d = .31, r = .15 Baseline to 8-months (6-months post-intervention effect size), GRI vs SRI: Cohen's d = .06, r = .03	*Barriers:* There was a main effect that approached statistical significance (F(12,27) = 2.05, p = .06, n^2 = .48) and a nonsignificant interaction effect (F(12,27) = 1.18, p = .34, n^2 = .35) Baseline to 2-months (post-intervention) effect size, GRI vs SRI: Cohen's d = -.23, r = -.11 Baseline to 8-months (6-months post-intervention effect size), GRI vs SRI: Cohen's d = -.14, r = -.07 2-months to 8-months effect size: Cohen's d = .06, p = .67 *Self-efficacy:* Barriers self-efficacy - neither the main effect (F(2,38) = 0.98, p = .39, n^2 = .05) nor the interaction effect (F(2,38) = 0.02, p = .98, n^2 = .001) was statistically significant. effect sizes revealed both groups reported modest increases in self-efficacy. The two most prominent barriers "too busy" and "lack of time" declined significantly (p = .02; p = .001). significant decreases in "feeling guilty" as a barrier (p = .009). Baseline to 2-months (post-intervention) effect size, GRI vs SRI: Cohen's d = .03, r = .02 Baseline to 8-months (6-months post-intervention effect size), GRI vs SRI: Cohen's d = -.04, r = -.02 2-months to 8-months effect size: Cohen's d = -.05	N/A	5/13 (High)

			progression and mastery experiences. *Prescribed FITT of PA:* SRI: "Couch to 5k" commercial program. It includes 3 sessions a week of 30-min of walking and jogging with the goal to progress towards 30 consecutive minutes of jogging. GRI: participants encouraged to choose PA types that they enjoy or are consistent with their core goals and values. No information provided regarding frequency, intensity, time.			Total strength was the mean of the scores with a maximum score of 100. *Planning (Behavioural Regulation):* The Exercise Planning and Scheduling Scale (Rovniak et al., 2002) 10 items related to scheduling and planning exercise as part of one's daily routine. Scale from 1 = does not describe to 5 = describes completely. Total score range: 10-50		*Planning:* The intervention group had significantly increased planning ($F(2, 38) = 12.40$, $p < .001$, $n^2 = .40$). This was sustained across the follow-up period and did not differ between groups ($F(2,38) = .89$, $p = .42$, $n^2 = .05$) Baseline to 2-months (post-intervention) effect size, GRI vs SRI: Cohen's d = .30, r = .15 Baseline to 8-months (6-months post-intervention effect size), GRI vs SRI: Cohen's d = .52, r = .25 2-months to 8-months effect size: Cohen's d = .16, p = .28		
(Mesk et al., 2022)	Malaysia	Total n = 110; experiment n = 55, control n = 55 Age: Experiment = 9.1% <20 years, 36.4% 20-30 years. 54.5% >30 years; Control = 9.1% <20 years, 30.9% 20-30 years, 60.0% >30 years Time postpartum: participants were recruited from an obstetrics and gynecology outpatient clinic (assumed to be recently postpartum)	**Randomized controlled trial** Duration: 3-months Time of assessments: baseline, 3-months, 6-months Intervention: Participants received the intervention via WhatsApp. It was informed by the Health Belief Model constructs to enhance behaviour change of pelvic floor muscle training. The four constructs were perceived benefit of regular practice of pelvic floor muscle exercise (PFME) PFME, perceived barriers during the PFME performance behaviours that are linked to social physical and emotional barriers, cues to	Health Belief Model BCTs: Perceived benefit of regular practice of PFME Perceived barriers during the PFME performance behaviours that are linked to social physical and emotional barriers Cues to action/motivation Self-efficacy	*Adherence:* PFME adherence was measured using the Exercise Adherence Rating Scale (EARS). It includes three parts: 1) participant records the recommended exercise which caregivers have directed them 2) 6-item measure of adherence 3) 10-item measure concerning of factors which affect (hinder or help) adherence to exercise.	*Self-efficacy (Beliefs about Capabilities):* Self-efficacy for Exercise scale has nine items that measure the expectations of self-efficacy which relates to the ability to continue exercise in the face of perceived barriers. The perceived statement barriers are based on the confidence of performing 15 contractions three times per day. The final score ranges from 1 to 10 with higher scores indicating higher self-efficacy for exercise	*Adherence:* Participants in the intervention group adhered significantly more than participants in the control group at 3-months and 6-months (Mann-Whitney p-value = .001 and .001) Data not provided. According to figure: Experiment (estimate of median): Baseline = <2, 3-months = between 4-5, 6-months = 5 Control (estimate of median): Baseline = <2, 3-months = <2, 6-months = between 3-4 Unable to calculate effect size	*Self-efficacy:* Intervention participants had significantly improved perceived benefits, self-efficacy, and cues to action for PFME and decreased perceived barriers to PFME compared to control participants. Unable to calculate effect size	N/A	6/13 (High)

		Baseline activity status: EARS score of less than 2 out of 10 Sample parity: Number of previous deliveries: Experiment = 20.0% 1 delivery, 61.8% 2-5 deliveries, 18.2% >5 deliveries; Control = 23.6% 1 delivery, 61.8% 2-5 deliveries, 14.5% >5 deliveries. Concomitant health issue: Urinary incontinence	action/motivation, and self-efficacy. The recommended PFME program had different combination of sets and repetitions and commonly used contractions. The contractions included a basic contraction to determine the correct muscles, contractions to enhance strength and durability, and contractions prior to coughing. It included graphical demonstration of the duration and intensity of each contraction and associated relaxation. They were given instructions on where to find the pelvic floor along with images. They also received information about urinary incontinence. *Prescribed FITT of PA:* They were recommended to do 15 pelvic floor contractions three times per day. Participants received a message once a week that encouraged and reminded them to continue with the program. Control: Control participants were in a wait-list group and received the intervention after 6-months follow-up.							
(Napolitano et al., 2021)	USA	Total n = 136; intervention n = 65, control n = 71	**Feasibility randomized controlled trial**	The content was culturally-specific and the intervention	*Self-report:* International Physical Activity Questionnaire (IPAQ) on MVPA minutes per	*Self-efficacy (Beliefs about Capabilities):*	*Exercise self-efficacy:* Intervention, mean: Baseline = 13.7, 3-months = 14.2, p = .73	*Self-report:* MVPA (volume; min/week):	N/A	5/13 (High)

		*M*Age (years): Total = 27.8(5.4), intervention = 28.28(5.6), control = 27.58(5.2) *M*BMI: Total = 32.5(4.3), Intervention = 32.1(4.0), Control - 32.7(4.6) All participants self-identified as African American or Black Time postpartum: within first 3-days Baseline activity status: MVPA (volume; min/week): Intervention mean = 279.9; Control, mean = 364.2 Sample parity: Total: 22.1% primiparous, 76.5% multiparous Intervention: 20.0% primiparous, 80.0% multiparous Control: 23.9% primiparous, 73.2% multiparous Concomitant health issue: BMI 25-40	Duration: 12-weeks Time of assessments: baseline, 3-months Intervention: Participants were instructed to download the Be Fabulous After Baby (BeFAB) app and were invited to a private Facebook group. The app included 12-weeks of content adapted from the Diabetes Prevention Program. Topics were tailored to social and familial context of having a new baby with consideration of key social, cultural, and environmental factors. For example, "Tip the Calorie Balance", "Being Active with Family", and "Stress, Family, and Weight". Lessons In-app messages delivered 5 days per week that included tips on how to be creative and fit in physical activity. Participants could track their weight and choose a nutrition and physical activity goal weekly (e.g., "Do 30 min of physical activity like walking or working around the house, Watch less than 2 h of TV per day") and they monitored their progress on these goals. Participants received virtual "badges" for meeting self-monitoring milestones. The Facebook group offered a community advisory board that provided additional input and feedback on the lessons and focus.	targeted specific behavioural predictor beliefs and attitudinal measures (e.g., self-efficacy to achieve weight management goals) [Social cognitive theory] BCTs: N/A	week. It included an additional question about family time activity: "How many times per month does your family do some kind of physical activity together, such as dancing, walking, playing sports, or going to the park?"	Exercise self-efficacy is a 5-item questionnaire assessing one's confidence to be active when faced with 5 common barriers. Score ranged from 5-25. *Social support (Social Influences):* Two subscales (each 8 items) assessed support and the online Facebook community: 1) emotional support (e.g., I gain a feeling of acceptance from using this group), 2) informational support (e.g., I find valuable information from this group). Responses were 1 = strongly disagree to 5 = strongly agree. *Stress and coping (Emotions and Behavioural Regulation):* Rhode Island Stress and Coping Inventory measured stress levels and adopted coping strategies in relation to having a newborn baby. Items assessed on a 5-point Likert scale. 7-items focused on stress (e.g., I felt I had more stress than usual), 5-	Control, mean: Baseline = 14.4, 3-months = 15.0, p = .52 Differences scores for Intervention Vs Control: Intervention CI = .4(-2.0, 2.9), Control CI = .6(-1.2, 2.3), p = .92 Didn't provide standard deviations to calculate effect size (p = .92) *Social support:* No significant between or within group differences found for social support (values not provided) *Stress score:* Intervention, mean: Baseline = 15.9, 3-months = 16.1, p = .93 Control, mean: Baseline = 15.3, 3-months = 17.0, p = .12 Differences scores for Intervention Vs Control: Intervention CI = .2(-3.4, 3.8), Control CI = 1.7(-.4, 3.9), p = .45 Didn't provide standard deviations to calculate effect size (p = .45) *Coping strategies score:* Intervention, mean: Baseline = 18.7, 3-months = 19.4, p = .87 Control, mean: Baseline = 18.1, 3-months = 18.0, p = .98 Differences scores for Intervention Vs Control: Intervention CI = .8(-1.9, 3.4), Control CI = -.1(-2.2, 2.0), p = .59 No significant between or within group differences were found for stress or coping.	Intervention, mean: Baseline = 279.9, 3-months = 618.4, p = .004 Control, mean: Baseline = 364.2, 3-months = 445.3, p = .41 Differences scores for Intervention vs Control: Intervention (95% CI) = 337.5(109.5, 567.6), Control (95% CI) = 81.1(-136.8, 299.0), p = .10 Didn't provide standard deviations to calculate effect size (p = .10) Significant increase in weekly minutes of MVPA among BeFab participants but no significant difference between groups.		

			Prescribed FITT of PA: Participants could choose one of six physical activity goals weekly. Examples were “Do 30 min of PA like walking or working around the house” and “Watch less than 2 hours of TV per day” Control: All participants received usual care which included written information regarding resumption of physical activity postpartum, weight-related expectations and return to pre-pregnancy weight, healthy eating, physical activity guidance and suggestion to monitor weight.			items focused on coping (e.g., I successfully solved problems that came up*)*	Didn't provide standard deviations to calculate effect size (p = .59)			
(Nicklas et al., 2014)	USA	Total n = 75; intervention n = 36, control n = 39 *M*Age (years): intervention = 33.6 (SD = 4.8), control = 33.3 (SD = 5.8). Race: intervention = 64% White, 25% African American, 11% Asian; control = 51% White, 36% African American, 13% Time postpartum: After 6 weeks postpartum. Intervention group 7.3 +/-2.6 weeks pp. Control group 7.0+/-1.6 weeks pp.	**Feasibility randomized controlled trial** Duration: 12-months Time of assessments: baseline (6-weels postpartum), 6-months postpartum, 12-months postpartum Intervention: Web-based lifestyle modification program (Balance after Baby). 12 core modules (1 per week for 12 weeks) focusing on Diabetes Prevention. Breastfeeding section had 4 additional modules and option to contact lactation consultant. Given goal to return to pre-pregnancy weight over the 12 months. If still overweight after reaching pre-pregnancy weight, they were encouraged to lose weight with goal of total 7%	N/A BCTs: Patient-centered counselling techniques	*Self-report:* International Physical Activity Questionnaire measured Walking time, time engaged in moderate/vigorous PA	*Depression (Emotions):* EPDS	*Depression* No significant difference between groups in EPDS scores (no data)	*Self-report:* Walking, MVPA (volume) No significant difference between groups for walking time or time engaged in moderate/heavy PA (no data)	N/A	4/13 (Low)

		Baseline activity status: N/A Sample parity: Nulliparous (baseline characteristics prior to initial visit): Intervention 18 (50%), control 15 (38%) Concomitant health issue: Gestational Diabetes Mellitus	weight loss from 6 week postpartum weight. Focuses on dietary choices, PA for 150mins per week or more. Suggested tracking with logbook. Telephone/email sessions with lifestyle coach (weekly for first 12 weeks, every other week for next 12 weeks, monthly after) and dietician. Received body weight scales, measuring cups/spoons, pedometers, YMCA membership for 10 months. *Prescribed FITT of PA:* Recommended to gradually increase to 150 min of PA per week or more, including resistance training. No information about frequency or intensity. Control: No additional information except for the handout everyone (both intervention/control) received at recruitment. Handout: "It's Never Too Early to Prevent Diabetes."							
(Norman et al., 2010)	Australia	Total n = 161; intervention n = 80, control n = 81 *M*Age (years): intervention = 29.3 (SD = 4.0), control = 30.1 (SD = 5.3) Time postpartum: 6- to 10-weeks Baseline activity status: Total PA M&B	**Randomized controlled trial** Duration: 8-weeks Time of assessments: baseline, 8-weeks, 12-weeks Intervention: One time per week for eight weeks, "Mother and Baby" (M&B) program, with specialized exercise with women's health physiotherapist and parenting education (30 min sessions with	N/A BCTs: N/A	*Self-report:* Questions: Type, duration and frequency of PA	*Depression (Emotions):* EPDS *Affect (Behavioural Regulation):* Positive Affect Balance Scale (PABS) measures an individuals' ability to cope with the stresses of everyday living and the positive affect questions demonstrate relationship with social	*Depression:* Significant effect: reduced risk for postnatal depression in intervention (M&B) group at 8 weeks (p < 0.0001). No significant change in EPDS at 12 weeks. M&B mean(SD): Baseline = 8.00(6.16), 8-weeks = 5.47(5.11), 12-weeks = 4.73(5.27) EO mean(SD): Baseline = 6.75(5.44), 8-weeks = 6.75(5.51), 12-weeks = 6.54(5.61)	*Self-report:* Total PA (volume; min/week) No significant difference between groups M&B, mean(SD)I: Baseline = 165(168), 8-weeks = 188(126), 12-weeks = 176(110) EO, mean(SD): Baseline = 141(148), 8-weeks = 154(153), 12-weeks = 155(173)	N/A	5/13 (High)

		Group: 165(168)min/week; EO group 141(148)min/week Sample parity: Primiparous: intervention n=42 (68%), control n=46 (63%). Concomitant health issue: N/A	different health care professionals). One hour sessions with group exercises with babies. Also received same written education material as control group. *Prescribed FITT of PA:* One hour per week group session with physiotherapist and included cardiovascular and strength components. Exercise were adapted to each woman depending on their type of delivery and recovery. No information about intensity or PA recommendations outside of the weekly classes. Control: Education only group. Written educational materials mailed to them every week for 8 weeks. Education included baby massage, nutrition for mothers, solids, lifestyle, communication, sun care, and play development.			participation, satisfaction with social life, and engagement in activities. Scored from 1= never, 2= sometimes, 3 = often. Total score ranged from 5 to 15 with 15 being maximum positive affect.	Baseline to 8-weeks effect size: Cohen's d = -.44, r = -.22 Baseline to 12-weeks effect size: Cohen's d = -.53, r = -.26 ANCOVA adjusted for baseline score, age, and parity: significant main effect (F(1,134) = 12.688, p < .0001) Significant between-group effect (post hoc t test: baseline vs 8 weeks) p <.0001 Nonsignificant between-group effect (post hoc t test: 8 weeks vs 12 weeks) p = .194 *Affect:* Improvement in PABS at 8 weeks for intervention group (P=0.007), but no significant difference between groups at 12 weeks. M&B mean(SD): Baseline = 10.72(2.19), 8-weeks = 11.82(2.08), 12-weeks = 11.93(2.31) EO mean(SD): Baseline = 10.67(2.17), 8-weeks = 10.47(2.26), 12-weeks = 10.49(1.91) Baseline to 8-weeks effect size: Cohen's d = .60, r = .29 Baseline to 12-weeks effect size: Cohen's d = .64, r = .31 *ANCOVA adjusted for baseline score, age and parity: significant main effect (F(1,134) = 18.065, p = .001);*	12-weeks ANCOVA adjusted for baseline score, age, and parity (F(1,134) = .14, p = .87) Baseline to 8-weeks effect size: Cohen's d = .06, r = .03 Baseline to 12-weeks effect size: Cohen's d = -.02, r = -.01		

							Significant between-group effect (post hoc t-test: baseline vs 8 weeks) p = .007 *Non-significant between-group effect (post hoc t test: 8 weeks vs 12 weeks) p = .580*			
(O'Reilly et al., 2016)	Australia	Total n = 573; intervention n = 284, control n = 289 *M*Age (years): Total = 33.8(5.2), Intervention = 34.1(5.3), Control = 33.6(5.1) *M*BMI: Total = 28.8(6.8), Intervention = 29.2(6.9), Control = 28.4(6.7) Ethnicity: Total = 3.5% Africa, .7% Americas, 38.9% Asia, 29.0% Europe, 1.2% Oceania, 22.9% Australia and New Zealand, .2% Aboriginal and Torres Strait Islander Intervention = 2.5% Africa, 1.1% Americas, 39.8% Asia, 25.0% Europe, 1.4% Oceania, 25.7% Australia and New Zealand, .4% Aboriginal and Torres Strait Islander Control = 4.5% Africa, .3% Americas, 38.1% Asia, 32.9% Europe, 1.0% Oceania, 20.1%	**Randomized controlled trial** Duration: 9-months (3-month intensive phase; 6-month maintenance phase) Time of assessments: baseline, 12-months Intervention: Participants received one individual and five group sessions from a specially trained healthcare professional. They received two additional follow-up maintenance telephone calls. The intervention is based on the GGT-DPP and is tailored to relevant barriers for mothers of young children (e.g., impact of sleep deprivation, stress management and mindful eating, healthy eating for families, weaning, culturally appropriate and cost- and time-saving food preparation, and exercise considerations when caring for young children). Mothers could bring children to group sessions. Participants received a MAGDA-DPP handbook. The first session was focused on the intention	Health action process approach Social cognitive theory Self-regulation theory BCTs: N/A	*Self-report:* Active Australia Questionnaire	*Depression (Emotions):* Depressive symptoms and suicidal ideation was measured with the Patient Health Questionnaire (PHQ-9)	*Depressive Symptoms:* Intervention, mean(SE): Baseline = 4.06(.23), 12-months = 4.41(.26), mean difference = .35 (.172) Control, mean(SE): Baseline = 4.57(.23), 12-months = 4.39(.25), mean difference = -.19 (p = .449) Mean difference (SE) between intervention and control at baseline = -.51 (p = .111) Mean difference (SE) between intervention and control at 12-months = .03 (p = .943) Baseline to 12-months effect size: Cohen's d = .14, r = .07	*Self-report:* MPA (% of participants meeting ≥30 min/day) Intervention: Baseline = 33.80%, 12-months = 45.45%, p = .005 Control: Baseline = 39.45%, 12-months = 43.24%, p = .498 Difference at baseline: p = .146 Difference at 12-months: p = .551 p - value for the Wald chi-squared test of the time by group interaction: p = .108	N/A	3/13 (Low)

		Australia and New Zealand, 0% Aboriginal and Torres Strait Islander Time postpartum: 3-months Baseline activity status: Moderate intensity PA: Total = 34.3(42.9) min/day Intervention = 33.4(43.7) min/day Control = 35.1(42.9) min/day Sample parity: Total: 1 = 44.5%, 2 = 34.2%, 3+=21.3% Intervention: 1 = 45.2%, 2 = 34.5%, 3+=20.3% Control: 1 = 43.9%, 2 = 33.8%, 3+=22.3% Concomitant health issue: Gestational Diabetes Mellitus in most recent pregnancy	formation, personalisation of type 2 diabetes mellitus risk using a risk algorithm, and individual goal setting. Five group sessions were held every 2-weeks, were 2-hours, with up to 15 women per group. Participants reviewed on personal goal related to diet and physical activity each session. Sessions were mainly focused on healthy eating. The fifth session was on building postnatal depression awareness and stress management. Participants received phone calls at 3- and 6-months after the final group session to review progress and longer term goal setting. *Prescribed FITT of PA:* Participants encouraged to set a PA goal. No information about frequency, intensity, time, type. Control: Participants received usual care and were offered the intervention after the 12-month final assessment.								
(Rhodes, Blanchard, et al., 2021)	Canada	Total n = 132 couples; education plus planning condition n = 74 couples, education control n = 58 couples Demographics reported by couple.	**Randomized controlled trial** Duration: 6-months Time of assessments: baseline, 3-months, 6-months Intervention:	Theory of Planned Behaviour extended with self-regulatory tactics BCTs: Goal setting (behavior)	*Device-measured (primary):* Triaxial accelerometers (GT3X, ActiGraph, Pensacola, FL). Worn for 7 consecutive days for >=10 hours a day. A minimum of 4 days (at least 1 weekend day) with >=600 minutes a day.	*Planning:* 6-items adapted from other sources (e.g., "I made plans regarding what to do if something interfered with engaging in PA, I set short-term goals for	*Planning:* There was a significant intercept X condition interaction, indicating that participants in the EP condition had higher planning at 3-months than the EC condition.	*Device-measured:* Compliance was low and wear time was associated with MVPA at all time periods, indicating data was not missing at random. *Self-report:* MVPA (volume; min/week)	N/A	4/13 (Low)

		Sex: Education plus planning condition = 51.0% female, education control = 50.5% female Ethnicity: Education plus planning condition = 19.5% visible minority, education control = 11.4% visible minority *M*Age: Education plus planning condition = 31.49 (SD = 4.92), education control = 32.50 (SD = 4.78) *M*BMI: Education plus planning condition = 25.99 (SD = 4.56), education control = 26.65 (SD = 4.40) Time postpartum: 2-months Baseline activity status: Self-report MVPA: Education plus planning condition = 231.62(255.88) minutes, education control = 197.07(203.55) minutes Self-report meeting guidelines: Education plus planning condition =	Participants received intervention materials face-to-face from research assistant. Both groups received MVPA guidelines in booklet form and verbal presentation on the importance of physical activity after birth. Education plus planning condition also received a workbook with two sections. The first section focused on benefits of postpartum physical activity on immunity, improved sleep, increased energy, controlled food cravings, reduced pain, and prevention and treatment of postpartum depression. At the end of this section, couples could list activities that they might find enjoyable to inform an action plan. The second section included self-regulatory approaches. They brainstormed barriers to physical activity and addressed social support strategies, problem solving, and implementation of planning methods. This section ended with discussion of a rest day (usually Sunday) where the couple could reorganize goals and plans for the following week. There were two in-person booster check-in sessions at 6-weeks and 3-months to ascertain goal progress and facilitate problem solving.	Goal setting (outcome) Information about health benefits Problem solving Action planning Review behavior goals Review outcome goals Self-monitoring of behavior Self-monitoring of outcome(s) behavior Instruction on how to perform the behavior Social support (unspecified) Social support as a couple (practical) Monitoring of emotional consequences Non-specific reward Discrepancy between current behavior and goal (reset day) Prompts/cues	Two datasets were used: 1) data rebuilt so that all participants had a complete 7-days data set, 2) data not rebuilt so participants had between 4-7 days of valid wear time *Self-report (secondary):* A modified Godin Leisure-Time Questionnaire that measured frequency and duration of physical activity with open-ended assessment.	PA...). Timer referred to assessment period (e.g., at 6-week assessment, the ref was over the last 6-weeks).	In the EP condition, planning steadily increased from baseline to 3-months and then began to decline. In the EC condition, planning was stable until 3-months and then began to decline (quadratic trend B = -.10) Education plus planning, mean(SD): Baseline = 2.55(.93), 6-weeks = 3.24(.76), 3-months = 3.02(.79), 6-months = 3.04(.98) Education control, mean(SD): Baseline = 2.59(1.00), 6-weeks = 2.72(.76), 3-months = 2.75(.82), 6-months = 2.47(.85) Baseline to 3-months effect size: Cohen's d = .32, r = .16 Baseline to 6-months effect size: Cohen's d = .63, r = .3	There was a significant quadratic trend (B = -.38; p = .01) but it was not significantly predicted by condition (B = -.10; p = .65). MVPA increased from baseline to 3-months in both conditions and remained stable in the education plus planning condition but declined slightly in the education control condition. Education plus planning (minutes/week), mean(SD): Baseline = 142.47(185.11), 6-weeks = 203.68(140.10), 3-months = 200.89(178.67), 6-months = 231.23(183.76) Education control (minutes/week), mean(SD): Baseline = 169.29(154.92), 6-weeks = 205.89(160.59), 3-months = 214.89(140.73), 6-months = 177.71(118.86) Baseline to 6-weeks effect size: Cohen's d = .14 Baseline to 3-months effect size: Cohen's d = .07, r = .04 Baseline to 6-months effect size: Cohen's d = .47, r = .23		

		50.0%, education control = 50.9% Sample parity: N/A Concomitant health issue: N/A	*Prescribed FITT of PA:* Recommended to meet 150-min of weekly MVPA Control: Participants received MVPA guidelines in booklet form and verbal presentation on the importance of physical activity after birth.							
(Teychenne et al., 2021)	Australia	Total n = 62; intervention n = 32, control n = 30 *M*Age: intervention = 33.6(3.7), control = 33.0(3.7) *M*BMI: intervention = 40% healthy weight, 30% overweight, 30% obese; control = 34% healthy weight, 34% overweight, 31% obese Time postpartum: 3- to 9-months Baseline activity status: Insufficiently active (responded 'no' to the question, "Do you do at least 150 minutes a week of PA that makes you breathe a little heavier (moderate intensity)?" Sample parity: Number of children living at home:	**Pilot randomized controlled trial** Duration: 12-weeks Time of assessments: baseline, 4-weeks, 8-weeks, 12-weeks Intervention: Participants were provided with Mums on the Move, a home-based physical activity intervention. They were lent home exercise equipment (treadmill or stationary bike based on personal preference), a logbook for goal setting and self-monitoring, access to an online forum for social support (facilitated by researcher) and web-app access (included motivational and informational material) for 12-weeks. The web-app included a PA program tailored to current activity levels, music workout mixes on Spotify, and tips to increase PA, reduce sedentary behaviour and overcome barriers. *Prescribed FITT of PA:* The program was tailored to their current activity/fitness levels	Socioecological model BCTs: Feedback and monitoring (self-monitoring of behaviour; feedback on behaviour) Goals and planning (goal setting; problem-solving; action planning) Shaping knowledge (instruction on how to perform behaviour; information about antecedents) Social support (practical and emotional) Antecedents (adding objects to the environment)	*Self-report:* Active Australia Survey measured physical activity in the past week. *Device-measured:* Accelerometers (MTI Actigraph Model Am7164-2.2C) were worn on right hip during waking hours for 7 consecutive days. Wear-time of 10hours of more was a valid day; 4 valid days, including at least one weekend ay, were required for calculating daily averages.	*Depressive symptoms (Emotions):* EPDS *Anxiety symptoms (Emotions):* Generalized Anxiety Disorder scale (GAD-7). Measures frequency of a range of feelings and behaviours relating to 7 anxiety symptoms in the past 2 weeks using a 4-point Likert scale. *Physical activity self-efficacy (Beliefs about Capabilities):* Physical activity self-efficacy scale (Marcus and Forsyth, 2009) with two additional items to assess self-efficacy when faced with common postpartum barriers: 1) "Do physical activity even when my child has not slept", 2) "Do physical	*Self-efficacy for physical activity:* Control mean(SD): Baseline = 2.4(.8), Week 12 = 2.3(.6) Intervention, mean(SD): Baseline = 2.7(.9), Week 12 = 2.8(.8) Mean difference at 12-weeks,B (95% CI): .4(.0, .7), p = .056 Baseline to 12-weeks effect size: Cohen's d = .23, r =.11 *Depressive symptoms:* Intervention, mean(SD): Baseline = 12.1(3.8), Week 4 = 7.3(3.4), Week 8 = 6.0(3.5), Week 12 = 6.0(4.3) Control, mean(SD): Baseline = 12.6(3.9), Week 4 = 5.9(2.7), Week 8 = 6.9(3.9), Week 12 = 7.4(3.6) Effect, B (95% CI): Week 4 = 1.6(-.1, 3.3), p = .070; Week 8 = .1(-1.7, 1.9), p = .881, Week 12 = -.9(-3.0, 1.1), p = .379 Baseline to 12-weeks effect size: Cohen's d = -.23, r = -.11 *Anxiety symptoms:* Intervention, mean(SD): Baseline = 8.2(4.6), Week 12 = 4.3(4.2)	*Self-report:* Total PA (volume; min/week) There was a positive effect in the intervention group at 4-weeks but this wasn't sustained. Intervention, mean(SD) mins/week: Baseline = 189.8(180.6), Week 4 = 364.0(234.2), Week 8 = 418.6(257.0), Week 12 = 487.8(369.4) Control, mean(SD) mins/week: Baseline = 172.1(145.8), Week 4 = 197.4(204.9), Week 8 = 283.0(290.6), Week 12 = 415.3(457.6) Mean difference, B (95% CI): Week 4 = 161.9(37.7, 286.2), p = .011, Week 8 = 137.3(-37.8, 312.3), p = .124, Week 12 = 57.4(-167.6, 282.4), p = .617 Baseline to 12-weeks effect size: Cohen's d = .33, r = .16 *Device-measured:* MVPA (%)	N/A	6/13 (High)

		Intervention = 63% 1 child, 37% more than 1 child Control = 63% 1 child, 38% more than 1 child Concomitant health issue: At risk of postnatal depression (i.e., score ≥10 on the EPDS)	suggesting walking, walking or stationary cycling at various speeds (e.g., steady walk = 5.5kph, brisk walk = 7.0 kph, jog = 9.5 kph). Warm up and cool down routines also recommended. Participants encouraged to build up towards 150-min of moderate intensity PA (such as brisk walking). Control: Participants were instructed to continue their usual routine during the intervention. After the study, they received access to the web-app and were provided with the exercise equipment hire contact details.			activity even when my child is unsettled" *Physical activity barriers and facilitators (Environmental Context and Resources):* 7-item scale to assess physical activity barriers and facilitators (Brownson et al., 2001). It measured how often each barrier (i.e., self-conscious, no safe place, lack of knowledge on how to exercise, no childcare, no energy, no motivation, do not have time) prevented them from being active on a 5-point Likert scale. *Behavioural skills (Behavioural Regulation):* 3-items assessing physical activity goal setting and self-monitoring (Giles-Corti & Donavan, 2003). How many times in the past month did you: a) Set a goal for how much physical activity you would like to do? b) Plan particular days on which you would do physical activity? 3) Monitor how much	Control mean(SD): Baseline = 6.8(2.4), Week 12 = 4.2(2.9) Mean difference at 12-weeks, B (95% CI): -.1(-1.9, 1.7), p = .879 Baseline to 12-weeks effect size: Cohen's d = -.35, r = -.17 *Physical activity barriers: Self-conscious: (Social Influences)* Control mean(SD): Baseline = 2.4(1.2), Week 12 = 2.0(.8) Intervention, mean(SD): Baseline = 2.6(1.0), Week 12 = 2.2(1.3) Mean difference at 12-weeks, B (95% CI): -.1(-.7, .4), p = .699 Baseline to 12-weeks effect size: Cohen's d = 0, r = 0 *No safe place: (Environment)* Control mean(SD): Baseline = 2.3(1.0), Week 12 = 2.3(1.2) Intervention, mean(SD): Baseline = 2.6(1.2), Week 12 = 2.0(.9) Mean difference at 12-weeks, B (95% CI): -.4(-.9, .2), p = .215 Baseline to 12-weeks effect size: Cohen's d = -.54, r = -.26 *Lack of knowledge on how to exercise: (Knowledge)* Control mean(SD): Baseline = 2.1(.9), Week 12 = 2.0(.9) Intervention, mean(SD): Baseline = 2.5(1.1), Week 12 = 1.6(.7) Mean difference at 12-weeks, B (95% CI): -.6(-1.0, -.2), p = .008 Baseline to 12-weeks effect size: Cohen's d = -.80, r = -.37	There was a negative intervention effect of decreased MVPA at 12-weeks. Intervention, % of time in MVPA, Mean(SD): Baseline = 1.3(1.0), Week 12 = 1.5(1.1) Control, % of time in MVPA, Mean(SD): Baseline = 1.1(.9), Week 12 = 3.1(3.2) 12-weeks Mean difference, B (95% CI): -1.3 (-2.5, -.1), p = .038 Baseline to 12-weeks effect size: Cohen's d = -1.89, r = -.69		

						physical activity you were doing? (Responses from 1 = never to 4 = more than once per week)	*No childcare: (Environment)* Control mean(SD): Baseline = 3.4(1.5), Week 12 = 4.0(1.3) Intervention, mean(SD): Baseline = 3.9(1.2), Week 12 = 3.3(1.3) Mean difference at 12-weeks, B (95% CI): -.7(-1.4, .0), p = .049 Baseline to 12-weeks effect size: Cohen's d = -.88, r = -.40 *No energy: (Memory)* Control mean(SD): Baseline = 3.5(.8), Week 12 = 3.8(.7) Intervention, mean(SD): Baseline = 3.6(.9), Week 12 = 3.2(.9) Mean difference at 12-weeks, B (95% CI): -.5(-1.0, -.1), p = .017 Baseline to 12-weeks effect size: Cohen's d = -.82, r = -.38 *No motivation: (Intentions)* Control mean(SD): Baseline = 3.4(.7), Week 12 = 3.6(1.0) Intervention, mean(SD): Baseline = 3.5(.9), Week 12 = 3.2(.9) Mean difference at 12-weeks, B (95% CI): -.4(-.8, .1), p = .123 Baseline to 12-weeks effect size: Cohen's d = -.62, r = -.30 *Do not have time: (Environment)* Control mean(SD): Baseline = 3.7(1.0), Week 12 = 4.2(.8) Intervention, mean(SD): Baseline = 3.4(.9), Week 12 = 3.3(.9) Mean difference at 12-weeks, B (95% CI): -.6(-1.0, -.2), p = .005 Baseline to 12-weeks effect size: Cohen's d = -.63, r = -.3			

							Physical activity goal setting & monitoring: (Behavioural Regulation) Control mean(SD): Baseline = 2.3(.9), Week 12 = 2.3(.8) Intervention, mean(SD): Baseline = 2.5(.9) Week 12 = 2.9(.7) Mean difference at 12-weeks, B (95% CI): .4(.0, .8), p = .034 Baseline to 12-weeks effect size: Cohen's d = .44, r = .22			
(Thompson et al., 2023)	USA	Total n = 41; intervention n = 19, observation n = 22 *M*Age (years): Total = 30.9 (SD = 5.8), Intervention = 30.5 (SD = 5.0), Observation = 31.2 (SD = 6.6) Ethnicity: Total = 90.2% Hispanic, 75.7% Mexican descent, 7.3% African American or Black Non-Hispanic, 2.4% White Non-Hispanic; Intervention = 89.5% Hispanic, 70.6% Mexican descent, 10.5% African American or Black Non-Hispanic, .0% White Non-Hispanic Observation = 90.9% Hispanic, 80.0% Mexican descent, 4.5% African American or Black Non-Hispanic,	**Pilot feasibility randomized trial** Duration: 12-weeks Time of assessments: baseline, 12-weeks Intervention: Participants received a multi-component intervention with the overall goal to reduce postpartum weight retention. Components were monthly in person visits (baseline, 4-weeks, 8-weeks) supported by an electronic counseling support tool and motivational interviewing, text messages, a Facebook support group, self-monitoring, and phone coaching. Participants complete a questionnaire from the HeartSmartMoms app which generated the HeartPrint, which was an individually tailored handout that highlighted health behaviours, specifically healthy eating and physical activity.	Social cognitive theory BCTs: N/A	*Self-report:* An adapted version of the Pregnancy Physical Activity Questionnaire (PPAQ) (Chasan-Taber et al., 2004)	*Readiness to change (Intentions):* Measured with 3-items that rated intentions to change behaviours to lose weight, eat healthy, and be active. *Self-efficacy (Beliefs about Capabilities):* Self-efficacy to follow healthy habits was measured with the Exercise Confidence Survey (subscales: "sticking to it" (n = 8 items) and "making time" (n = 3 items))	*Self-efficacy:* There was a statistically significant difference in change in the sticking to it physical activity scale but not for the making time for exercise scale. Sticking to it: Change from baseline to 12-weeks, mean(SD): Intervention = .4(1.0), Control = -.5(.9); p<.01 Making time for exercise: Change from baseline to 12-weeks, mean(SD): Intervention = .0(.8), Control = -.3(1.0); p = .31 Unknown baseline *SD, unable to calculate effect size.* *Readiness for change:* There was a significant difference in change of readiness to change current level of physical activity (p = .01). There was a greater increase in the intervention group (85.7%) compared to the control group (27.3%).	*Self-report:* There was no significant difference in change of LPA or MVPA between the groups LPA (volume; MET hours / week) Change in LPA from baseline to 12-weeks, mean(SD): Intervention = 19.7(44.1), control = -13.9(56.9); p = .07 MVPA (volume; MET hours / week) Change in MVPA from baseline to 12-weeks, mean(SD): Intervention = 18.9(115.5), control = -31.5(160.9); p = .32 Unknown baseline SD, unable to calculate effect size.	N/A	5/13 (High)

		4.5% White Non-Hispanic MBMI at baseline: Total = 32.5(4.7), Intervention = 31.8(4.3), Observation = 33.2(5.0) Time postpartum: 3- to 12-months Baseline activity status: N/A Sample parity: Number of children (mean(SD)): Total = 2.7(1.3), Intervention = 2.5(1.2), Observation = 2.9(1.4) Concomitant health issue: BMI 25 to 50 kg/m^2	They received pedometers to encourage self-monitoring. Text messages were mainly unidirectional that were based on the Diabetes Prevention Program (Fischer et al., 2016). Participants reported their weight and weekly step count weekly. In the Facebook support group, a research educator and registered dietitian posted information about nutrition, physical activity, and healthy recipes. Participants could receive weekly phone coaching about behaviour changes *Prescribed FITT of PA:* Participants were encouraged to monitor their step count with a pedometer. Control: Participants received usual postpartum care as well as a packet of written materials that focused on weight-related health recommendations. They were offered to meet with a registered dietitian after the 12-week data collection was complete.				PreAction Intervention, n(%): Baseline = 12(75.0), 12-weeks = 2(14.3); p <.01 Action Intervention, n(%): Baseline = 4(25.0), 12-weeks = 12(85.7) PreAction Control, n(%): Baseline = 15(71.4), 12-weeks = 16(72.7), p = 1.00 Action Control, n(%) = 6(28.6), 12-weeks = 6(27.3) p-value from repeated measures logistic regression with generalized estimation equations = .01 Unknown baseline SD, unable to calculate effect size.			
(Thomson et al., 2018)	USA	Total n = 54; intervention n = 24, control n = 30 *M*Age Total = 23.0(4.76) Pre-pregnancy *M*BMI = 29.2(8.18) Post-pregnancy *M*BMI = 31.6(7.73)	**Randomized controlled trial** Duration: 12-months Time of assessments: PA = 1-month, 6-months, and 12-months postpartum; psychosocial constructs = 1- and 12-months postpartum	Social cognitive theory Transtheoretical model Foundational elements from the Diabetes Prevention	*Self-report:* Modified version of the Pregnancy and Physical Activity Questionnaire. Modifications included small wording changes (e.g., driving or riding in a car vs driving or riding in a car or bus) and time frame adjustment (during this month vs during this	*Attitude* (Social/Professional Role and Identity)*:* Survey with 5-items including a mix of health topics such as diet, physical activity, weight gain, and chronic disease. The	No n's to calculate SDs and effect sizes *Attitudes:* Control, mean(95% Confidence limit): PM 1 = 1.00(.49, 2.05), PM 12 = 1.78(.79, 4.02)	*Self-report:* MVPA (volume; min/week): Control, mean(95% Confidence limit): PM 1 = 27.8 (17.32, 38.21), PM 6 = 49.5 (36.52, 62.56), PM 12 = 50.2 (37.5, 63.0) Intervention: PM 1 = 39.8 (28.13, 51.49), PM 6 = 42.1 (26.78,	N/A	8/13 (High)

		Ethnicity: intervention = 95.8% African American, 4.2% White; control = 96.7% African American, 3.3% White Time postpartum: recruited at 14- and 19-weeks pregnant; receiving information at 6- 9- and 11-months postnatal visits Baseline activity status: During postpartum, few participants were classified as performing a moderate level of PA (5 or less participants at each of the 3 time points) and no participants performed at the high level (based on the algorithm from the 2005 Guidelines for Data Processing and Analysis of the International PA Questionnaire) Sample parity: Participants had one, two, or three children Concomitant health issue: N/A	Intervention: Participants in the intervention group, in addition to the PAT curriculum received by the control group, received a culturally tailored, maternal weight management with early childhood obesity prevention components. Mothers were educated on ways they can facilitate development of appropriate eating, physical activity, and other health behaviours in their children, including modeling these behaviours themselves. Participants could request and receive specific nutrition and physical activity information of interest to them. They received personal goal setting for physical activity and nutrition. Intervention components included appropriate weight gain during pregnancy and weigh management after pregnancy, nutrition and physical activity in gestational (mother) and postnatal (mother and infant) periods, breastfeeding, appropriate introduction of solid foods, parental modeling of positive health behaviours. Participants received information about postnatal maternal physical activity at 6-, 9-, and 11-month postnatal visits.	Program including a flexible, culturally sensitive, individualized educational curriculum taught on a one-to-one basis.	trimester) to make the instrument more relevant to the participants who were rural, southern women and the Delta Healthy Sprouts study design.	item "How important is it for you to be physically active/exercise daily?" was analyzed separately. Scored: 1 = not at all important, 2 = somewhat important, 3 = very important. *Outcome expectations (Beliefs about Consequences):* Survey with 5-items using 6 agreement responses ranging from 1 = strongly disagree to 6 = strongly agree. Higher scores indicated higher expectations of the benefits of physical activity. *Self-efficacy (Beliefs about Capabilities):* Survey with 5-items assessed with 5 confidence statements ranging from 1 = not confident to 5 = extremely confident. *Social support (family and friends) (Social Influences):* Survey with 5-items using 5 confidence statements ranging from 1 = not confident to 5 = extremely confident.	Intervention, mean(95% Confidence limit): 2.43(1.01, 5.86), 1.10(.47, 2.59) P-value (arm, time, int) = .427, .067, .016 *Expectations:* Control, mean(95% Confidence limit): PM 1 = 26.8(25.6, 28.0), PM 12 = 27.0(25.6, 28.4) Intervention, mean(95% Confidence limit): PM 1 = 27.5(26.1, 28.8), PM 12 = 27.0(25.6, 28.5) P-value (arm, time, int) = .606, .878, .656 *Self-efficacy:* Control, mean(95% Confidence limit): PM 1 = 9.3(7.7, 11.0), PM 12 = 9.0(7.2, 10.8) Intervention, mean(95% Confidence limit): PM 1 = 11.0(9.2, 12.8), PM 12 = 9.4(7.5, 11.4) P-value (arm, time, int) = .240, .285, .509 *Social support family:* Control, mean(95% Confidence limit): PM 1 = 21.0(19.1, 22.9), PM 12 = 20.3(18.2, 22.3) Intervention, mean(95% Confidence limit): PM 1 = 21.9(19.8, 24.0), PM 12 = 20.1(17.9, 22.4) P-value (arm, time, int) = .696, .240, .601 *Social support friends:*	57.34), PM 12 = 40.1 (25.08, 55.20) There was a significant time effect but pairwise tests failed to reach statistical significance P-value (arm, time, Int) = .785, .043, .075 No n's to calculate SDs and effect sizes		

			Prescribed FITT of PA: Participants were encouraged to do daily PA. They set individualized goals. Unknown intensity, type, time. Control: Participants followed the nationally recognized, evidence-based, Parents and Teachers(R). This program includes one-on-one home visits, optional monthly group meetings developmental screenings, and a resource network for families. It seeks to increase parental knowledge of child development, improve parenting practices, provide early detection of developmental delays, prevent child abuse, and increase school readiness.			*Barriers (Environmental Resources and Context):* Survey with 7-items using 6 agreement responses ranging from 1 = strongly disagree to 6 = strongly agree. Higher score indicated more perceived barriers.17 From Carlson et al., 2012; Oayashi et al., 1995 ; Sallis et al., 1987 ; Sallis et al., 1988	Control, mean(95% Confidence limit): PM 1 = 18.2(16.8, 19.6), PM 12 = 18.6(17.1, 20.1) Intervention, mean(95% Confidence limit): PM 1 = 20.6(19.0, 22.1), LM 12 = 19.5(17.9, 21.2) P-value (arm, time, int) = .034, .666, .341 *Barriers:* Control, mean(95% Confidence limit): PM 1 = 20.6(18.1, 23.2), PM 12 = 22.4(19.6, 25.3) Intervention, mean(95% Confidence limit): PM 1 = 20.0(17.1, 22.9), PM 12 = 19.2(16.1, 22.3) P-value (arm, time, int) = .174, .725, .358			
(van der Pligt, 2015; van der Pligt et al., 2018)	Australia	Total n = 119; intervention n = 28, control 1 n = 48, control 2 n = 43 *M*age: intervention = 33.2(3.54), control 1 = 32.4(4.23), control 2 = 32.9(4.38) *M*BMI (kg/m2): intervention = 26.0(4.64), control 1 = 25.4(5.24), control 2 = 24.9(4.71) Ethnicity: intervention = 77.5% Australia born, 2.5% UK born, 20.0% other; control 1 = 78.3% Australia born, 1.7% UK born, 20.0%	**Nonrandomised pilot study** Duration: 9-months Time of assessments: baseline (9-months postpartum), 18-months postpartum Intervention: Participants received 1) a brochure including PA recommendations for Australian adults; 2) a pedometer, 3) a tape measure and instructions for self-monitoring of waist circumference, 4) a SMART goal setting chart for weight and/or lifestyle behaviour goals, 5) a pocket calorie counter book including nutritional information	Social cognitive theory with evidence-based behaviour change components, including self-monitoring, feedback, and goal setting.	*Self-report:* Australian Institute of Health and Welfare's Active Australia Survey	*Beliefs about capabilities:* PA-related self-efficacy was evaluated with one item assessing the perceived confidence in making multiple PA choices in the next 12-months. Perceived confidence was measured on a 5-point rating scale of 1 = not at all confident to 5 = extremely confident for various PA-related practices.	*Self-report:* Total PA (min/week) Baseline: intervention = 349.46(273.92); control 1 = 405.08(345.23); control 2 = 288.02(275.07) 9-months follow-up: intervention = 363.21(248.83); control 1 = 387.29 (307.48); control 2 = 289.52 (230.90) Control 1 β-coef: −30.17(−147.18, 86.84), p = 0.606 Control 2 β-coef: −58.40(−165.57, 48.77), p = 0.278 Baseline to 9-months (Intervention/Control 1): Cohen's d = .10, r = .05	*Beliefs about capabilities:* Baseline mean(SD): intervention = 2.99(.91); control 1 = 2.68(.82); control 2 = 2.75(.92) 9-months follow-up mean(SD): intervention: intervention = 2.76(.80); control 1 = 2.67(.80), control 2 = 2.72(.71) Control 1 β-coef: .03(-.24, .30), p = .814 Control 2 β-coef: -.01(-.26, .25), p = .94 Baseline to 9-months (Intervention/Control 1): Cohen's d = -.25, r = -.12	N/A		1/9 (Low)

		Other; control 2 = 76.7% Australia born, 3.3% UK born, 20.0% Other Time postpartum: 9-12 months Baseline activity status: MPA: intervention = 29.29(47.29)min/week; control 1 = 40.64(85.83)min/week; control 2 = 27.21(62.08)min/week Sample parity: First time mothers Concomitant health issue: N/A	for Australian food products, and 6) a detailed instruction manual to assist using the online Calorieking program. Resources were adapted to women from a previous weight-loss intervention for adult males. Calorieking includes a behaviour therapy website that provides tools to assist individuals in improving diet and PA. One month into the program, participants had the option to pay for and download an iPhone only app for the program. Participants received 3 x one-on-one telephone calls with a dietitian at baseline, 3- and 6-months. Calls lasted 30min and were tailored to the individual (motivational interviewing, health coaching strategies). Goals were set and discussed pertaining to diet and PA, such as reducing sitting time when at home or work, increasing incidental exercise, and exploring options to increase planned walking or structed exercise. Group support was optional with an online discussion board for the study duration. *Prescribed FITT of PA:* Participants recommended to meet the Australian PA guidelines. No information on specifics of these guidelines.				Walking (min/week) Baseline: intervention = 206.61(161.14), control 1 = 259.96 (193.89); control 2 = 211.63(193.80) 9-months follow-up: intervention = 207.68(149.58); control 1 = 264.46(221.03); control 2 = 180.78(154.54) Control 1 β-coef: 31.91(−54.99, 118.80), p = 0.463 Control 2 β-coef: −49.91(−116.12, 16.30) p = 0.136 Baseline to 9-months (Intervention/Control 1): Cohen's d = - .04, r = -.02 Moderate PA (min/week) Baseline: intervention = 29.29(47.29); control 1 = 40.64 (85.83), control 2 = 27.21(62.08) 9-months follow-up: intervention = 55.36(89.79); control 1 = 54.05(115.72); control 2 = 28.06(53.63) Control 1 β-coef: −20.13(−73.64, 33.38), p = 0.452 Control 2 β-coef: −19.27(−63.56, 25.03), p = 0.385 Baseline to 9-months (Intervention/Control 1): Cohen's d = .18, r = .09 Vigorous PA (min/week) Baseline: intervention = 113.57(163.09); control 1 =			

			Control: Participants were taking part in the 3-year Melbourne inFANT Extend RCT. Control 1 participants were in the control arm and received usual care as part of the Maternal and Child Health system in Victoria, Australia. They also received mailed newsletters with information regarding baby's health. Control 2 participants were in the intervention arm. They received 6 x 2hour group sessions delivered by a dietitian from 3-months to 18-months postpartum. Sessions focused on child feeding, active play, screen time alternatives, parent modelling, child-focussed PA and sedentary behaviors. They had group discussions with a Dietician (e.g., 'colour every meal with fruit and veg', 'eat together play together' and 'parents provide, kids decide'. Participants also received a DVD and written information on each topic.				107.40(171.74); control 2 = 49.19(76.16) 9-months follow-up: intervention = 100.18(111.94); control 1 = 82.37(103.64), control 2 = 75.31(79.36) Control 1 β-coef: -21.56(−68.37, 25.23), p = 0.358 Control 2 β-coef: −17.46(−58.13, 23.20), p = 0.391 Baseline to 9-months (Intervention/Control 1): Cohen's d = .07, r = .04			
(Watson et al., 2005)	Australia	Total n = 108; intervention n = 60, control n = 48 *M*Age (years): intervention = 29.6, control = 29.2 Ethnicity: intervention = 80.0% Australian	**Quasi-experimental study** Duration: 6-months Time of assessments: baseline, 6-months Intervention:	N/A BCTs: N/A	*Self-report:* Physical activity was measured with an adapted version of the 1999 National Physical Activity Survey. Adequate activity was defined as 150-minutes of physical activity	*Social support (Social Influences):* Social contacts were measured with questions adapted from those used in a Finnish study of social connections and	*Social support:* There were no significant differences between groups at baseline or follow-up for frequency of social contact, size of social networks, or attendance at clubs and associations.	No baseline SDs, unable to calculate effect size *Self-report:* MPA (frequency, volume; min/week) Times moderate last week:	N/A	3/9 (Low)

		born, control = 79.2% Australian born Time postpartum: Up to 6-months Age of baby in weeks, mean: intervention = 10.8, control = 11.0 Baseline activity status: Mean activity of participants was under 150-minutes of moderate to vigorous PA in a week Sample parity: Number of children, mean: intervention = 1.6, control = 1.5 Concomitant health issue: N/A	Participants were invited to join pram walking groups. They were held once a week in various locations, approximately 1-hour. They were led by a project officer. Routes were planned with consideration of the following: width and condition of the pay, road crossings on the route, accessibility by public transport, aesthetic nature of the route, presence of clean toilets and shade or shelter with a seat for feeding, preferably a starting point. After 3-months, participants were invited to join leadership training with the hopes they would take on leading through group after completion of the intervention. *Prescribed FITT of PA:* Once a week, walking for one hour. Unknown intensity. Control: Participants were invited to join the pram walking groups 6-months later.		accrued over the past week on at least 5 separate sessions of activity. Vigorous activity was weighted by a factor of two	mortality with an additional item on satisfaction with social contact	Participants visited friends or relatives on average once a week and went to 5-6 different homes each month. Participants received fewer visits and phone calls per day after giving birth (intervention $X^2 = 8.7$, $p = .003$, control $X^2 = 8.1$, $p = .004$). There was no difference between groups in satisfaction with social contact at baseline. At follow-up, significantly more intervention participants were satisfied with their social contacts (36.7%, 95% CI: 23.1, 50.3) compared to control participants (18.8%, 95% CI: 8.9, 28.7) ($X2 = 4.18$, $p = .041$). There was no significant change in very satisfied with social contact from baseline to follow-up in the intervention group. In the control group, there was a significant decrease in participants who were very satisfied with their social contacts from baseline (35.4%, 95% CI: 21.9, 48.9) to follow-up (18.8%, 95% CI: 8.9, 28.7)($X^2 = 13.9$, $p < .001$) Overall non-significant since there wasn't a significant change from baseline to follow-up in the intervention group.	Intervention: Baseline = .6, Follow-up = .5 Control: Baseline = .3, Follow-up = .3 Minutes moderate last week: Intervention: Baseline = 26.2, Follow-up = 17.7 Control: Baseline = 13.1, Follow-up = 8.4 VPA (frequency, volume; min/week) Time vigorous last week: Intervention: Baseline = .5, Follow-up = 1.2 ($p = .04$) Control: Baseline = .7, Follow-up = .7 Minutes vigorous last week: Intervention: Baseline = 23.1, Follow-up = 49.8 Control: Baseline = 30.9, Follow-up = 28.5 Walking (frequency, volume; min/week) Times walked last week: Intervention: Baseline = 3.4, Follow-up = 4.4 Control: Baseline = 2.8, Follow-up = 3.4 Minutes walked last week: Intervention: Baseline = 135.5, Follow-up = 165.0 Control: Baseline = 88.6, Follow-up = 137.0 ($p = .02$)		

								No participants chose to take the walking group leaders' training course. Participation in the pram walking groups slowly dropped over the 6-months after the withdrawal off the project officer who was originally leading the walks. 42% joined a pram walking group less than once a month and 23% didn't attend a walking group. In the beginning, nearly 40 participants joining a walking group however after a month, this number dropped below 25 for the remaining months. There was no significant increase in intervention participants classified as performing adequate physical activity between baseline (33.3%, 95% CI: 21.7-46.7) and follow-up (43.3%, 95% CI: 30.6-56.8). There also wasn't a significant increase in control participants between baseline (22.9%, 95% CI: 12.0-37.3) and follow-up (35.4%, 95% CI: 22.2-50.5). There was no significant difference in physical activity participation at baseline or follow-up between the groups.		

Supplemental Material 4 Risk of Bias and Analysis

Risk of Bias

Risk of bias assessment was conducted using the Joanna Briggs Institute critical appraisal tools (Tufanaru et al., 2020). The Checklist for RCTs includes 13 questions related to randomization, concealment, baseline measures, blinding, external factors, follow up, analysis, outcome measure, analysis, and study design. At the end of the checklist, the researcher provides an overall appraisal of include, exclude, or seek further info. The Checklist for Quasi-Experimental Studies (Non-Randomized Experimental Studies) includes nine questions related to the cause and effect, baseline measures, external factors, control group, outcome measures, follow up, and statistical analysis. At the end of the checklist, the researcher provides an overall appraisal of include, exclude, or seek further info. Both checklists include explanations as to why researchers would answer yes, no, unclear, or not applicable for each question. Risk of bias was assessed independently by two researchers (HH and ST) and disagreements between judgments were resolved by a third researcher. The overall risk of bias of a study was defined as high risk when more than one-third of the factors (RCTs: $\geq$5 of 13 factors; quasi-experimental >3 of 9 factors) were deemed high risk. The results were grouped in a sub-analysis by quality in order to evaluate whether this was a moderator of the findings.

Analysis

Results were first categorized by mediator domain (i.e., 1) knowledge, 2) skills, 3) social/professional role and identity, 4) beliefs about capabilities, 5) optimism, 6) beliefs about consequences, 7) reinforcement, 8) intentions, 9) goals, 10) memory, attention and decision processes, 11) environmental context and resources, 12) social influences, 13) emotion, and 14) behavioural regulation. Next, they were divided into the four mediation paths (See Figure 1) of:

1) the relationship between the intervention and the mediator (i.e., Path A), 2) the relationship between the mediator and PA (i.e., Path B), 3) the relationship between the intervention and PA (i.e., Path C), and 4) the relationship between the intervention and PA after controlling for the mediator (i.e., Path C'). Themes were created whereby at least two studies within the same domain investigate a similar pathway (i.e., Path A, B, C, or C') (Rhodes, Zhang, et al., 2020). Due to the heterogeneity across interventions (e.g., length and mode of delivery) and outcome measure instruments for each domain, we decided not to conduct a meta-analysis and instead provided summaries of effect estimates for each domain and type of PA outcome (McKenzie & Brennan, 2019).

Findings were grouped by PA outcome (i.e., MVPA, total PA, walking, light PA, MSE, PFMT). When multiple PA outcomes were present in the same study, we prioritized device-measured (i.e., accelerometer) PA outcomes over self-report PA outcomes and PA volume (e.g., minutes per week) over frequency (e.g., times per week), duration (e.g., minutes per session) and percentage of PA time (e.g., percentage of PA time spent in MVPA). We also included an omnibus PA category which included data from papers that did not report MVPA but did report total PA.

Once studies were categorized by domain, path, and PA outcome, the results of each theme were collated and statistical significance was set to $p < .05$. For each theme (i.e., where at least two studies tested the same domain, path, and PA outcome) mean differences for each continuous outcome between intervention and control group were examined. The median effect size (ES) and interquartile range for each domain, path, and PA outcome were presented. Effect sizes represented the standardized mean difference between the change in outcomes of the intervention group compared to the control group. With this calculation, the baseline standard deviations were used for the pooled standard deviation. RStudio was used to calculate the standardized mean difference ES (i.e., Cohen's d) which was subsequently converted to Pearson's R with an online ES conversion calculator (https://www.escal.site/). If multiple measurements are taken of the same domain of putative mediator outcome, we coded the one with the largest ES.

Additional Analyses

In studies where multiple measurements were taken of the same domain of putative mediator outcome, if 50% or more of the tests in a given category were significant, the paper was deemed significant (Rhodes, Zhang, et al., 2020). As per the Sallis and colleagues (2000) rubric for determining the impact and consistency of findings, themes were considered to a) have a positive pathway (+) if more than 59% of studies report a positive significant effect, b) have a negative pathway (-) if more than 59% of studies report a negative significant effect, c) be inconclusive (?) if 34%-59% of studies find a significant effect, d) are non-significant (ns) if less than 34% of studies showed a significant effect. If fewer than two studies examined a path, the evidence strength was not assessed but the results were represented in Supplemental Table 1.

Supplemental Material 5 Risk of Bias Analysis

Supplemental Table 2

Risk of Bias Analysis for Randomized Controlled Trials

Article	1. Was true randomization used for assignment of participants to treatment groups?	2. Was allocation to treatment groups concealed?	3. Were treatment groups similar at baseline?	4. Were participants blind to treatment assignment?	5. Were those delivering treatment blind to assignment?	6. Were treatment groups treated identically other than the intervention of interest?	7. Were outcome assessors blind to treatment assignment?	8. Were outcomes measured in the same way for treatment groups?	9. Were outcomes measured in a reliable way?	10. Was follow-up complete and if not, were differences between groups in terms of their follow-up adequately described and	11. Were participants analyzed in the groups to which they were randomized?	12. Was appropriate statistical analysis used?	13. Was the trial design appropriate and any deviations from the standard RCT design (individual randomization, parallel groups) accounted for in the conduct and analysis of the trial?	HR	Overall Appraisal

										analyzed ?					
(Albright et al., 2019)	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	3	Low
(Berry et al., 2016)	Unclear	Unclear	No	No	No	Yes	Yes	Yes	Yes	No	Yes	No	Yes	7	High
(Bick et al., 2020)	Yes	Yes	Unclear	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	4	Low
(Burkart et al., 2020)	Unclear	Unclear	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	5	High
(Cramp & Brawley, 2006)	Unclear	Unclear	Yes	No	No	Yes	Unclear	Yes	Yes	No	No	No	Yes	8	High
(Cramp & Brawley, 2009)	Unclear	Unclear	Yes	No	No	Yes	Unclear	Yes	Yes	No	No	No	Yes	8	High
(Daley et al., 2015)	Yes	Yes	Yes	No	No	No	No	Yes	Yes	Yes	Yes	No	Yes	5	High
(Daley et al., 2020)	Yes	Yes	Unclear	No	No	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	4	Low
(Daley et al., 2008)	Yes	Unclear	Unclear	No	No	No	Unclear	Yes	Yes	No	Yes	Yes	Yes	7	High

(deRosset et al., 2013)	Unclear	No	Unclear	No	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	6	High
(Fjeldsoe et al., 2013)	Unclear	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	5	High
(C. Keller et al., 2014)	Yes	Unclear	Unclear	No	No	Yes	Unclear	Yes	Yes	No	No	Unclear	Yes	8	High
(Kernot et al., 2019)	Yes	Yes	Unclear	No	No	Yes	No	Yes	Yes	No	Yes	Yes	Yes	5	High
(LeCheminant et al., 2014)	Yes	Unclear	Yes	No	No	Yes	No	Yes	Yes	Unclear	Yes	No	Yes	6	High
(A. S. Lee et al., 2016)	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	No	Yes	Yes	4	Low
(Mailey & Hsu, 2019)	Yes	Unclear	Yes	Yes	No	Yes	Unclear	Yes	Yes	Yes	No	No	Yes	5	High
(Mesk et al., 2022)	Yes	No	Yes	No	No	Yes	No	Yes	Yes	No	No	Yes	Yes	6	High
(Napolitano et al., 2021)	Yes	Yes	Unclear	No	No	Yes	Unclear	Yes	Yes	Yes	No	Yes	Yes	5	High

(Nicklas et al., 2014)	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	Unclear	Yes	4	Low
(Norman et al., 2010)	Yes	Yes	No	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	5	High
(O'Reilly et al., 2016)	Yes	Yes	Yes	No	No	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	3	Low
(Rhodes, Blanchard, et al., 2021)	Yes	Yes	Unclear	No	No	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	4	Low
(Teychenne et al., 2021)	Yes	Yes	Unclear	No	No	Yes	Unclear	Yes	Yes	No	No	Yes	Yes	6	High
(Thompson et al., 2023)	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	No	Yes	No	Yes	5	High
(Thomson et al., 2018)	Unclear	Unclear	Yes	No	No	Yes	No	Yes	Yes	Unclear	No	No	Yes	8	High

Supplemental Table 3

Risk of Bias Analysis for Quasi-Experimental Trials

Article	1. Is it clear in the study what is the ‘cause’ and what is the ‘effect’ (i.e. there is no confusion about which variable comes first)?	2. Were the participants included in any comparisons similar? (i.e., at baseline)	3. Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	4. Was there a control group?	5. Were there multiple measurements of the outcome both pre and post the intervention/exposure?	6. Was follow up complete and if not, were differences between groups in terms of their follow up adequately described and analyzed?	7. Were the outcomes of participants included in any comparisons measured in the same way?	8. Were outcomes measured in a reliable way?	9. Was appropriate statistical analysis used?	HR	Overall Appraisal
(Bashirian et al., 2020)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	2	Low
(Kim et al., 2021)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Unclear	2	Low

(van der Pligt et al., 2018)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	1	Low
(Watson et al., 2005)	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Unclear	3	Low

Supplemental Material 6 Results for MVPA, Total PA, Walking, and Light PA

Moderate- to Vigorous-Intensity Physical Activity

Path A. Eighteen articles reported Path A and the median effect sizes were small for beliefs about consequences (Median r = .14; IQR: .01, .32), behavioural regulation (Median r = .25, IQR: .22, .30), and intentions (Median r = -.24; IQR: -.27, .01); and very small for knowledge (Median r = .09; IQR: -.14, .32), beliefs about capabilities (Median r = .03; IQR: -.07, .18), environmental context and resources (Median r = .02; IQR: -.07, .14), social influences (Median r = .02; IQR: -.09, .14), and emotions (Median r = -.05; IQR: -.14, .02).

There was a significant positive pathway for behavioural regulation and inconclusive pathways for knowledge, beliefs about capabilities, beliefs about consequences, and intentions. The pathways for environmental context and resources, social influences, and emotion were non-significant.

Path B. Two articles reported Path B and the median effect sizes were small for beliefs about capabilities (Median r = .23; IQR: .16, .29), beliefs about consequences (Median r = .24; IQR: .12, .35), social influences (Median r = .22; IQR: .21, .24), and environmental context and resources (Median r = -.16; IQR: -.25, -.08). This significance of all pathways was inconclusive.

Path AB. Two articles reported Path AB and the median effect sizes were very small for beliefs about capabilities (Median r = .08; IQR: .04, .11), beliefs about consequences (Median r = .02; IQR: .01, .02), environmental context and resources (Median r = .01, IQR: .01, .01), and social influences (Median r = .08, IQR: .07, .10). All pathways were non-significant.

Path C'. Two articles reported Path C' for beliefs about consequences and the pathway was non-significant.

Supplemental Table 4

Mediation Paths A, B, and AB for MVPA

	Path A (effect size r) Median(IQR) (n = 18)	Path A (p-value) (n = 24)	Path B (effect size r) Median (IQR) (n = 2)	Path B (p-value) (n = 2)	Path AB (effect size r) Median (IQR) (n = 2)	Path AB (p-value) (n = 2)
Knowledge	.09(-.14, .32)[1,2]	(?)[1,2]	NA	NA	NA	NA
Skills	NA	NA	NA	NA	NA	NA
Social/professional role and identity	NA	NA	NA	NA	NA	NA
Beliefs about capabilities	.03(-.07, .18)[1,3–10,28]	(?)[1,3–10,13–17,28]	.23(.16, .29)[3,9]	(?)[3,9]	.08(.04, .11)[3,9]	(ns)[3,9]
Optimism	NA	NA	NA	NA	NA	NA

Beliefs about consequences	.14(.01, .32)[2,3,5,7,9,18]	(?)[2,3,5,7,9,13,18]	.24(.12, .35)[3,9]	(?)[3,9]	.02(.01, .02)[3,9]	(ns)[3,9]
Reinforcement	NA	NA	NA	NA	NA	NA
Intentions	-.24(-.27, .01)[1,2,7]	(?)[1,2,8,17]	NA	NA	NA	NA
Goals	NA	NA	NA	NA	NA	NA
Memory, attention and decision processes	NA	NA	NA	NA	NA	NA
Environmental context and resources	.02(-.07, .14)[1–3,6,9]	(ns)[1–3,6,9,13]	-.16(-.25, -.08)[3,9]	(?)[3,9]	.01(.01, .01)[3,9]	(ns) [3,9]
Social influences	.02(-.09, .14)[1–3,9,10,19]	(ns)[1–3,9,10,13,16,19,21]	.22(.21, .24)[3,9]	(?) [3,9]	.08(.07, .10) [3,9]	(ns)[3,9]
Emotion	-.05(-.14, .02)[1,8,10,11,19,22–24]	(ns)[1,8,10,15,16,19,22,23,25,26]	NA	NA	NA	NA

Behavioural regulation	.25(.22, .30)[1,6,7,18,27]	(+)[1,6,7,16,18,27]	NA	NA	NA	NA

Notes:

(+) = more than 59% of studies report a significant positive effect (p <.05).

(-) = more than 59% of studies report a significant negative effect (p <.05).

(?) = 34%-59% of studies find a significant effect in each direction (inconclusive)

(ns) = less than 34% of studies showed an effect in each direction (unremarkable)

NA = not applicable due to inadequate studies available to assess the summary effect

See Appendix A Supplemental Material 7 for a reference list of all included articles

Total Physical Activity

Path A. Eight articles reported Path A and the median effect sizes were small for emotions (Median r = -.17; IQR: -.26, -.09) and behavioural regulation (Median r = .22; IQR: 0, .27), very small for beliefs about capabilities (Median r = .07; IQR: -.06, .15), and negligible for social influences (Median r = 0; IQR: -.18, .30). There was a significant positive pathway for behavioural regulation and the remaining pathways (beliefs about capabilities, social influences, and emotion) were non-significant.

Supplemental Table 5

Mediation Paths A, B, and AB for Total PA

	Path A (effect size r) (n = 8)	Path A (p-value) (n = 9)
Knowledge	NA	NA
Skills	NA	NA
Social/professional role and identity	NA	NA
Beliefs about capabilities	.07(-.06, .15)[1,4,10–12,28]	(ns)[1,4,10–12,14,15]
Optimism	NA	NA
Beliefs about consequences	NA	NA
Reinforcement	NA	NA
Intentions	NA	NA
Goals	NA	NA
Memory, attention and decision processes	NA	NA
Environmental context and resources	NA	NA

Social influences	0(-.18, .30)[1,10,20]	(ns)[1,10,20]
Emotion	-.17(-.26, -.09)[1,11,20,24]	(ns)[1,10,11,15,20,24]
Behavioural regulation	.22(0, .27)[1,20,24]	(+)[1,20,24]

Notes:

(+) = more than 59% of studies report a significant positive effect (p <.05).

(-) = more than 59% of studies report a significant negative effect (p <.05).

(?) = 34%-59% of studies find a significant effect in each direction (inconclusive)

(ns) = less than 34% of studies showed an effect in each direction (unremarkable)

NA = not applicable due to inadequate studies available to assess the summary effect

See Appendix A Supplemental Material 7 for a reference list of all included articles

Walking

Path A. Six articles reported Path A and the median effect sizes were small for social influences (Median r = -.12; IQR: -.24, .16); and very small for beliefs about capabilities (Median r = -.04; IQR: -.10, .11) and emotions (Median r = -.06; IQR: -.19, -.05). The pathway significance was inconclusive for social influences and the remaining pathways (beliefs about capabilities and emotion) were non-significant.

Supplemental Table 6

Mediation Paths A, B, and AB for Walking

	Path A (effect size r) (n = 6)	Path A (p-value) (n = 7)
Knowledge	NA	NA
Skills	NA	NA
Social/professional role and identity	NA	NA
Beliefs about capabilities	-.04(-.10, .11)[4,9,10,28]	(ns)[4,9,10]
Optimism	NA	NA
Beliefs about consequences	NA	NA
Reinforcement	NA	NA
Intentions	NA	NA
Goals	NA	NA
Memory, attention and decision processes	NA	NA

Environmental context and resources	NA	NA
Social influences	-.12(-.24, .16)[9,10,19]	(?)[9,10,19,21]
Emotion	-.06(-.19, -.05)[19,22]	(ns)[10,19,22,26]
Behavioural regulation	NA	NA

Notes:

(+) = more than 59% of studies report a significant positive effect (p <.05).

(-) = more than 59% of studies report a significant negative effect (p <.05).

(?) = 34%-59% of studies find a significant effect in each direction (inconclusive)

(ns) = less than 34% of studies showed an effect in each direction (unremarkable)

NA = not applicable due to inadequate studies available to assess the summary effect

See Appendix A Supplemental Material 7 for a reference list of all included articles

Light-Intensity Physical Activity

Path A. Three articles measured Path A and the median effect size was very small for emotions (Median ES = .03; IQR: 0, .22). There was a significant positive pathway for beliefs about capabilities and the pathway for emotion was non-significant.

Supplemental Table 7

Mediation Paths A, B, and AB for Light PA

	Path A (effect size r) (n = 3)	Path A (p-value) (n = 6)
Knowledge	NA	NA
Skills	NA	NA
Social/professional role and identity	NA	NA
Beliefs about capabilities	NA	(+)[8,14,15,17]
Optimism	NA	NA
Beliefs about consequences	NA	NA
Reinforcement	NA	NA
Intentions	NA	NA
Goals	NA	NA

Memory, attention and decision processes	NA	NA
Environmental context and resources	NA	NA
Social influences	NA	NA
Emotion	.03(0, .22)[8,19,25]	(ns)[8,15,19,25]
Behavioural regulation	NA	NA

Notes:

(+) = more than 59% of studies report a significant positive effect (p <.05).

(-) = more than 59% of studies report a significant negative effect (p <.05).

(?) = 34%-59% of studies find a significant effect in each direction (inconclusive)

(ns) = less than 34% of studies showed an effect in each direction (unremarkable)

NA = not applicable due to inadequate studies available to assess the summary effect

See Appendix A Supplemental Material 7 for a reference list of all included articles

Supplemental Material 7 Reference List of Included Studies

1. Teychenne M, Abbott G, Stephens LD, et al. Mums on the Move: A pilot randomised controlled trial of a home-based physical activity intervention for mothers at risk of postnatal depression. *Midwifery*. 2021;93:102898. doi:10.1016/j.midw.2020.102898
2. Bashirian S, Ouji Z, Afshari M, Barati M, Heydarimoghadam R, Soltanian A. Effect of an educational intervention based on the BASNEF model on promoting physical activity among postpartum women. *Int Q Community Health Educ*. 2020;40(2):151-158. doi:10.1177/0272684X19858897
3. Albright CL, Wilkens LR, Saiki K, White KK, Steffen AD. Mediators of a 12-month change in physical activity in ethnically diverse sample of postpartum women. *Transl J Am Coll Sports Med*. 2019;4(19):215-224. doi:10.1249/TJX.0000000000000106
4. Bick D, Taylor C, Bhavnani V, et al. Lifestyle information and commercial weight management groups to support maternal postnatal weight management and positive lifestyle behaviour: the SWAN feasibility randomised controlled trial. *BJOG: An International Journal of Obstetrics & Gynaecology*. 2020;127(5):636-645. doi:10.1111/1471-0528.16043
5. Cramp AG, Brawley LR. Moms in motion: a group-mediated cognitive-behavioral physical activity intervention. *International Journal of Behavioral Nutrition and Physical Activity*. 2006;3(1):23. doi:10.1186/1479-5868-3-23
6. Mailey EL, Hsu WW. Is a general or specific exercise recommendation more effective for promoting physical activity among postpartum mothers? *J Health Psychol*. 2019;24(7):964-978. doi:10.1177/1359105316687627

7. Lee AS, McInnes RJ, Hughes AR, Guthrie W, Jepson R. The effect of the More Active MuMs in Stirling trial on body composition and psychological well-being among postnatal women. *Journal of Pregnancy*. 2016;2016:e4183648. doi:10.1155/2016/4183648

8. Daley AJ, Winter H, Grimmett C, McGuinness M, McManus R, MacArthur C. Feasibility of an exercise intervention for women with postnatal depression: a pilot randomised controlled trial. *Br J Gen Pract*. 2008;58(548):178-183. doi:10.3399/bjgp08X277195

9. Fjeldsoe BS, Miller YD, Marshall AL. Social cognitive mediators of the effect of the MobileMums intervention on physical activity. *Health Psychology*. 2013;32(7):729-738. doi:10.1037/a0027548

10. Daley AJ, Blamey RV, Jolly K, et al. A pragmatic randomized controlled trial to evaluate the effectiveness of a facilitated exercise intervention as a treatment for postnatal depression: the PAM-PeRS trial. *Psychological Medicine*. 2015;45(11):2413-2425. doi:10.1017/S0033291715000409

11. deRosset L, Berry D, Sanchez-Lugo L, et al. Mama Sana . . . Usted Sana: Lessons learned from a postpartum weight loss intervention for hispanic women with infants six months or less. *Hispanic Health Care International*. 2013;11(2):78-86.

12. Berry DC, Hall EG, Neal MN, Adatorwovor R, Schwartz TA, Stuebe A. Results of the optimizing outcomes in women with gestational diabetes mellitus and their infants, a cluster randomized, controlled pilot study: Lessons learned. *J Natl Black Nurses Assoc*. 2016;27(2):1-10.

13. Thomson JL, Tussing-Humphreys LM, Goodman MH, Landry AS. Enhanced curriculum intervention did not result in increased postnatal physical activity in rural, southern, primarily African American Women. *Am J Health Promot*. 2018;32(2):464-472. doi:10.1177/0890117117736090

14. Burkart S, Marcus BH, Pekow P, et al. The impact of a randomized controlled trial of a lifestyle intervention on postpartum physical activity among at-risk hispanic women: Estudio PARTO. *PloS one*. 2020;15(7):e0236408. doi:10.1371/journal.pone.0236408

15. LeCheminant JD, Hinman T, Pratt KB, et al. Effect of resistance training on body composition, self-efficacy, depression, and activity in postpartum women. *Scandinavian Journal of Medicine & Science in Sports*. 2014;24(2):414-421.

16. Napolitano MA, Harrington CB, Patchen L, et al. Feasibility of a digital intervention to promote healthy weight management among postpartum African American/Black women. *International Journal of Environmental Research and Public Health*. 2021;18(4):2178. doi:10.3390/ijerph18042178

17. Thompson DA, Haemer MA, Krebs NF, et al. A WIC-based behavior change intervention for postpartum women with overweight and obesity: A pilot feasibility randomized trial. *Health Promotion Practice*. Published online May 25, 2023:15248399231173704. doi:10.1177/15248399231173704

18. Cramp AG, Brawley LR. Sustaining self-regulatory efficacy and psychological outcome expectations for postnatal exercise: Effects of a group-mediated cognitive behavioural intervention. *British Journal of Health Psychology*. 2009;14(3):595-611. doi:10.1348/135910708X383732

19. Keller C, Ainsworth B, Records K, et al. A comparison of a social support physical activity intervention in weight management among post-partum Latinas. *BMC Public Health*. 2014;14(1):1-15. doi:10.1186/1471-2458-14-971

20. Kim SH, Kim HJ, Shin G. Self-management mobile virtual reality program for women with gestational diabetes. *International Journal of Environmental Research and Public Health*. 2021;18(4):1539. doi:10.3390/ijerph18041539

21. Watson N, Milat AJ, Thomas M, Currie J. The feasibility and effectiveness of pram walking groups for postpartum women in western Sydney. *Health Promotion Journal of Australia*. 2005;16(2):93-99. doi:10.1071/HE05093

22. Kernot J, Lewis L, Olds T, Maher C. Effectiveness of a facebook-delivered physical activity intervention for postpartum women: A randomized controlled trial. *Journal of Physical Activity and Health*. 2019;16(2):125-133. doi:10.1123/jpah.2017-0573

23. O'Reilly SL, Dunbar JA, Versace V, et al. Mothers after Gestational Diabetes in Australia (MAGDA): A randomised controlled trial of a postnatal diabetes prevention program. *PLOS Medicine*. 2016;13(7):e1002092. doi:10.1371/journal.pmed.1002092

24. Norman E, Sherburn M, Osborne RH, Galea MP. An exercise and education program improves well-being of new mothers: A randomized controlled trial. *Physical Therapy*. 2010;90(3):348-355. doi:10.2522/ptj.20090139

25. Daley AJ, Jolly K, Bensoussane H, et al. Feasibility and acceptability of a brief routine weight management intervention for postnatal women embedded within the national child immunisation programme in primary care: randomised controlled cluster feasibility trial. *Trials*. 2020;21(1):1-19. doi:10.1186/s13063-020-04673-9

26. Nicklas JM, Leiferman JA, Lockhart S, Daly KM, Bull SS, Barbour LA. Development and modification of a mobile health program to promote postpartum weight loss in women at elevated risk for cardiometabolic disease: Single-arm pilot study. *JMIR Formative Research*. 2020;4(4):e16151. doi:10.2196/16151

27. Rhodes RE, Blanchard CM, Quinlan A, Symons Downs D, Warburton DER, Beauchamp MR. Couple-based physical activity planning for new parents: A randomized trial. *American Journal of Preventive Medicine*. 2021;61(4):518-528. doi:10.1016/j.amepre.2021.04.020

28. van der Pligt P, Ball K, Hesketh KD, et al. A pilot intervention to reduce postpartum weight retention and central adiposity in first-time mothers: results from the mums OnLiNE (Online, Lifestyle, Nutrition & Exercise) study. *J Hum Nutr Diet*. 2018;31(3):314-328. doi:10.1111/jhn.12521

29. Mesk Z, Manaf RA, Shahar HK. Effectiveness of theory based intervention using social media to reduce urinary incontinence among postpartum women in Hebron city hospitals: Randomized controlled trial. *Malaysian Journal of Medicine and Health Sciences*. 2022;18(1):241-249.

Appendix B

Supplemental Material for Study 2

Supplemental Material 1 Instrumentation

PA volume was assessed using a modified version of the Godin Leisure-Time Exercise Questionnaire which has demonstrated acceptable validity and reliability (Godin & Shephard, 1997). This instrument is open-ended, with questions relating to frequency and volume of mild, moderate, and strenuous PA "during a typical week since having your baby". Participants reported the number of times per week and average duration (in minutes) for each intensity of PA. The number of times per week was multiplied by duration to determine the volume of each intensity of PA and then the totals of moderate and strenuous PA were summed to determine the overall MVPA volume (Courneya et al., 2004). This method is similar to that of the International Physical Activity Questionnaire (Craig et al., 2003) and has been performed in prior studies focused on PA intention-behaviour translation (Grant et al., 2022; Hollman, Sui, et al., 2022).

M-PAC constructs were framed for PA and defined as "achieving at least 150-min of MVPA per week," corresponding with PA guidelines at the time of the survey (Bull et al., 2020; Evenson et al., 2024b).

Attitudes towards engaging in MVPA were measured using six items that assessed both instrumental (e.g., "In a typical week, it is wise for me to engage in PA on a regular basis") and affective components (Ajzen, 2002; Rhodes & Courneya, 2003). Scores ranged from 1 (strongly disagree) to 5 (strongly agree).

Perceived capability was assessed with 8-items (α = .90) from the Barrier Self-efficacy scale, asking participants how confident they were in engaging in 150-min of MVPA per week despite various barriers (Resnick & Jenkins, 2000). Key barriers were applied from previous research on PA postpartum and mothers with young children (Grant et al., 2022; Moore et al., 2021) and included low back and/or pelvic pain; hip pain; lower extremity pain (e.g., thigh, knee, leg, ankle, foot); upper extremity pain (e.g., shoulder, arm, elbow, wrist, hand); upper back and/or neck pain; urinary leakage; vaginal heaviness; and fatigue. Scores ranged from 1 = extremely unconfident to 5 = extremely confident.

Perceived opportunity was assessed with 2-items (Rhodes et al., 2006). Scores ranged from 1 = strongly disagree to 5 = strongly agree.

Decisional intention to be physically active was measured using one item: "In a typical week I intend to engage in at least 150-minutes of MVPA per week" (Plotnikoff et al., 2001; Rhodes & Rebar, 2017). Participants either agreed with this statement or not.

Behavioural regulation was assessed with 14-items ($\alpha = .90$) using the Physical Activity Regulation Scale (Rhodes & Lithopoulos, 2023). It includes four subscales for proactive regulation (e.g., action planning; $\alpha = .90$), reactive regulation (e.g., emotional regulation; $\alpha = .88$), social monitoring ($\alpha = .69$), and self-monitoring ($\alpha = .88$). *Proactive regulation* (e.g., action planning) is formulated prior to PA performance and is used to select or prioritize behavioural option and pre-emptively modify circumstances for that option (e.g., by determining the when, where, what, and how) (Hagger & Luszczynska, 2014; Rhodes, Grant, et al., 2020); *reactive regulation* includes tactics that are employed at the point of behavioural performance (Duckworth et al., 2016; Ruissen et al., 2022); *social monitoring* measures the extent that an individual might rely on others (e.g., through feedback or reminders) to enact PA behaviour; and *self-monitoring* implies intrapersonal measures taken to track or records one's PA behaviour (Rhodes & Lithopoulos, 2023). Scores ranged from 1 = strongly disagree to 7 = strongly agree.

Habit was assessed with 4-items ($\alpha = .91$) from the self-reported automaticity subscale (Gardner et al., 2012) of the Self-Report Habit Index (Verplanken & Orbell, 2003). The items stemmed from the following (Gardner et al., 2012; Verplanken & Orbell, 2003): 1) "I do the following automatically", 2) "I do the following without having to consciously remember", 3) "I do the following without thinking", 4) "I start to do the following before I realize I'm doing it." They each concluded with 150-minutes of MVPA per week. Scores ranged from 1 = strongly disagree to 5 = strongly agree.

Identity was measured using 3-items ($\alpha = .90$) adapted from the role identity subscale (Wilson & Muon, 2008) of the exercise identity scale (Anderson & Cychosz, 1994). The items were: "I consider myself someone who does regular PA", "When I describe myself to others, I usually include my involvement in PA", "Others see me as someone who does the following regularly: PA." Scores ranged from 1 = strongly disagree to 5 = strongly agree.

LPP was assessed with questions similar to Gutke et al. (2018): "In the past 4 weeks, have you had pain in your low back and/or pelvic girdle pain?", "If yes, was this pain bad enough to limit your usual activities or change your daily routine for more than one day?", "If you had low back and/or pelvic girdle pain in the past 4 weeks, did it start during pregnancy or within your first 3 weeks postpartum?". LPP duration was asked with the following question: 1) "If you had low back and/or pelvic girdle pain in the past 4 weeks, how long was it since you had a whole month without low back and/or pelvic girdle pain? Responses included "Less than 3 months", "3 months or more but less than 7 months", "7 months or more but less than 3 years", and “3 years or more”. LPP location was asked with the following questions: “Do you believe your pain is from:” with response options “the back” yes/no and “the pelvic girdle” yes/no. If you think your pain is from the pelvic girdle, do you believe your pain is from: with response options “the front of the pelvic girdle” (yes/no), “the back of the right pelvic girdle” (yes/no), “the back of the left pelvic girdle” (yes/no).

Pain intensity of the low back, posterior pelvic girdle, and anterior pelvic girdle were measured using the Visual Analogue Scale scored from 0 = no pain to 10 = worst pain (Carlsson, 1983). Pain was classified as mild (≤ 3.4), moderate (3.5 to 7.4), or severe (≥ 7.5) (Boonstra et al., 2014). *Pain disability* was measured with the Oswestry Disability Index (ODI) (Fairbank et al., 1980) with the total score ranging from 0 to 100 and higher scores indicating worse function (i.e., 0-20 = minimal disability, 20-40 = moderate disability, 40-60 = severe disability, 60-80 = crippled, 80-100 = bedbound or exaggerating) and the Pelvic Girdle Questionnaire (PGQ) (Stuge et al., 2011) with a total score ranging from 0 to 100 and higher scores indicating worse function. Both of these scales show good internal consistency, reliability, and construct validity among postpartum individuals (Grotle et al., 2012).

Secondary Analyses for 120 min/week MVPA cut/off

Using an MVPA cut-off of 120 min/week, there was still a moderate and significant effect of the PA profile on the dependent variables (F[10, 184] = 15.11, Wilks = .55, Pillai = .45, ηp^2 = .08]. Similarly, two discriminant functions were revealed. The first one explained 88.54% of the variance and the second one explained 11.46% of the variance. The first discriminant function had a Wilks’ Lambda of .001 [X^2 (20) = 1266.15, p < .001; eigenvalue = 79.29; canonical r = .99, R^2 = .99) and the second discriminant function had a Wilks’ Lambda of .089

[X^2 (10) = 450.42, $p < .001$; eigenvalue = 10.26, canonical r = .95, R^2 = .92). Based on the correlation with the first discriminant function, the order of importance for the predictors (from high to low) was: identity (r = .94), affective attitude (r = .81), behavioural regulation (r = .80), habit (r = .71), perceived opportunity (r = .56), instrumental attitude (r = .39), fear of movement (r = -.29), LPP (r = -.25), perceived capability (r = .17), and perceived change in gait (r = .15). The order of importance for the predictors (from high to low) regarding correlation with the second discriminant function was the following: fear of movement (r = -.74), habit (r = .22), behavioural regulation (r = -.22), perceived opportunity (r = .19), LPP (r = -.17), perceived change in gait (r = -.15), instrumental attitude (r = -.14), perceived capability (r = .09), identity (r = .08), and affective attitude (r = .08).

Post hoc analyses also generally matched the earlier post hocs with successful intenders holding the highest scores for all variables except perceived capabilities, social monitoring, perceived change in gait, and LPP (Supplemental Table 6). Key differences were that perceived opportunities and reactive regulation no longer predicted successful from unsuccessful intenders, while behaviour regulation and self-monitoring did. The PA intention-behaviour gap was lower (19.7%) while individuals with P-LPP reported the highest intention-behaviour gap (28.3%) compared to individuals with NP-LPP (15.4%) and N-LPP (14.1%).

Supplemental Table 1

Physical Activity Intention-Behaviour Profiles

	Frequency	**%**	**P-LPP**	**%**	**NP-LPP**	**%**	**N-LPP**	**%**
Non-intenders	47	21.08	25	27.78	9	21.95	13	14.13
Unsuccessful Intenders	40	17.94	21	23.33	5	12.20	14	15.22
Successful Intenders	117	52.47	39	43.33	21	51.22	57	61.96
Non-intenders meeting physical activity guidelines	19	8.52	5	5.56	6	14.63	8	8.70
Intention-Behaviour Gap		25.48		35.00		19.23		19.72

Note.

P-LPP = lumbopelvic pain (LPP) that started during pregnancy or first 3-weeks postpartum; NP-LPP = LPP that did not start during pregnancy or first 3-weeks postpartum; N-LPP = no LPP

Supplemental Table 2

Pearson Correlation Matrix of Continuous Variables

Variable	*M*	*SD*	1.	2.	3.	4.	5.	6.	7.
1.	4.12	.90							
2.	4.69	.47	0.52***						
3.	3.28	.84	0.20**	0.24***					
4.	3.24	.74	0.44***	0.29***	0.10				
5.	4.40	1.28	0.60***	0.32***	0.09	0.49***			
6.	3.16	1.19	0.60***	0.23**	0.15*	0.47***	0.49***		
7.	3.69	1.08	0.70***	0.36***	0.21**	0.50***	0.69***	0.73***	
8.	21.22	5.32	-0.36***	-0.44***	-0.42***	-0.27***	-0.14	-0.25***	-0.31***

Note. M and SD are used to represent mean and standard deviation, respectively

1. Affective Attitude
2. Instrumental Attitude
3. Perceived Capability
4. Perceived Opportunity
5. Behavioural Regulation
6. Habit
7. Identity
8. TSK

* p <.05, ** p <.01, ***p <.001

Supplemental Table 3

Type of Physical Activity

	Light Intensity Physical Activity (n =)	Moderate Intensity Physical Activity (n =)	Vigorous Intensity Physical Activity (n =)
Aerobic			
Walking	172	123	7
Running		2	49
Cycling		9	14
Crossfit		1	9
Coaching		1	
Yoga	49	1	
Indoor Spin		1	12
Swimming		12	6
Rowing		1	1
Indoor cardio machine		1	6
HIIT		1	13
Housework	23	66	
Childcare/playing with kids	11	9	1
Hiking	1	19	11
Babywearing	6	12	
Stretching	22		
Pushing stroller	9	10	
Pilates	3	5	1
Barre	1	2	2
Gardening	5	26	
Dragon Boat		1	1
Core exercises	2		
Physio exercises	2		
Lifting	1		
Home workouts	1	2	
Dancing	1	7	4
Weights		22	23
Pickleball		3	
Baseball		3	
Water walking/Aquafit		2	

Snowboard/Downhill Ski	4	1
Horseback riding	1	
Tennis	1	1
Shoveling driveway	2	
Volleyball	1	1
Nordic skiing	1	3
Climbing	1	2
Fitness class	1	16
Soccer		2
Snowshoeing		1
Roller Derby		2
Ice Hockey		1
Ball Hockey		1
Paddling		1

Supplemental Table 4

Postpartum LPP Descriptions

	All LPP (n =)	(%)	P-LPP (n =)	(%)	Non-P-LPP (n =)	(%)
Limited usual activities	131					
Yes	51	38.93	39	43.33	12	29.27
No	80	61.07	51	56.67	29	70.73
How long since a month without pain	132		91		41	
	2.33 (1.01)		2.36 (.91)		2.24 (1.20)	
Believe pain is from low back	129		90		39	
Yes	106	82.17	68	75.56	38	97.44
No	23	17.83	22	24.44	1	2.56
Believe pain is from pelvic girdle	119		82		37	
Yes	81	68.07	64	78.05	17	45.95
No	38	31.93	18	21.95	20	54.05
Believe pain is from front of pelvic girdle	114		84		30	
Yes	44	38.60	36	42.86	8	26.67
No	32	28.07	27	32.14	5	16.67
N/A	38	33.33	21	25.00	17	56.67
Believe pain is from the back of the right pelvic girdle	113		82		31	
Yes	38	33.63	30	36.59	8	25.81
No	40	35.40	33	40.24	7	22.58
N/A	35	30.97	19	23.17	16	51.61

Believe pain is from the back of the left pelvic girdle	112		81		31	
Yes	38	33.93	28	34.57	10	32.26
No	36	32.14	31	38.27	5	16.13
N/A	38	33.93	22	27.16	16	51.61
Visual Analogue Scale						
VAS Low Back	n = 123 3.46 (2.05) (Range: 0,8)		n = 83 3.45 (2.09) (Range: 0,7)		n = 40 3.50 (2.01) (Range: 0,8)	
VAS Posterior PGP	n = 103 3.25 (2.09) (Range: 0, 7)		n = 74 3.19 (2.08) (Range: 0,7)		n = 29 3.41 (2.13) (Range: 0, 7)	
VAS Anterior PGP	n = 89 2.10 (1.98) (Range: 0,7)		n = 68 2.34 (2.13) (Range: 0,8)		n = 21 1.43 (1.57) (Range: 0,4)	
Oswestry Disability Index	n = 132		n = 91		n = 41	
Sum of 9 sections if section 8 is missing and sum of 10 sections if section 8 is present	12.34 (10.43) (Range 0, 36) CA: .88(.85, .91)		13.05 (10.46) (Range 0, 36) CA: .87(.83, .91)		10.03 (8.76) (Range: 0, 27) CA: .92(.87, .95)	
Pelvic Girdle Pain Questionnaire	n = 132		n = 91		n = 41	
	23.18 (18.00)		24.69 (18.42)		19.27 (15.29)	

	(Range: 0, 72)	Range: 0, 71)	(Range: 1, 49)
	Cronbach's alpha: .94(.93, .95)	CA: .94(.93, .95)	CA: .93(.90, .96)

Supplemental Table 5

Two-way ANOVA accounting for LPP

	Exclude people with non-pregnancy related LPP			Including people with non-pregnancy related LPP		
Affective Attitude†	Df	F	Pr(>F)	Df	F	Pr(>F)
PA Profile	1	7.52	**<.01**	1	11.69	**<.001**
LPP	1	13.63	**<.001**	1	12.26	**<.001**
PA Profile : LPP	1	.74	.39	1	.05	.82
Residuals	127			153		
Instrumental Attitude†						
PA Profile	1	.10	.75	1	.37	.54
LPP	1	7.02	**<.01**	1	.62	.43
PA Profile : LPP	1	.24	.62	1	.10	.76
Residuals	127			153		
Perceived Capability†						
PA Profile	1	.10	.75	1	.30	.59
LPP	1	7.02	**<.01**	1	5.05	**<.05**
PA Profile : LPP	1	.24	.62	1	.08	.78
Residuals	127			153		
Perceived Opportunity						
PA Profile	1	16.98	**<.001**	1	16.02	**<.001**
LPP	1	3.89	.05	1	4.29	**<.05**
PA Profile : LPP	1	7.61	**<.01**	1	6.68	**<.05**
Residuals	127			153		
Behavioural Regulation						
PA Profile	1	5.69	**<.05**	1	5.30	**<.05**
LPP	1	1.85	.18	1	.58	.45
PA Profile : LPP	1	3.82	.05	1	1.29	.26
Residuals	127			153		
Proactive Regulation						
PA Profile	1	1.11	.29	1	1.05	.31
LPP	1	.01	.92	1	.06	.81
PA Profile : LPP	1	.47	.50	1	.00	.97
Residuals	127			153		
Reactive Regulation						
PA Profile	1	7.63	**<.01**	1	7.18	**<.01**
LPP	1	1.34	.25	1	.44	.51

PA Profile : LPP	1	4.42	**<.05**	1	2.43	.12
Residuals	127			153		
Social Monitoring						
PA Profile	1	1.15	.29	1	1.19	.28
LPP	1	1.06	.30	1	.85	.36
PA Profile : LPP	1	1.02	.32	1	.57	.45
Residuals	127			153		
Self-Monitoring						
PA Profile	1	3.57	.06	1	3.52	.06
Main effect of LPP	1	2.85	.09	1	1.08	.30
PA Profile : LPP	1	3.08	.08	1	1.17	.28
Residuals	127			153		
Habit						
PA Profile	1	9.32	**<.01**	1	9.42	**<.01**
LPP	1	.26	.61	1	.01	.91
PA Profile : LPP	1	.88	.35	1	.15	.70
Residuals	127			153		
Identity†						
PA Profile	1	15.57	**<.001**	1	18.65	**<.001**
LPP	1	2.42	.12	1	3.04	.08
PA Profile : LPP	1	1.38	.24	1	.88	.35
Residuals	127			153		
TSK						
PA Profile	1	3.23	.07	1	3.07	.08
LPP	1	.98	.32	1	2.11	.15
PA Profile : LPP	1	.53	.47	1	.15	.70
Residuals	121			153		
Perceived Changed Gait						
PA Profile	1	.03	.87	1	.03	.87
LPP	1	.30	.58	1	.44	.51
PA Profile : LPP	1	.10	.75	1	.85	.85
Residuals	127			153		

† Homogeneity of variance was significant, therefore, Welch's ANOVA, Games Howell Post-Hoc Test

Supplemental Table 6

PA Intention-Behaviour Profiles with a 120-min MVPA cut point

	Frequency	**%**	**P-LPP**	**%**	**NP-LPP**	**%**	**N-LPP**	**%**
	n = 223		n = 90		n = 41		n = 92	
Non-intenders	38	17.04	20	22.22	7	17.07	11	11.96
Unsuccessful Adopters	31	13.90	17	18.89	4	9.76	10	10.87
Successful Adopters	126	56.50	43	47.78	22	53.66	61	66.30
Non-intenders Meeting PA guidelines	28	12.56	10	11.11	8	19.51	10	10.87
I-B Gap		19.74		28.33		15.38		14.08

Supplemental Table 7

One-way ANOVAs with a 120-min MVPA cut point

Variable n = 195	Non-Intenders (NI) n = 38	Unsuccessful Adopters (UI) n = 31	Successful Adopters (SI) N = 126	ANOVA	Pr(>F)	Post-hocs (Effect size Cohen's d or Hedges' d)
Affective Attitude†	3.24 (.97)	3.98 (.83)	4.47 (.63)	F(2.00, 55.09) = 28.91	**<.001**	NI < UI (.81)** < SI (.72)* NI < SI (1.69)***
Instrumental Attitude†	4.47 (.52)	4.70 (.47)	4.78 (.40)	F(2.00, 57.66) = 5.58	**<.01**	NI, UI (.45), SI (.20) NI < SI (.71)**
Perceived Capability	3.16 (.86)	3.22 (.66)	3.38 (.85)	F(2, 192) = 1.28	.28	NI, UI (.08), SI (.20) NI, SI (.26)
Perceived Opportunity	3.20 (1.02)	3.53 (1.10)	4.10 (.82)	F(2, 192) = 16.29	**<.001**	NI, UI (.32), SI (.64)** NI < SI (1.03)***
Behaviour Regulation	3.13 (1.13)	4.34 (1.03)	4.88 (1.05)	F(2, 192) = 39.96	**<.001**	NI < UI (1.12)*** < SI (.52)* NI < SI (1.64)***
Proactive Regulation	3.03 (1.53)	4.55 (1.37)	4.98 (1.63)	F(2, 192) = 22.52	**<.001**	NI < UI (1.04)***, SI (.27) NI < SI (1.22)***
Reactive Regulation†	3.03 (1.57)	4.62 (1.32)	5.19 (1.20)	F(2.00, 58.87) = 30.59	**<.001**	NI < UI (1.07)***, SI (.46) NI < SI (1.66)***
Social Monitoring	3.46 (1.60)	3.74 (1.52)	4.10 (1.52)	F(2, 192) = 2.84	.06	NI, UI (.18), SI (.24) NI, SI (.42)
Self-Monitoring	3.06 (1.90)	4.28 (1.76)	5.14 (1.64)	F(2, 192) = 22.22	**<.001**	NI < UI (.66)* < SI (.52)* NI < SI (1.22)***

Habit†	2.18 (1.06)	2.73 (1.26)	3.57 (.99)	F(2.00, 59.19) = 28.16	**<.001**	NI, UI (.47) < SI (.80)** NI < SI (1.37)***
Identity†	2.13 (.99)	3.11 (1.12)	4.04 (.86)	F(2.00, 57.78) = 60.35	**<.001**	NI < UI (.92)*** < SI (1.01)*** NI < SI (2.13)***
TSK	22.0 (5.14)	24.30 (5.17)	20.00 (5.04)	F(2, 192) = 9.55	**<.001**	NI, UI (.44) > SI (-.84)*** NI, SI (-.39)
Gait	No = 25 Yes = 13	No = 16 Yes = 15	No = 65 Yes = 61	F(2, 192) = 1.24	.30	NI, UI (.29), SI (.00) NI, SI (.29)
LPP	No = 11 Yes = 27	No = 10 Yes = 21	No = 61 Yes = 65	F(2, 192) = 3.04	.05	NI, UI (.07), SI (.40) NI, SI (.33)

* p < .05
**p<.01
***p<.001
† Homogeneity of variance was significant, therefore, Welch's ANOVA, Games Howell Post-Hoc Test, and Hedge's d were applied.

Supplemental Table 8

Post-Hoc Evaluations of Two-way ANOVAs accounting for LPP

		Cohen's d	**95% Confidence Interval**	**p-value**
Affective Attitude (excluding Non-PLPP)	UA/NP – SA/NP	-.75	-1.35, -.15	.06
	UA/NP – UA/P	.34	-.34, 1.03	.75
	UA/NP – SA/P	-.01	-.63, .61	1.00
	SA/NP – UA/P	1.09	.57, 1.62	**<.001**
	SA/NP – SA/P	.74	.32, 1.16	**<.01**
	UA/P – SA/P	-.35	-.89, .19	.57
Affective Attitude (including Non-PLPP)	UA/NP – SA/NP	-.75	-1.35, -.16	.06
	UA/NP – UA/P	.45	-.21, 1.11	.53
	UA/NP – SA/P	-.20	-.79, .38	.90
	SA/NP – UA/P	1.20	.71, 1.69	**<.001**
	SA/NP – SA/P	.55	.18, .92	**<.05**
	UA/P – SA/P	-.65	-1.12, -.18	**<.05**
Instrumental Attitude (excluding Non-PLPP)	UA/NP – SA/NP	-.18	-.77, .41	.93
	UA/NP – UA/P	.33	-.36, 1.01	.78
	UA/NP – SA/P	.37	-.25, 1.00	.63
	SA/NP – UA/P	.51	-.00, 1.02	.20
	SA/NP – SA/P	.55	.14, .97	**<.05**
	UA/P – SA/P	.04	-.49, .58	1.00
Instrumental Attitude (including Non-PLPP)	UA/NP – SA/NP	-.18	-.77, .41	.93
	UA/NP – UA/P	.26	-.39, .92	.86
	UA/NP – SA/P	.20	-.39, .78	.91
	SA/NP – UA/P	.44	-.03, .91	.25
	SA/NP – SA/P	.38	.01, .75	.18
	UA/P – SA/P	-.06	-.53, .40	1.00
Perceived Capability	UA/NP – SA/NP	-.18	-.77, .41	.93

(excluding Non-PLPP)				
	UA/NP – UA/P	.33	-.36, 1.01	.78
	UA/NP – SA/P	.37	-.25, .99	.63
	SA/NP – UA/P	.51	-.00, 1.02	.20
	SA/NP – SA/P	.55	.14, .97	**<.05**
	UA/P – SA/P	.04	-.49, .58	1.00
Perceived Capability (including Non-PLPP)	UA/NP – SA/NP	-.18	-.77, .41	.93
	UA/NP – UA/P	.26	-.39, .92	.86
	UA/NP – SA/P	.20	-.39, .78	.91
	SA/NP – UA/P	.44	-.03, .91	.25
	SA/NP – SA/P	.38	.01, .75	.18
	UA/P – SA/P	-.06	-.53, .40	.99
Perceived Opportunity (excluding Non-PLPP)	UA/NP – SA/NP	-1.23	-1.84, -.62	**<.001**
	UA/NP – UA/P	-.68	-1.37, .01	.20
	UA/NP – SA/P	-.80	-1.42, -.17	.06
	SA/NP – UA/P	.55	.04, 1.06	.14
	SA/NP – SA/P	.43	.02, .84	.17
	UA/P – SA/P	-.12	-.65, .42	.98
Perceived Opportunity (including Non-PLPP)	UA/NP – SA/NP	-1.19	-1.80, -.59	**<.001**
	UA/NP – UA/P	-.69	-1.35, -.03	.17
	UA/NP – SA/P	-.90	-1.49, -.30	**<.05**
	SA/NP – UA/P	.51	.04, .98	.14
	SA/NP – SA/P	.29	-.07, .66	.39
	UA/P – SA/P	-.21	-.68, .25	.80
Behavioural Regulation (excluding Non-PLPP)	UA/NP – SA/NP	-.71	-1.31, -.12	.09
	UA/NP – UA/P	-.47	-1.15, .22	.53
	UA/NP – SA/P	-.39	-1.01, .23	.59
	SA/NP – UA/P	.24	-.26, .75	.78
	SA/NO – SA/P	.32	-.09, .73	.42
	UA/P – SA/P	.08	-.46, .61	.99

Behavioural Regulation (including Non-PLPP)	UA/NP – SA/NP	-.69	-1.28, -.09	.10
	UA/NP – UA/P	-.25	-.91, .40	**.87**
	UA/NP – SA/P	-.51	-1.10, .08	.32
	SA/NP – UA/P	.44	-.04, .90	.26
	SA/NO – SA/P	.18	-.19, .54	.77
	UA/P – SA/P	-.26	-.72, .21	.70
Proactive Regulation (excluding Non-PLPP)	UA/NP – SA/NP	-.31	-.91, .23	.72
	UA/NP – UA/P	-.03	-.72, .65	1.00
	UA/NP – SA/P	-.07	-.69, .55	1.00
	SA/NP – UA/P	.28	-.23, .79	.69
	SA/NO – SA/P	.24	-.17, .66	.65
	UA/P – SA/P	-.04	-.57, .50	1.00
Proactive Regulation (including Non-PLPP)	UA/NP – SA/NP	-.31	-.90, .28	.73
	UA/NP – UA/P	.08	-.58, .73	**1.00**
	UA/NP – SA/P	-.22	-.80, .37	.89
	SA/NP – UA/P	.38	-.09, .85	.37
	SA/NO – SA/P	.09	-.28, .46	.96
	UA/P – SA/P	-.29	-.76, .17	.59
Reactive Regulation (excluding Non-PLPP)	UA/NP – SA/NP	-.82	-1.42, -.23	**<.05**
	UA/NP – UA/P	-.40	-1.08, .29	**.65**
	UA/NP – SA/P	-.38	-1.00, .24	.62
	SA/NP – UA/P	.42	-.08, .93	.35
	SA/NO – SA/P	.45	.03, .86	.14
	UA/P – SA/P	.02	-.51, .56	1.00
Reactive Regulation (including Non-PLPP)	UA/NP – SA/NP	-.80	-1.40, -.20	**<.05**
	UA/NP – UA/P	-.22	-.88, .44	**.91**
	UA/NP – SA/P	-.43	-1.02, .16	.48
	SA/NP – UA/P	.58	.11, 1.05	.07

	SA/NO – SA/P	.37	.00, .74	.19
	UA/P – SA/P	-.21	-.67, .26	**.81**
Social Monitoring (excluding Non-PLPP)	UA/NP – SA/NP	-.32	-.91, .27	.71
	UA/NP – UA/P	-.36	-1.04, .33	.73
	UA/NP – SA/P	-.27	-.89, .35	.82
	SA/NP – UA/P	-.04	-.54, .47	1.00
	SA/NP – SA/P	.05	-.36, .46	1.00
	UA/P – SA/P	.09	-.45, .62	.99
Social Monitoring (including Non-PLPP)	UA/NP – SA/NP	-.33	-.92, .27	.70
	UA/NP – UA/P	-.31	-.96, .35	.79
	UA/NP – SA/P	-.35	-.93, .24	.65
	SA/NP – UA/P	.02	-.45, .49	1.00
	SA/NP – SA/P	-.02	-.39, .35	1.00
	UA/P – SA/P	-.04	-.50, .42	1.00
Self-Monitoring (excluding Non-PLPP)	UA/NP – SA/NP	-.56	-1.16, .03	.24
	UA/NP – UA/P	-.58	-1.27, .10	**.33**
	UA/NP – SA/P	-.43	-1.05, .19	.52
	SA/NP – UA/P	-.02	-.53, .49	1.00
	SA/NO – SA/P	.14	-.28, .55	.92
	UA/P – SA/P	.15	-.38, .69	.94
Self-Monitoring (including Non-PLPP)	UA/NP – SA/NP	-.56	-1.15, .03	.24
	UA/NP – UA/P	-.34	-1.00, .31	**.73**
	UA/NP – SA/P	-.49	-1.08, .10	**.35**
	SA/NP – UA/P	.22	-.25, .68	**.80**
	SA/NP – SA/P	.07	-.30, .43	.98
	UA/P – SA/P	-.15	-.61, .32	.92
Habit (excluding Non-PLPP)	UA/NP – SA/NP	-.91	-1.51, -.31	**<.05**
	UA/NP – UA/P	-.18	-.86, .51	**.96**
	UA/NP – SA/P	-.71	-1.33, -.09	.11
	SA/NP – UA/P	.73	.22, 1.25	**<.05**
	SA/NP – SA/P	.20	-.21, .61	**.77**
	UA/P – SA/P	-.53	-1.07, .01	.20

Habit (including Non-PLPP)	UA/NP – SA/NP	-.92	-1.51, -.32	**<.05**
	UA/NP – UA/P	-.04	-.69, .62	**1.00**
	UA/NP – SA/P	-.81	-1.40, -.21	**<.05**
	SA/NP – UA/P	.88	.40, 1.36	**<.05**
	SA/NO – SA/P	.11	-.26, .48	**.94**
	UA/P – SA/P	-.78	-1.24, -.30	**<.01**
Identity (excluding Non-PLPP)	UA/NP – SA/NP	-1.11	-1.72, -.51	**<.01**
	UA/NP – UA/P	-.15	-.83, .53	**.97**
	UA/NP – SA/P	-.73	-1.35, -.11	.09
	SA/NP – UA/P	.96	.44, 1.48	**<.01**
	SA/NO – SA/P	.38	-.03, .80	**.26**
	UA/P – SA/P	-.58	-1.12, -.04	.15
Identity (including Non-PLPP)	UA/NP – SA/NP	-1.09	-1.70, -.49	**<.01**
	UA/NP – UA/P	-.06	-.71, .60	**1.00**
	UA/NP – SA/P	-.76	-1.35, -.17	.05
	SA/NP – UA/P	1.03	.55, 1.52	**<.001**
	SA/NO – SA/P	.33	-.03, .70	**.28**
	UA/P – SA/P	-.70	-1.17, -.23	**<.05**
TSK (excluding Non-PLPP)	UA/NP – SA/NP	.54	-.06, 1.13	**.28**
	UA/NP – UA/P	-.34	-1.03, .34	.76
	UA/NP – SA/P	-.10	-.71, .52	.99
	SA/NP – UA/P	-.88	-1.39, -.36	**<.01**
	SA/NP – SA/P	-.63	-1.05, -.22	**<.05**
	UA/P – SA/P	.24	-.29, .78	**.80**
TSK (including Non-PLPP)	UA/NP – SA/NP	.52	-.07, 1.11	.30
	UA/NP – UA/P	-.48	-1.14, .18	**.47**
	UA/NP – SA/P	.19	-.40, .77	.92
	SA/NP – UA/P	-1.00	-1.48, -.52	**<.001**
	SA/NP – SA/P	-.34	-.70, .03	**.27**
	UA/P – SA/P	.67	.20, 1.14	**<.05**
Changed Gait (excluding Non-PLPP)	UA/NP – SA/NP	.05	-.54, .64	1.00
	UA/NP – UA/P	-.19	-.87, .49	.95
	UA/NP – SA/P	-.27	-.89, .35	.82
	SA/NP – UA/P	-.24	-.75, .27	.78

	SA/NP – SA/P	-.32	-.73, .09	.42
	UA/P – SA/P	-.08	-.62, .46	.99
Changed Gait (including Non-PLPP)	UA/NP – SA/NP	.05	-.54, .64	1.00
	UA/NP – UA/P	-.22	-.88, .44	.91
	UA/NP – SA/P	-.24	-.83, .34	.85
	SA/NP – UA/P	-.27	-.74, .20	.67
	SA/NP – SA/P	-.29	-.66, .07	.39
	UA/P – SA/P	-.02	-.49, .44	1.00

Appendix C

Supplemental Material for Study 3

Supplemental Material 1 Semi-Structured Interview Guide

Verbal consent check-in: Before we begin this interview, I would like to remind you of the voluntary nature of your participation and ask if you continue to consent to participate in this study?

1. *(All participant/partners)* Can you tell me what your first impressions of the app were?

2. *(Health providers)* What would prevent you from using such an app as a co-intervention for promoting physical activity to your postpartum clients with lumbopelvic pain?

3. *(Health providers)* What changes would you make to the mHealth app to increase the likelihood that you would use it as a co-intervention?

2. *(Postpartum people with LPP)* What would prevent you from using such an app to guide your return to physical activity postpartum?

3. *(Postpartum people with LPP)* What changes would you make to the mHealth app to increase the likelihood of using it to guide you in returning to physical activity postpartum?

Let's think of two hypothetical postpartum individuals (personas). I'd like you to think about the same two questions for each individual.

Siti Sutanto

35 years old, East Asian

6-months postpartum

PHYSICAL ACTIVITY (PA)

MVPA: 1 x 70min walking hills

Light PA: 7x 20min leisure walks

Muscle strengthening training exercise: None

Pelvic floor muscle training: Never

BIO

Siti is 6-months postpartum with her first child. She started experiencing mild (VAS = 3/10) lingering pain around 2-weeks postpartum and it has been on and off since then. She also has some symptoms of stress urinary incontinence.

She is on maternity leave for 12-months from her job as an elementary school teacher.

Siti was an avid runner prior and during pregnancy (up to 30-weeks) but is questioning returning to running as her body feels like a whole new territory now.

Her daughter is exclusively breastfed and prefers to co-sleep. Thus, she won't nap independently during the day and either needs to be carried in the ergo or pushed in the stroller.

M-PAC CONSTRUCTS

High PA enjoyment, knowledge, self-efficacy, perceived opportunity, moderate planning, self-monitoring; Low habit, identity

APP PREFERENCES

Owns a smartphone
Doesn't use any postpartum PA Apps; would likely use one

Desired features: PA tracking, goal setting, videos of muscle strengthening exercises and pelvic floor muscle training exercises.

Desired content: Returning to running postpartum, exercising with baby

Other suggestions: Real time tracking with comparison from day to day; vetted by professionals, available for free

Jessica Anderson

30 years old, White

4-months postpartum

PHYSICAL ACTIVITY (PA)

MVPA: 1 x 20min walking

Light PA: None

Muscle strengthening training exercise: None

Pelvic floor muscle training: 2x per week

BIO

Jessica is 4-month postpartum and has experienced moderate lumbopelvic pain (VAS = 6/10) since mid-pregnancy. She is disappointed that the pain didn't reside following childbirth.

Since giving birth, she has also been experiencing symptoms of urinary and stool leakage, vaginal heaviness, and diastasis rectus abdominus.

Jessica is self-employed and unfortunately doesn't have paid maternity leave or health benefits. She recently became a single mom and is also caring for her active 3-year old toddler. Her baby will nap independently but wakes up several times through the night. She is feeding with a combination of nursing and formula.

Overall she is feeling very discouraged with returning to physical activity.

M-PAC CONSTRUCTS

Low PA enjoyment, Moderate knowledge, Low self-efficacy, perceived opportunity, planning, self-monitoring, habit, identity

APP PREFERENCES

Owns a smartphone
Doesn't use any postpartum PA apps; neutral about using one

Desired features: PA tracking, goal setting, examples and videos of exercises (aerobic, MSE, flexibility), ability to communicate with other postpartum people and health provider

Desired content: how to exercise while fatigued, how to safely exercise with consideration of pain, urinary incontinence, diastasis rectus abdominis

4. *(Health providers)* What would prevent you from using such an app as a co-intervention for promoting physical activity to Siti Sutanto? And to Jessica Anderson?

5. *(Health providers)* What changes would you make to the mHealth app to increase the likelihood that you would use it as a co-intervention for Siti Sutanto? And for Jessica Anderson?

4. *(Postpartum people with LPP)* What do you think would prevent Siti Sutanto from using such an app to guide their return to physical activity postpartum? What about Jessica Anderson?

5. *(Postpartum people with LPP)* What changes would you make to the mHealth app to increase the likelihood of Siti Sutanto using it to guide their return to physical activity postpartum? What about for Jessica Anderson?

6. (*All partners*) Now we have several questions related to the M-PAC theory that informs the mobile app:

a. *Intentions:*
    i. What do you think would help postpartum individuals with LPP to increase their intentions to be physically active?

b. Reflexive Processes:
    i. *Instrumental Attitude:* What do you think the benefits of physical activity are for postpartum individuals with LPP? What physical activity benefits do you think are important to postpartum individuals with LPP?
    ii. *Affective Attitude:* How do you think postpartum individuals feel (e.g., pleasant/unpleasant) or want to feel when they are being active?

iii. *Perceived Capability*: Do you think there are ways to help postpartum individuals with LPP to improve their confidence in being physically active?

iv. *Perceived Opportunity:* Do you think there is anything that these individuals could do to increase the likelihood of fitting physical activity into their schedules (e.g., environment, postpartum exercise classes, home equipment)? Are there any specific postpartum exercise classes or YouTube videos that you think would be helpful?

c. *Regulatory Processes:*

i. What strategies do you think postpartum individuals with LPP could use to plan how, when and where to be active? Is there anyone in their social circles that you think could help support them to be active? If so, what could they do? How do you think postpartum individuals with LPP feel when they receive this type of support?

ii. What strategies do you think postpartum individuals with LPP could use to be active around the schedule of their infant/other children? What about doing physical activity with their infant/other children? Are there any additional strategies pertaining to using a stroller or a baby carrier that you think would be useful?

iii. When postpartum individuals with LPP are having a tough day, or are low in mood or energy, do you think there is anything that could help them to overcome these challenges and still be physically active?

d. *Reflexive Processes:*

   i. What do you think would help postpartum individuals with LPP to make regular physical activity a habit? Keep in mind that by habit, we do not mean frequency of past behaviour, but rather we refer to habits as automatic processes of behavioural influence. Using this definition, habits are developed when people regularly do physical activity at the same time of day or the same context and start to develop automatic cue-behaviour associations whereby when they experience a cue, the urge to engage in a habitual behaviour is triggered, leading to that behaviour (Rhodes & Rebar, 2018).
   What prompts/cues could they use to help?

   ii. What do you think being an "active person" means to postpartum individuals with LPP, beyond just being active/exercising? Do you think there could be any parallels with their new identity in becoming a mother or parent?

7. *(All partners)* Is there anything else you would like to tell us about the mHealth app?

8. *(All partners)* Would you like to take part in making the changes to the app? Probes: If yes, what would you like to contribute? When are you available?

Supplemental Table 1

Eight Patient Engagement in Research (PEIR) Framework Components in Relation to the Present Study

PEIR Component	**How it was applied in this study**
Procedural Requirements	Participant/partners were informed of the expected time commitments, the required activities, and honorariums they would receive for each activity.
Convenience	Participant/partners were informed that the interviews and surveys could be completed at times that worked for them, they could choose between in-person, phone call, zoom call, or walking meeting (if located in Victoria, BC), they could bring their infants and children to the meetings, if located in Victoria, BC they would receive parking compensation for interviews, and they had the option to receive communication via email or Whatsapp text message.
Contributions	Participant/partners were informed they would be providing feedback and suggestions for app modifications, they would have the opportunity to contribute changes to the app if desired, and they would have the opportunity to be co-authors or co-presenters or the research project.
Support	Participant/partners were offered the use of the lab computers if they resided in Victoria, BC and did not have access to a computer.

Team Interaction	Participant/partners were informed they would be addressed by their preferred title and pronouns.
Research Environment	Participant/partners were informed that, where possible, decision-making would be made by consensus*, app modifications would be performed if they could be done in a reasonable time by the research team and the Pathverse development team within 2-3 months, background research on postpartum PA research was provided (specifically the preliminary findings from Hollman et al., submitted), and that the app would need to maintain its original theoretical base of the M-PAC framework and they were walked through the framework online (http://mpac.yeef.ca/).
Feel Valued	Participant/partners were told they would have the option to be co-authors or co-presenters on the research project and that there time would be valued (they would be given extra time to complete project items if needed).
Benefits	Participant/partners were informed of the honorariums and opportunities for co-authorship and co-presenting. They were also asked if there was anything else that wasn't covered by the PEIR workbook that would make the research experience more meaningful to them. In order to systematically evaluate the end-user engagement process, participant/partners.

Notes: *While not an explicit deviation of the study methods, the authors would like to make note of one modification that might be helpful for future researchers involved in co-development, particularly when applying independent interviews and online survey methods. Participant/partners were initially informed that "where possible, decision-making will be made by consensus." While decisions were always made by consensus of at least one participant/partner, the first author, and the research supervisor, decisions were not always made by consensus of all participant/partners due the independent feedback that was provided in one-on-one and interview and survey formats. For example, in the second interview, one participant/partner requested that the app banner be changed to a more gender neutral colour. While the decision to change the app colour was technically not made by consensus amongst the research participant/partners, it was deemed an acceptable suggestion that would enhance the scalability of the app. Future co-design research studies might want to add phases that would include opportunities for participant/partners reach consensus on certain items, for example an online survey that asks specific questions related to participant/partner feedback obtained from prior interviews and/or surveys to determine whether or not there is consensus in relation to the initial request.

Supplemental Table 2

First Interview Synthesis from Partners

Theoretical Domains Framework Domain	**Themes from Participant/Partners with Lived Expertise of Postpartum Lumbopelvic Pain (LPP)**	**Themes from Participant/Partners who are Healthcare Providers with Expertise in Managing Postpartum LPP**	**App Modifications**
1. Knowledge	Need for postpartum-specific content: - pelvic floor - return-to-running - pain relief - lumbopelvic pain - hormones - nutrition *"So I guess that's the 1st thing is like. So - so the app needs to kind of help them manage their pain first before anything."* [P5] Information on safe exercises and exercise program *"So have a clear idea of like how, what exercises are safe for them to do at this point or - and also reassured that they're on the right track."* [P4]	Need for postpartum-specific content: - sleep - lumbopelvic pain - pelvic floor - physical activity safety - return-to-running - up-to-date *"There's no discussion of pain anywhere in it, and I think - you know, if even in lesson one, I would have one of the - the lesson objectives of discussion like, 'What if you are in pain?' When it says, 'What is physical activity?' I think it could be like - when it talks about exercises versus physical activity, like one of the examples could be 'lifting a car seat' or 'lifting the baby out of the crib'."* [HP5] App is more helpful for people without a healthcare provider or with lower PA, self-efficacy, knowledge	- Replaced adult with postpartum PA guidelines - Added content relevant to postpartum LPP - Ensured every lesson was relevant to postpartum and LPP if possible - Replaced images with postpartum-relevant images Added content on return-to-running postpartum - Added pelvic floor content that was also reviewed and edited by the pelvic floor physiotherapist partners of this study

		"Whereas I feel like this has a bit more utility for somebody who can't access care and then they need to have - you know like midwives are like 'Here's - here's a tool for you to help you resume some activity'. But less so for somebody who already has access to some types - yeah, experts, healthcare services." [HP1] Need for specific actionable advice before theory *"But I'm like, I don't have the capacity or the resources for all of this right now. So that would be the only thing I think, that would prevent me from that is like - it's time and wordy, and that kind of stuff. And I think they're like, I just want a solution, or just give me one simple exercise to do. Not the mindset behind the exercises, kind of thing. So."* [HP2]	
2. Skills	Need for specific and variable examples of exercises and short exercise sessions/videos	Need for specific and variable examples of exercises and short exercise sessions/videos Need for individualized PA advice	- Added an early lesson with examples (videos) of simple exercises (e.g., deep breathing, core activation,

	"I think that like detailed examples and different exercises that they could do specifically in the home." [P4] Need for exercise modifications for pain *"It is - It's kind of like that catch 20 situation where - you know, it is important to do it, but you can't really do it –"* [P3]	*"I think in her case she needs more - guided videos, guided exercises, and less of the theory behind how to get your body and mind in an exercise movement, and that, yeah, she needs more of the - doing as opposed to the why kind of component."* [HP2] Emphasize a slow progression, starting deep breathing exercises *"I would do it for both like. Like, I think, from a nervous system regulation standpoint. She's in pain. She's newly single. She has 2 kids. She's working, I think (laughing), if anybody needs deep breathing, it's this lady. And then we also know that that deep breathing is actually beneficial for the pelvic floor as well."* [HP5]	thoracic mobility, lumbopelvic strengthening)
3. Social/ professional role and identity	PA helps for motherhood and to be a role model to children *"And also kind of I guess, some positivity and like role modeling too that they're being healthy for their child."* [P4] Important to prioritize own health	PA is part of parenthood and helpful for daily postpartum life *"And so you're more active with your kids as well, you're able to lift them without pain. You're able to take care of them. So it helps you both as a parent - it helps your confidence, which I think improves your mood*	- Modified language of the identity lesson so it is more relevant to postpartum - Added examples of ways to boost PA identity based on Strachan et al. (2025) user-guide for building and strengthening identity

	"You know - kids are playing next to me, but I just watch, but also do yoga. But maybe sometimes I have to put like chores for the next day, like, you know." [P2] Identifying as an active person is inconsistent among postpartum people *"Keeping up with your kids. Being a good parent. I'm not saying those who aren't active aren't - aren't good parents. But I do think kids are active - your baseline should be almost your kids activity level. Every parent - I assume, because you're a parent - you want to spend time with your kids and kids run around. So you know, being able just to keep up with your kids I think is - is kind of important."* [P1] *"Hmm, for me, I don't have that overlap, but for some people that might be important, especially if they were very fit before pregnancy and postpartum."* [P5]	*and helps with that postpartum mood - and then again, like simple things, like, you now have the control."* [HP2] Important to prioritize own health *"Like I think people generally feel that boost of themselves meeting needs and their baby's needs because they've gotten that physical activity in a meaningful way so, yeah."* [HP1]	
4. Beliefs about capabilities	Encourage slow progression with achievable steps in increasing PA *"Yeah, like baby steps very gradually and giving them the tool like giving it. So then*	Encourage slow progression with achievable steps in increasing PA *"If everything just feels too hard and too defeating - they give up right*	- Modified content to emphasize slow progression of exercises - Added facts related to LPP, pelvic floor dysfunction, and

	you don't have to think because you're not in that mental capacity to set goals, or to think, or to do, or to initiate anything yourself." [P3] Normalize postpartum experiences and challenges *"I think, kind of normalizing it [LPP] and- and sharing a little bit more, that it's something a lot of people experience."* [P4] Postpartum body feels like a new territory *"I know that for a lot of postpartum women like their body actually is, you know, a point of insecurity, and they miss their old body, or, you know, whatever."* [P5]	*away - because they just don't have the facilities to kind of go forward. So I think it needs to be small enough that it's approachable, but enough that it feels like a challenge, that they then can overcome in an approachable way."* [HP2] Normalize postpartum experiences and challenges *"It's not a solo issue that only you have to deal with. And that gives confidence alone of like, oh, lots of people deal with this. This isn't like a rare, crazy, scary condition. So I think that's number one in starting. And then having just like that encouragement and support throughout like saying. 'Hey, look at your progress'. 'You've done X, Y, and Z since you started this'. And then they can actually kind of reflect on that feedback. I think that's another confidence booster."* [HP4] Postpartum body feels like a new territory	diastasis rectus abdominis to demonstrate they are common experiences and there are actionable methods to address these conditions

		"I think they want to feel like themselves. Honestly, I know that's a very vague statement, but it's the number one thing I hear all the time is 'I feel out of my body'. 'I don't feel like myself'. 'I feel slow'. 'I feel heavy'. 'I don't feel great'" [HP4]	
5. Optimism	Mixed perception regarding satisfaction of the app in its current form *"To be honest on an app like this - I probably wouldn't use it."* [P5] App feels like an academic course *"I know you have stuff referenced like, where is it - you're just - you're just sourcing it really like in the background. Is that necessary doing it in the text, even though you have the reference section? It feels very academia."* [P1]	Mixed perception regarding satisfaction of the app in its current form *"So I guess I was… I mean, a little confused because I know this is like meant for lumbopelvic pain for postpartum."* [HP1]	- Removed citations from the cards - Created a references document that users can access in the References module
6. Beliefs about Consequences	There are many physical and mental health benefits of postpartum physical activity *"I think, equally important because mental - mental health is connected also physical health - after exercising, [I feel]*	There are many physical and mental health benefits of postpartum physical activity *"So across the board, like the pain, the energy, the mood, the confidence, all of it - huge, so."* [HP2]	- Modified the lesson on benefits of PA so it briefly described benefits to adults in general and then went into more detail on the specific evidence-based benefits during the postpartum period

	like physically healthier and mentally happier, that will continue to get more exercise on the next day and following day, so I - I think both are equally important." [P2]	Pain benefits of PA *"Well, let me think. I mean when I think about clients that have had lumbopelvic pain, especially if they've been active before - activity and re-engaging in activity, for lots of them is incredibly empowering for them - and giving them the tools to get back to even little bits of activity, knowing that - that it's actually decreasing their pain is - is like, it's like the lights turn on in - in some of those clients, so it can be empowering"* [HP5]	
7. Reinforcement	Opportunities for postpartum PA habit formation - pair PA with someone else - regular time of day but needs to be flexible - pair with other routines - app reminders *"So, finding common things that moms end up doing with their baby or around the house and giving examples of a physical activity you could attach to it. So, knowing that you may have to - you know, wash bottles, or you may have to*	Opportunities for postpartum PA habit formation - match the activity that the child is doing - pair with trackers, reminders, rewards - consistent time of the day - pair with naps - pair with other routines - pair with someone else - put clothes out, make equipment accessible - start with easy things	- Moved the lesson on developing PA habits earlier in the program - Included many postpartum-specific cues that could encourage automatic cue-behaviour associations - Activated Activities feature to enable users to set trackers - Activated My Points feature to award points to users upon completing modules

	do this or this. What is something you can kind of link to that that's doable with activities." [P4] The app needs for more gamification *"But if it's for personal use, I probably wouldn't be excited to use it, or have motivation to use it if it doesn't have any gamification."* [P5]	*"Yeah, like, I think the reminders is big - again within that community"* [HP2] The app needs for more gamification *"We need incentive - so we need to be able to visualize and think about when, how, where we're doing that exercise. And then we need some kind of reward for actually doing it and tracking it right (laughing)."* [HP5]	
8. Intentions	Needs incentive/encouragement to do the exercises *"She already knows that it's good for her, but she needs to - she needs encouragement on how to do it, like - some like some incentive like, whether it's like that idea here."* [P5] Needs incentive to use the app *"I have to read. I mean - reading is good. Reading is great, but I just can't find time to just sit down and read…if I'm like putting kids to bed, and I'm - if I'm laying down – I - I rather just look at Instagram."* [P2]	Needs incentive/encouragement to do the exercises *"Just the safety of returning to running and like the pelvic floor pieces for sure people - I mean, yeah, it's wild what - the pervasive amount of fear in the world about the postpartum body being really difficult and I think that would be, again, the big challenge is just not having postpartum-specific info - might not motivate people as much."* [HP1] Needs incentive to use the app	- Added videos to each module so users can watch the videos instead of reading through the cards

		"It's gotta - It's gotta have value to you in that moment. So if I'm in pain, the very first thing I've got to know about is, 'How do I get out of this pain?' And if I can figure out that it's about activity, then what is that activity? What is that minimal activity that I can do to get out of pain? So. Yeah." [HP5] Postpartum people often have intentions to be active, it's just difficult to do it *"And for certain things are really good like – just to promote, because people – like really don't know what are the barriers when they are trying to exercise, and it's not letting them exercise. And they're like we are trying. We want to do it. But we can't do it right, because right?"* [HP3]	
9. Goals	The app needs to provide examples of goals and how they could be modified for LPP *"Same with the goal setting section is like - and the coping, to be honest - we're all like when you're in pain, how do you cope, and how that affects your planning*	Postpartum people might find it helpful to make a list of opportunities for being physically activity *"But like, making an opportunities list with people and just like having them go, 'Okay, when are the*	- Added examples of postpartum-specific PA goals in the Menu

	like planning for when you're in pain almost." [P1]	*moments when like, when is it possible? Is it…' you know, 'Is it in the kitchen first thing in the morning - is it…?'"* [HP1]	
10. Memory, attention and decision processes	Need for shorter chunks of content and shorter titles *"I guess also, including - making it kind of like it already is easy to do in small amounts of time. You know, in between those contact naps and stuff like that."* [P4] Preference for content through audio *"But if there's any like audio contents - I will probably listen…I mean - reading is good. Reading is great, but I just can't find time to just sit down and read."* [P2] Postpartum people are tired and have limited free time *"Oh, that's really tough, because it's - when the baby naps, all we want to do is nap instead of doing physical activity (laughing)."* [P5] Preference for less PA theory	Need for shorter chunks of content and fewer cards *"You're going to have to grab her in a way that speaks to her every desire in order for her to follow along – like she's - she's got 3 min a day to herself while she sits on the toilet, and that's it."* [HP5] App information was digestible *But the information was very digestible. So that's kind of my first impression. Like it's definitely something that somebody who has no idea what to expect - can take a lot of information from.* [HP4] PA planning advice comes too late *"Yeah. Cause like the goal setting and planning comes so far down the line, which I think, again, for some parents just needs to be like – 'One, two, three, things you do every day.*	- Cut back on text and cards where possible while maintaining the essence of the program

	"I don't need that much theory about physical activity from the get go." [P5] Marketing needs to be done according to individual needs *"But if she's introduced, and there is like more marketing done according to her needs, then she would use it."* [P3]	*Go do those things'. (laughing) Yeah."* [HP1] Replace content text with videos *"I - I like in one of the lessons it used the short little video. And I think – I - I think the combination of video and reading would be good, because I'm thinking, you know, you're breastfeeding your baby, and you're listening to a video on the side or something you might be able to do that."* [HP5] Need to simplify the app *"I think - if I think about who I was in that time period - I would need it to be simpler, like, just - you know, you're having to make all these decisions about a baby that you barely know what you're doing there that - anything that's going to help you is just going to be so dead easy to use."* [HP5] Consider incorporating AI

		"A navigator. So people going through the app could ask questions to a navigator and it was like a real person." [HP1]	
11. Environmental context and resources	Advise for exercising with a baby carrier and stroller *"Working out with carriers, yeah, just like facts and knowledge of like proper postures and things like, this might be a proper posture normal, but this might be a proper posture while wearing baby. A newborn versus, you know a baby who has neck - neck movement, and stuff. I think that knowledge will give moms power."* [P1] Provide recommendations for exercising with baby *"I mean, activities don't need to be specific for breastfeeding people, but sometimes it's nice to have certain variations of like - if your kid is clingy and like always with you - so like, you know, using a baby as a weight and stuff like that - that might prevent her from using it, I think."* [P4]	Advise for exercising with a baby carrier and stroller *"Yeah, I mean, if somebody is in a lot of pelvic pain like the second person, I would try to get them to limit how much time they're using an ergo or that kind of stuff."* [HP5] Overcoming barriers to postpartum PA *"The thing that I always do is like, what are the barriers and what is the modifier with the barrier, you know, like, 'Today it's snowing. So people don't want to go outside because they can't take their stroller outside and they can't' - and so it's like, 'Okay, well, what's the thing you can do inside on that day so that you're having' - so people recognize the interchangeability of different types of physical activity so that you can - you're achieving physical activity in*	- Added content related to exercising with baby, using a stroller and baby carrier - Provided examples of exercising at home with minimal equipment

	Environment and equipment considerations for postpartum PA *"I think, like getting creative and using stuff you have within your home to be physically active. So, not needing any specialized equipment, but kind of being supported to use things that you have around your home already, or like body - information on like body weight exercises or using the baby."* [P4]	*different forms every day and that's still an achievement."* [HP1] Need for balance between price and quality of PA *"And then money support, right? Like - not everybody can afford a personal trainer right? Or coming in for physio session every week like that, right? So that the support is the - the more - more important component here."* [HP3] Environment and equipment considerations for postpartum PA *"And again, like simplistic or minimal equipment and ease of accessibility."* [HP2] Provide recommendations for exercising with baby *"Yeah, I think - one of the strategies is that you are doing some of the stuff with your child – so, or children - so you're taking the oldest for a walk to the park, and you're pushing the baby, and that's your activity.*

You are getting down on the ground, and you are doing exercises over your baby that - you know, you're making faces at your baby, but you're doing so - and I think that's a mind shift for people, too, because you're so used to working out on your own." [HP5]

Suggest additional supports to be able to be physically active without pain

"The other thing too is just like reminding people to swing their arms or switch their arms. Like I think that that's like with the stroller too and lumbopelvic pain, we're not getting this bilateral arm swinging happening and so letting people know like, 'Okay for this block, you're going to drop this arm and this block, you're going to drop that arm'. Get your friend to, you know, push the stroller so that you can swing your arms freely - I think that's a like - or you're holding your baby's head in the carrier and so you forget to drop your arms and swing your arms." [HP1]

12. Social influences	Suggest group classes but also explain the challenges in finding them and making it to them *"Oh, so there are, I know, for a fact, there are some like centers that provide fitness classes where moms can go with their babies…but there, there's not that many, you know - and you think - like I live in [Canadian city] - you think it's a big city - like, I've only been able to really find maybe 2, 3 places that kind of offer these things, and they're often paid…and sometimes the scheduling doesn't work, but, like I said before, for some people - they feel like, 'Oh, if I paid, I should go. I'm going to wake up the baby, because I really have to go' for me, though if a baby's sleeping, I won't go."* [P5] App is lacking a social aspect "*Yes, more the motivation, like, I think. Oh, I'm – 'I'm one year and a half like postpartum is still'…, you know, and fighting, you know it's - it's difficult to get exercise, and blah blah - we can maybe chat on the app?"* [P2]	Provide social support examples specific to postpartum (other postpartum people, healthcare providers) *"I love - you know there's a ton of postpartum programs where you get to bring the baby so - that social being able to be active and be around other people that are like going - like slogging it through, too."* [HP5] App is lacking a social aspect *"And then the - yeah, the - the - we don't have anything which we which provides with communication with other people and healthcare provider."* [HP3] Downsides of social support *"So apps, I love - and Youtube videos and home workouts I love because it works within their schedule as opposed to - as much as I love a community, and I love the support of going to group programs*	- Emphasized the benefits of social support for postpartum PA - Acknowledged that social support may not always be available and that often PA opportunities that encourage social support may not be possible due to the baby's schedule - Provided options for engaging in postpartum PA when social support is not available - Activated the Social Forum feature

	Provide social support examples specific to postpartum *"Their partner. I think it's a partner's responsibility to make sure that whoever gave birth is back to their baseline. I think it's not fair that whoever gave birth, it affects their life, and they are now no longer, even at their baseline."* [P1] Social support may not be consistent *"At least, that's what happened to me, like if you don't have help."* [P3]	*or a timed thing, it's like - if baby's fussy then or needs to feed, or you're tired or so - apps or home stuff I really like, because they can work it into their schedule whenever works."* [HP2] Provide social support examples specific to postpartum *"Oh, their partners, 100%. Partners and friends, I feel like a lot of people are quick to just give the full like give yourself grace, don't worry about it, you're postpartum, take it slow. I find that is great to an extent, but having that support from friends and partners to say, you know what, if you want to do that, I'll support you."* [HP4]	
13. Emotion	Postpartum people want to feel confident, happy, strong, normal, energized, and wanted while exercising *"Oh, want to feel happy than feeling exhausted, and then feeling like doing chore…because, like, you know, already, having so many chores to do at home and*	Postpartum people want to feel ease, challenged (but not too challenged), and like themselves while exercising *"And I think, what do they want to feel? I think - I think they want to feel - like I mean a lot of people say to me, I want to feel like I did before I was pregnant, like, they want to feel*	- Emphasized choosing PA that is enjoyable and pairing it with a reward

	like - I don't want to feel like exercise is another chore." [P2] Provide ways to increase postpartum PA enjoyment *"Um - and also - incorporating some ways into the app to help increase that physical activity enjoyment."* [P4]	*similar to that. And - and sometimes that's possible. But I think it's interesting - I often say to my clients like 'Once postpartum, always postpartum' like there are changes that happen right? Like, and I'll say to people like, I'm stronger now than I was before I had babies, but it took me a long time to get back to this - yeah."* [HP5]	
14. Behavioural regulation	Suggestions to still be active when having a bad day or feeling tired *"I guess on days like that make the chall - make the app's actions, or challenges more low key - like give them something to like, you know, feel like they won. Like for that day, have one where it's like, eat some nuts, and you - you get the you - you win the day, or something, or, like, you know, take - take a shower, and then you win the day for - for those ones for those days (laughter)."* [P5] Postpartum people have a desire to check things off a list	Suggestions to still be active when having a bad day *"Then be like, "You know what, let's skip the weighted workout, or let's skip the HITT, or let's skip this, and let's just go for a walk instead". And like, even in that, offering a - meditation soundtrack, or a simple thing like that, I think would be great, because it still gets gentle movement in, and it gets them out of the house, and fresh air."* [HP2] Postpartum people have a desire to check things off a list *"I think people are very - goal driven and checklist driven, and that in our*	- Added a tracker to track LPP pain symptoms after logging exercises - Activated the Notes feature - Added pain science education to the emotion regulation module

"And then you do that - maybe you just check off the app and then something like you get a little bonus or something." [P5]

Using a PA tracker is helpful

"Yeah, visual, like, what I've done would be nice - like, it's - I think it's more motivation for - like, if I can see it in a visual." [P2]

Advice for scheduling postpartum PA

"It is very hard. Oh, God - I would say. Even like - having minutes like starting by minutes - so I would suggest like, you know – when - when the baby is sleeping, sleep for some time, and then, you know, do a baby step of - you know exercises in order to re-energize yourself. So say the baby is sleeping for an hour, sleep for half an hour or 45 min - and leave that like 5, even like 5 minutes per day. It's not much, but it does help your body to kind of you know, recover." [P3]

society, especially in that postpartum period, you're like, 'Okay, have I done this and done this? And yes, baby's fed and dog's fed, and I'm fed'. And so I definitely think a lot of people love trackers that like check in or they're like, 'Hey, you haven't hit your water goal yet. Did you drink your cup today' like a checklist, or checking something off, and then it going, 'Yes'. So a tracker in that way helps." [HP1]

The app should track symptoms

"Having different – you know - access points for them to kind of log their symptoms, but also know that there's – you know - an understanding of what that symptom means. And then 'here's a stretch related to that' or something where it's very targeted to what they're going through. I feel like that's overall my biggest comment on it." [HP4]

Using a PA tracker is helpful

		"And I think tracking is a big one, whether it's - look how many more reps you can do, or how much more weight or the pain that you now feel - to track it and see that is huge." [HP2] Advice for scheduling postpartum PA *"I think schedules work for a lot of moms, especially when they're like 'My baby sleeps at this time', and that, so strategies would be making it fit into their schedule - like, if you have a long wake window first thing in the morning, maybe choose to do your walk or your workout then, or if you have grandma coming over to help at this time, maybe plan for when you have extra hands."* [HP2]	
15. Usability	Acronyms needed defining *"MPAC? As a non-educator, I have no idea what that means. Yeah, you may have referenced it, and I just maybe didn't go back and find it."* [P1]	Acronyms needed defining *"It says SMART goals early on, and it never elaborates what that is. It says CSEP, and it never elaborates what that is. So those are the things I think, like, you and I know exactly what that is. But would - would*	- Only used acronyms if they were spelled out on the same card - Changed the all images, including the landing image and the Congratulations card image so they were more postpartum-relevant

	Mixed reviews on aesthetics and visual display *"Yeah, it just looks like an educational poster. So - I wasn't. It wasn't very appealing. Yeah."* [P5] Overall user friendly *"But the other instructions were pretty straightforward, like, you know, doing the surveys and everything they are - they are pretty good, so keep that –"* [P3] Don't like scrolling through PA time numbers *"Oh, I wanted to mention you about - when I log exercise - this numbers (scrolling numbers) - I would like to just type (rather than scrolling through the numbers)."* [P2] App glitches identified *"when I complete the surveys on there. It would always bump me back to the very beginning of the module"* [P4] Desired features – ability to take notes	*anybody else? …Again, the FITT principle - FITT principle - it starts out where it doesn't itemize, and then a couple pages later, it says what it is"* [HP5] Mixed reviews on aesthetics and visual display *"I'm very visual - so even in this app, I get a little bit lost, like I wasn't sure - where it starts, where it finishes. You know what I mean? I would like the map on Noon…It's gotta look nice."* [HP5] Did not like the app name *"so I would change the name of the app. Because I - I think - I think if you're going get anybody to - to use it, it's gotta speak to them."* [HP5] App glitches identified *"The only thing I would say is, and it didn't happen in Module 6, 7, or 8, but one to 5 for sure did it - maybe 6 - the last like survey questions that it would do, like - the ones that were*	- Pathverse programming team addressed the survey glitch - Ensure all quizzes matched the recent content - Pathverse programming team updated the exercise logging feature so users could type in the time rather than scroll through the minutes - Unblocked all modules - Pathverse programming team created new feature that enabled grouping of modules - Modules were grouped into "Introductory Modules", "Getting Started", "Sticking To It", "Return to Running", and "References"

"So, starting with that, like a journal or a diary. And maybe having that on the app like, you know how you have notes, and you can make notes on a phone." [P3]	*almost like a quiz. Once you completed those, it kicked you back to the start of the module, and you had to swipe through all the way again for it to go complete."* [HP2]
Modules blocked (2)	Easy to navigate
"If I - so if I'm on Section Lesson 2, and I'm like, 'Well, I want to check that out'. I can't actually click on my reference." [P1]	*"Easy to navigate, which is huge, I think, for it - and like simplistic, but in a good, non-overwhelming way, so."* [HP2]
Change terminology for blocked module	Sliding cards was not always intuitive
"I was thinking like "locked" doesn't sound positive. And I don't know if changing the terminology of that would make any difference to people - because I like how it's completed in green that makes you feel like you've accomplished something - but locked almost feels like it's restricted and like it, is restricted, but almost like – too restricted like you're not allowed here versus like, 'Hey, you haven't made it here yet'. I don't know that's just an over - that's an over." [P1]	*"I have a small phone and maybe - like some of the ones where you have to scroll up and down was - maybe a little less intuitive. Like I didn't really notice the bar and then I couldn't go sideways. But that also might just be because I have a really old and small phone (laughing)."* [HP1] Desired feature – visual summary of PA completed
Quizzes had mixed reviews	*"And then - I like the ability to track again my app. Once I finish the video*

	"So in the long term health benefits section. There's a quiz in the middle, and it doesn't ask about short term, long term benefits, it asks - it's the quiz that's right after that topic after short term long term - and it doesn't mention the quiz. I feel like the quiz was - it felt like it was out of place." [P1]	*and click 'Yes' it puts it into my calendar, it's done, and I can look in the month and go, 'Oh, look, yeah, I hit 5 days that month', or that kind of thing."* [HP5]	

Supplemental Table 3
First Online Survey Feedback
(n = 9 participants; 4 postpartum people, 5 healthcare providers)

Item	**Mean (SD)** **1 = Very dissatisfied to 5 = Very satisfied**	**# of participant/ partners that suggest changes**	**Suggested Changes**	**Changes Made**
Overall App	3.78 (.67)	6	Postpartum People • Change header images of intro lessons 2 & 3 as they feel busy & distracting. Also I feel like a solid colour header image would be less distracting than the cherry blossoms. • Many modules are still too text-heavy, the images are inconsistently themed, and the layout seems a bit aimless Healthcare Providers • Generally it's just not as easy to use as many high budget apps. Certainly challenges developing a tool that both reaches academic standards and is user friendly. I think it is useful and helpful as	• Changed the banner to solid pink colour • Updated placeholder images or modules 2 and 3 • Went through modules to try to reduce text while maintaining intervention fidelity • Adding video summaries to each module to user does not need to swipe through cards for each lesson

			it currently is and could be further designed for user experience in the future. • More interactive • Less swiping - was very tedious to go through 20+ slides • Include more video content	
App Tutorial and Introduction	4.00 (1.00)	2	Postpartum People • Change youtube videos to embedded video & remove face recording of Heather (• Reduce text, more bullet points, less slides, more interactive	• Updated videos to remove Heather's face recording • Changed the term lessons to modules
Postpartum Physical Activity Recommendations	4.22 (.97)	3	Postpartum People • The term "lessons" feels very academia and not a real world common/street term • More photos and gamification, less text Healthcare Providers • Simple visual	
Is Physical Activity Safe For Me?	4.33 (1.05)	3	Postpartum People • Less text, more diagrams and examples of exercises Healthcare Providers • Simplify, too wordy	

Lumbopelvic Pain Considerations	4.33 (1.00)	3	Postpartum People • Less text, more diagrams and examples of exercises Healthcare Providers • ADDIING A BRIEF ON WHAT LUMBO PLEVIC PAIN IS, like how pelvic floor dysfunction is explained • Simple visuals	• Added description of lumbopelvic pain in the lumbopelvic pain lesson
Pelvic Floor Considerations	4.22 (.97)	3	Postpartum People • Needs extreme reduction of text and more gamification Healthcare Providers • the video where Jodie explained the PF model should be placed before the pelvic floor health providers (page 13, 14) should be interchanged or the link to find the PFPT should be at the end of the module • Simple visuals	• Move the Global News video earlier in the module and sent the two cards with information on how to find a pelvic floor healthcare provider to the end of the module
Examples of Beginner	4.67 (.50)	2	Postpartum People • It would ok as-is, but a menu to guide the user to which video is best for them (e.g. baed on their needs) could be helpful Healthcare Providers	• Suggestions for future iterations of the apply to apply artificial intelligence to help users determine which exercise video is most appropriate for them

Postpartum Exercises			• Less wordy
Incorporating Physical Activity Into Our Postpartum Routine	4.11 (1.05)	2	Postpartum People • Less text, more diagrams and examples of exercises Healthcare Providers • Less wordy
Exercising with Baby	4.33 (.71)	2	Postpartum People • Less text, more diagrams and examples of exercises Healthcare Providers • Simple
Building Confidence	3.89 (1.17)	2	Postpartum People • Less slides, text reduction Healthcare Providers • Too wordy

Making It Enjoyable	3.89 (1.05)	3	Postpartum People • Spelling error on star chart page - says "start" instead of star in one section • Less slides, text reduction Healthcare Providers • Too wordy	• Updated spelling error
Benefits of Postpartum Physical Activity	4.44 (.73)	3	Postpartum People • Might be nice to add benefit of postpartum physical activity if planning subsequent pregnancies, and value in activity before another pregnancy • It's ok but could benefit from more text reduction Healthcare Providers • More simple	
Setting Goals	4.22 (.83)	2	Postpartum People • Reduce text and slides, more gamification and interactivity, Healthcare Providers • Simple	

Planning To Achieve Our Goals	4.22 (1.09)	2	Postpartum People • Needs extreme reduction of text and more gamification Healthcare Providers • Simple
Tracking Our Progress	4.33 (.87)	2	Postpartum People • Ok as-is, but could use example diagram or templates for use Healthcare Providers • Too wordy
Having a Tough Day?	4.00 (1.12)	2	Postpartum People • Needs extreme slide and text reduction Healthcare Providers • Simplify
Social Connections	4.00 (.87)	2	Postpartum People • Ok as-is, but some photos have been previously used, and could use example diagram Healthcare Providers • Simplify

Building Opportunities	3.89 (.78)	2	Postpartum People • Ok as-is, but could use example diagram Healthcare Providers • Simplify, too wordy	
Part Of Who We Are	3.78 (.97)	2	Postpartum People • Could be removed in my opinion or parts of the topic incorporated elsewhere Healthcare Providers • Simplify, too wordy	• Future iterations of this app will involve a questionnaire that helps determine where users are along the continuation of developing intentions, translating intentions, and maintaining regular physical activity. This questionnaire will then signal the app which modules to provide for each user.
Return-to-Run Postpartum	4.44 (.88)	2	Postpartum People • Ok as-is, but could use slide and text reduction and more examples, lists, and diagrams Healthcare Providers • Just the visual	
References	3.67 (1.12)	1	Postpartum People	• Added a link to a document that includes a

			• Just make this one page with hyperlinks for each module instead of slide-based	list of all references and links to the references
Videos	3.78 (.83)	2	Postpartum People • See above (Change youtube videos to embedded video & remove face recording of Heather) • I like the videos! Could be shorter and more of an overarching summary	
Trackers Feature	4.22 (.83)	1	Postpartum People • An in-app tutorial on how to use the tracker feature would be helpful	
Goals Feature	4.22 (.67)	1	Postpartum People • An in-app tutorial on how to use the goals feature would be helpful , and/or have it connect to or from the goals module somehow	
Activities Feature	4.00 (.87)	3	Postpartum People • A chance to add activities & customize • Suggested activities should be presented first Healthcare Providers • Easier to access	• Users can add activities under "Selected Activities" • Informed the Pathverse programmers that users would like "Suggested Activities" first and that they would like to be able to customize activities

Social Feature	3.67 (.87)	3	Postpartum People • Additional topics like goal accountability buddies, Runners, post partum yogies. Ways to connect moms by physcial interest • Add some starting discussion points to encourage conversation perhaps • More questions and prompts to fuel discussion may help, or groups based on baby's birth months (e.g. December 2025 babies, etc.)	• Added the following forum topics: ○ Goal Accountability Buddies ○ Discussion for individuals who gave birth in 2024 ○ Discussion for individuals who gave birth in 2025 ○ Discussion for Postpartum Yogis ○ Discussion for Postpartum Runners and Walk/Runners
Survey History Feature	3.44 (1.24)	2	Postpartum People • I feel this is not necessary • I do not even know what this feature is for	
My Points Feature	3.56 (1.13)	3	Postpartum People • I personally don't find points are a motivator for myself - but can see how others could! • Needs clarity on what I can redeem the points for Healthcare Providers • I don't see any value of that	

FAQ	Postpartum People • Yoga? • None • No • How do I use this app? What's in it for me? Which module should I use if I only want to X, Y, or Z? Healthcare Providers • Na • when should I start exercises? when to seek help if I have any pain or dysfunction? • No • No – all is thorough! • How to navigate the app	• Added a link to a video for how to use and navigate the app. • Added the following items to the Resources: o When is it safe to start exercising postpartum? o When should we seek help if we have any pain or other common postpartum symptoms of pelvic floor dysfunction or diastasis rectus abdominis?
Resources Tab	Postpartum People • N/A • None • No • Grab and go activities should be higher up and more featured. And more resources like that! Healthcare Providers • Na • Pelvic health healthcare provider list • Link of pelvic floor physios nearby	• Requested to Pathverse development team to be able to reorder Resources items (that would facilitated moving Grab and Go activities to the top) • Added a resource for finding pelvic healthcare providers

	• Same as above (no – all is thorough) • List of videos	
Suggested Goals	Postpartum People • N/A • No – I like the ones listed! • No • N/A Healthcare Providers • Na • Gentle mobility / 20 min yoga • No • N/A • I might prompt with a fill in the blank exercise goal	• Added the following suggested goals: • 10-min Gentle Mobility exercises • 20-min Yoga • Users can create goals in the Goals feature
Final Overall Feedback	Postpartum People • Maybe a section about fueling your body for activity & recovery • None - very well done! I really enjoy all the changes and the content. • No • N/A All comments made throughout survey Healthcare Providers • I think it is ready for testing and getting user feedback. It is content heavy and that is always a balance. As	• Moved the "Benefits of Postpartum Physical Activity" module to before the "Examples of Beginner Postpartum Exercises" module • There is pre-existing information on diastasis rectus abdominis with suggested exercises in the "Pelvic Floor Considerations" Module

		an expert it is harder for me to know what info people will make the most use of. Sometimes it is overwhelming to have too much information but other people thrive with it. I think a launch will be helpful for more input. • I would suggest that In getting started section, the benefits postpartum physician activity should be before examples of beginners exs. Adding more information on DRA, maybe adding a separate section on explaining that and suggesting some exs • No • Just the swiping! And using more attractive aesthetic so it doesn't feel as rudimentary of an app - think of apps like the "Form" app by Sami Clarke or Flow app by Bailey Brown. It just makes the user engage a bit more and brag about it to friends! • No	

Supplemental Table 4

Think Aloud Interview Findings from Participant/Partners with Lived Expertise of Postpartum Lumbopelvic Pain

Usability Heuristic	Code	Sample Quotes
1. Visibility of System Status		
Positive Feedback	Auto-correct is helpful (1)	"Okay, so I'm gonna click on the pelvic floor picture. I, I see it, and I swipe along, and we're gonna get started. And we're gonna type in test. Oo, that's an auto-crack, that's fun. Okay, next." [P1]
2. Match Between the System and the Real World		
Positive Feedback	Easy to access Resources from the Menu (4)	"Okay, so I'm just gonna click on menu, scroll down, I'm just looking for it… I believe that that… was in…Resources… looking for… okay, there it is. I'm gonna click View, and it's loading, and there we go. Awesome." [P4] "I hit the menu, then I hit on Resources, and then I scroll down to see the 2025 Canadian guidelines for, the physical activity, and I'm just gonna click on it." [P3]
	Easy to find and access Survey History (4)	"And I'm clicking Survey History. Aha! I see, the 'test' text that I wrote in on the…on the previous module." [P5]
	Tracker feature – easy to log an exercise (4)	"Okay, so just finding that in the bottom there, I can see that. Just click on it [Trackers], okay, and I'm gonna log an exercise. So, going to Exercise Logging, Log an Exercise, I'm gonna say that I rode my bike, and click next. Let's call that light physical activity for a light bike ride, and say I did it for 30 minutes. How much did I enjoy it? This is working good [the scroll bar], very little [laughing]. I don't like riding my bike. Let's see, very light. Toggling… let's see, let's say I felt happy after…How much pain did I feel? This is pretty easy to use, which is great. I'll add "test" as a comment and click save, and there it is. Awesome, that worked really well." [P4]
	Navigating through a module is easy (4)	"Okay, so I'm just scrolling through…Going through… everything's working." [P4]

	Goals feature – easy to log a goal (3)	“Okay, so I'm gonna look at the bottom there, there's Goals, I'm gonna click Add. Picking a priority, we'll say it's a high priority, picking a deadline…Let's do it by next week. And then an alert notification. Let's say single… And have it alert me tomorrow at 9am, my goal will be - maybe to go on a walk and… To a new place. Oops, I forgot to put a comment in there. So I think that I can… but that's okay.” [P4]
	Activity cards are easy to use (3)	“And now I'm gonna get started, and we're gonna test [typing text into the final activity card]. And next, and then I'm gonna put that down and continue.” [P1]
	Activities feature – easy to add an activity (3)	“Okay, so clicking that [Activities], clicking add an activity, add an enjoyable activity, let's say… hike…and the description will be, one hour hike…'How often do I want to do this?' Let's say weekends, instead of reminder - let's say, like, 11 AM… Maybe 11.30, yeah, that worked good. Okay, and then save. Perfect. There we go.” [P4]
	Found Menu fairly quickly (1)	“Oh, okay [scrolling up and down the modules, trying to find the Menu, sees it in the top right], I'm going to menu right now.” [P5]
	App is overall user-friendly (1)	“I don't think so. It seems really user-friendly, and it's… everything is captured there really well” [P4]
	Activity card – placement of typing makes sense (1)	“I'm now scrolling through. I'm at the activity mod – um, Section. I clicked start on the button. Okay, I'm gonna write 'test' as instructed in there.” [P5]
	Clicking on a video to play it is intuitive (1)	“Okay, I'm clicking on the video to see if it works.” [P5]
	Embedded video is working (1)	“I hear the video, and I see it moving.” [P5]
Negative Feedback or Suggestions	Goals feature – do not like the time setting for a goal (1)	Y”eah, so, like, the Notification and the Ongoing, that makes sense to me, that there's a time, but I don't know…yeah, why there would be a time for a Deadline, unless it notifies you, maybe. Yeah. This is, [typing into New Title] 'Try something new'. Is my new goal. So it showed up, and – okay.” [P1]

	My Studies screen – initially not intuitive that the user has to choose a study (1)	"No idea what it is, so I would personally go to the 'List View' [still on My Studies screen]. Lumbo…Or I would go to… that's me, sorry. I won't touch that again, now that I know that's me. What was it called again?" [P1]
	Tracker feature – initially unsure how to log an exercise (1)	"On the pink, module. It says… Exercise, so I finished my daily exercise. I'm gonna click on…[pressed the Sync with heart button]" [P3]
3. User Control and Freedom		
Positive Feedback	Navigating back to Home after completing a module is easy (4)	I continued with the module. I'm at the summary, and I'm at the congratulations. And now…I clicked go back to the main page. [P5]
	Resources – exited out of a Resource by clicking Done and it went back to list of Resources (4)	"Yeah, so I'm just gonna click done in the top left corner, and then I'm gonna keep clicking back on the back arrow [the top left], and here we are." [P4]
	Ellipsis for exiting the module is intuitive (3)	"Get out of it? Okay [found the ellipsis and exited]" [P3]
	References module – able to exit a reference by clicking Done (3)	"Yep. So, in order to get out, I'm just gonna hit, done - and then go on the three dotted lines, and exit module, and then it brings me back to the main page." [P3]
	Social Forum feature – able to edit a comment (1)	"That makes sense, but there's no comments yet. Okay, so let's go test [typing in 'test' at the bottom]. And then I click enter. I want to swipe left to see if I can edit it, because I'm curious if I can. So I'm trying to swipe. Oh, takes me to the whole topics [it swipes back to the list of topics]. Swipe left on your comment to edit or delete. Okay, I was swiping right, so I'm just dyslexic today. Yeah, so something like that feature would be nice, in the last section, where you can swipe – left - to edit." [P1]
Negative Feedback or Suggestions	Activities feature – unable to edit added activity (2)	"Right, okay. So I go in and then I want to see if I can edit it, now that I've added it, and I'm clicking around, but it doesn't look like I can edit it once I've added it." [P1]

	Goals feature – unable to edit a goal once it had been logged (1)	“Exactly, it just says, “delete” - is the only option.” [P4]
	Initially took some time to figure out how to exit a module (1)	“Okay, so I'm previously in the references section, I'm actually trying to go back now [scrolling back to the start of the module], because I – um - there was a back button before in the other modules, but this one doesn't have it, so I'm clicking on the top three button, uh, three - the ellipsy thingies, and clicking ‘Exit Module’.” [P5]
	Resources – after accessing a Resource then clicking the “back arrow,” it took user out of Menu completely (1)	“Okay, so I'll go back to get to my Menu… oh, that's interesting, so I went ‘Go back’ that time, it took me, out of it [out of the Menu], which isn't an issue, but… That's a difference.” [P1]
4. Consistency and Standards		
Positive Feedback	Resources – accessed a resource by clicking View (4)	“So let's click the ‘View’. Yep, it takes me to an internet browser, which looks normal to everything else, so I'm going to then go ‘Done’, and it takes me back to the app. I like how smooth that is.” [P1]
	Social Forum feature – typed in the bottom right away (2)	“Okay…so just clicking that, let's choose, Postpartum Physical Activity Tips. I'm gonna comment, test, click next, and that little arrow worked good, and it's up there. Sweet.” [P4]
Negative Feedback or Suggestions	Social Forum feature – initially was not intuitive to type in comment at the bottom of the card (2)	“Um…I'm - I tried to click on the top part by accident [where it says Comments (0), but I'm seeing that to ‘add a comment’ - it's on the bottom.” [P5]
	Resources – tried to click the title of a Resource to access it (instead of clicking View) (1)	“I'm clicking on the [clicks on the title]… oh, the title didn't do anything” [P5]

	Tracker feature – how hard were you working has numbers and words (1)	"And I'm gonna slide this up and down [How hard were you working?]. There's some that have words, there's also some that have numbers. I will just put it in the middle for now, 'Hard'." [P5]
5. Error Prevention		
Negative Feedback or Suggestions	Tracker screenshot image is confusing (3)	"It's not letting me, select the pane [trying to tap on the screen shot]…For some reason, so I'm just gonna hit 'next'. It's not letting me go to the next page. Should I cancel?" [P3]
	Glitch with an activity card (1)	"Okay [laughing], I am now typing in 'test'. Oh, it's kinda… [after pressing 'return' it did not exit out of the typing screen] oh. Okay, there we go. Oh, okay. So, yeah, I was trying to type in test, but the screen is pretty limited, so I had to…Click a bunch of places away…. Again, I have an iPhone, and it's hard to…I had to click out to get out of the screen [out of the screen that showed the keyboard that popped up]." [P5]
	Pressed something accidentally (1)	"Okay, I'm clicking on the purple menu button at the top right. Oops, I accidentally, moved my finger in a way that it closed the menu" [P5]
6. Recognition Rather than Recall		
Negative Feedback or Suggestions	Suggestion for "In Progress" labels for modules not yet completed (1)	"What happens if there's a module that's not fully completed that, like, I have half left? Would that show up in the top left corner as something? Like, where it says…New, which is…Let's go… Let's just click through halfway, kind of. Let's go here, and then if I exit… it doesn't show it as anything [doesn't show up on the Module card that half of it was completed already]. So I think that would be helpful, like, as a mom, because a lot of times you get interrupted in things. So, like, you know, 'Incomplete', or… not incomplete, that's not encouraging, like, 'In Progress', or…" [P1]
7. Flexibility and Efficiency of Use		
Negative Feedback or Suggestions	Activities feature – does not want to be required to select every day (1)	"So that, to me, seems a bit annoying, so if I want to - because I would… if I want to do it weekdays, maybe I don't want to do it every weekday, because maybe it's, I don't know, something I'm doing. I have daycare on Tuesdays and Thursdays. Maybe it'd be helpful to have the individual days

		as well here [Under the options for 'How often do you want to engage in this activity?'].” [P1]
	Tracker feature – when trying to find where it was located, first checked to see if it was in the Menu (1)	“The tracker, I see it on the bottom. I'm curious if it is in the Menu, so I'm just clicking to look as well, but no, it's not, because it is only in the bottom, which is fine.” [P1]
	Trackers feature – be able to label exercises as “completed with a baby” (1)	“Or a special section of your logging activity, like, 'with baby'. Like, you know, if I'm 'jogging with baby', if I'm 'lifting weights with baby,' 'yoga with baby', because then - maybe if I'm tracking something, and then that one activity is a bad day, and it's slower, or whatever - I can see, 'oh, that that's with baby', so that kind of doesn't discourage you, it just almost, like, shows you that there was an added complexity to it. I think that would be a fun, fun feature.” [P1]
8. Aesthetic and Minimalist Design		
Positive Feedback	Navigating to a module is easy (4)	“Okay, Lumbopelvic Pain, I'll scroll down, there it is, click on it.” [P4]
	References module – easy to find (4)	“Okay, so I'm on… I've scrolled down, and I clicked on References, and then I will click on the link [P3]
	References module – easy to access document and click in link to one of the references (4)	Yeah, perfect. Okay, there we go, so it's just popping up, and we've got the references PDF, and then I can click one of those. Awesome, so it's just loading…I accept [cookies]… yeah, and it looks like I can see that, so that's really awesome.” [P4]
	Social Forum feature – easy to look through different items (3)	“Okay, going back to the bottom, clicking on Social Forum…Scrolling down to see the different topics…Okay, I will just… I'll click the bottom one, just to spice it up a bit.” [P5]
	Tracker feature – intuitive to find at the bottom of the screen (2)	“I'm going to go to the Tracker Feature on the bottom. And then I'm going to log an exercise.” [P5]

	App is accessible by clicking loading image (1)	“Okay, lumbopelvic pain [swiping back and forth between Postpartum PAL and PAL app]. Oh, okay, there's the app, I'm clicking into the app [the Postpartum PAL app], it's loading…” [P5]
Negative Feedback or Suggestions	Suggestion to be able to add photos to logged activities (1)	“What else…maybe it'd be nice, if possible, to add a photo to your activities? Like, I know, like, Strava and Garmin, you can add a photo of what you did something, so some people are really motivated by that. I, myself, not so much, but sometimes, you know.” [P1]
	Tracker feature – initially difficult to find (1)	“If I go down, I'm trying to see the tracker feature… [explaining where the Tracker feature is] Tracker feature, okay, so I clicked on the Tracker feature.” [P3]
9. Help Users Recognize, Diagnose, and Recover from Errors		
Negative Feedback or Suggestions	Embedded videos are not working and therefore unable to access videos at all (3)	“So it's unavailable, so I'm just clicking on it, hoping that it might load. Oh - I clicked on the bottom right corner, and it didn't load, but it did take me to YouTube. So I'm gonna go back, because I'm just curious, maybe that's, like, a loading error? But my Wi-Fi shows it's on, so I feel like that might be just an error.” [P1]
10. Help and Documentation		
Negative Feedback or Suggestions	Menu difficult to access directly from the module (3)	“In the Menu…[presses the ellipsis] Do I keep scrolling through it?” [P4]
Additional Overall feedback	App is on the right track (4)	“Oh, gosh – um, I see a lot of the feedback has been incorporated. Like, when I was going through the app, it didn't even look familiar [to the PAL app – the original version]. Like, it was different than the iteration that the - like, you had first sent it to me. It's… I'd say it's on the right track.” [P5] “I don't think so. It seems really user-friendly, and it's… everything is captured there really well” [P4] “No, to be honest, because I think… I think it's a pretty well set up app, because it involves everything. I really like the, you know, when it shows

		the video, it actually gets you more involved. Plus, like, all the other, features, like the Tracker and, like, Setting Goals, I really, really like that. So it is - it is a really good app, according to me. I don't think I would make any more changes to it. Yeah [scrolling through the modules]." [P3]
	Would need more time with the app to come up with further improvements (1)	"Like, obviously, like, I can't… like, I can't think of anything specific, because I would have to obviously see, like, it would have to be in front of me, and then I'd have to, like, try it out again and, like, write it out. But right now, it's… it looks like it's on the right track. Like, I… I think there is more to improve, obviously, but, like, I can't think of anything right now." [P5]

Supplemental Table 5

Think Aloud Interview Findings from Participant/Partners who are Healthcare Providers with Expertise in Managing Postpartum

Usability Heuristic	Code	Sample Quotes
1. Visibility of System Status		
Positive Feedback	Auto-correct is not working (1)	"Flex… oh my goodness. So, typo-ing, if there were, like, an autocorrect, I don't know if that's something I have to turn on, I just have fat fingers [auto-correct didn't seem to be working]." [HP4]
	Desire for progress bar to monitor physical activity (1)	"And one more thing as I'm, like, thinking about this, again, I don't know why the Aura app is, like, coming to my brain right now, but it's exciting to see your progress, or it's exciting to have something kind of give you, feedback or, like, congratulations for doing things. So, even if there were to be, like… I'm pointing with my finger as if you can see me. You can only see my screen right now, right? …Okay, so, if you were to have, like, a progress bar at the very, very top, so it's like, 'You have successfully completed 5 activities this week', or 'You have successfully completed 3 activities' based on what their goal may be. Just to, like, give them, like, a, 'Oh my goodness, I've done, you know, 2 out of the 5, I only have 3 more to go this week, I can do it'. But something visibly to give them some feedback, like, you've been doing really well, keep it up, kind of thing." [HP4]
2. Match Between the System and the Real World		
Positive Feedback	Easy to access Resources from the Menu (5)	"Okay, so I'm gonna click on Menu, gonna find Resources and click on it, and then the 2025 Canadian Guidelines for Physical Activity, scrolling down to get there, clicking on View. And then scrolling through." [HP2]
	Navigating through a module is easy (5)	"Um, okay, and then going to the next one [net card]…again, just reading the text. We'll use the traffic light to help us grade our activity. Okay, that makes sense." [HP1]

		"Most… going through the app, going through this module, it kind of goes through…a lot of, like, explanation about a lumbopelvic pain and how…what physical activity we have to do, and just kind of going through, like, topics like activity pacing, information about that, and then, method to help with activity pacing, and then tracking your pain. Then there's a video for that, and then - other thing is graded activity. Then, again, like a traffic light method to help graded activity, and then you can track how you feel, pain-wise." [HP3]
	Easy to find and access Survey History (4)	"I'm looking for Menu [now sees it at the top right after exiting the Module]. And then Survey History and clicking on that." [HP1]
	Tracker feature – easy to log an exercise (4)	"Okay. And so…Inputting information using the keypad, pressing next… And press selecting [selected LPA], and then… Entering numbers, pressing next…And scrolling over with my finger to update the enjoyment. Hitting next. Again, entering the intensity, or how hard, hitting next…Scrolling over and next. Inputting pain using fingers, and next. And then confirming everything, and hitting 'Save'." [HP2]
	Activity cards are easy to use (4)	"Okay, so I am gonna try and find that activity card, so we're gonna hit start. And you just want me to just put in 'test' [typing in 'test']. Okay, and then I'm gonna hit next, and hitting 'test' again, or typing out test again. And then I'm going to hit continue." [HP4]
	Activities feature – easy to add an activity (4)	"Right, so again, looking just at this screen, there's activities at the bottom, so clicking on Activities. Pressing the 'add an activity' button, adding an activity name, test activity by typing in on the keyboard. Activity description would be 'test'. I'll pick on Weekdays at the clicking, and then I will select a reminder. And there's different options for when you want the reminder, and if you want an alternative check-in. Both of those are set, and then scrolling up and hitting save." [HP2]
	Goals feature – easy to log a goal (3)	"Okay, so from here, I'm able to see along the bottom that there's a Goals option. It looks like there's some options in here, but there's one that just says 'Add', so I'm gonna click on that. Priority… Just pick anything, a

		Deadline… let's give it a week…And I can change the time, too. Alerts, you can pick how often you want it, so I'm gonna go daily, at 11 and pick a time, we'll go 11 o'clock. Just do [type in] test. And enter." [HP2]
	App is overall user-friendly (2)	"But the actual functionality of the app is actually quite good. I feel like it's very smooth and easy to use." [HP4]
	Embedded video is working (1)	"So going over a video about how to activity pace… Audio shared by [HP4] phone: Hi, I'm just here to talk to you guys about." [HP4]
	Tracker feature – liked the pain scale (1)	"But I would… I would… I would keep it like what you did, because that would not make it… people know, and people will decide how they are… like, ranking their pain, or what they… yeah, it's subjective, so I would… yeah." [HP1]
Negative Feedback and Suggestions	Goals feature – would prefer a different order of items (3)	"Oh, I see Goals, okay, yeah. Log a goal. Ooh, I like this. Now - I have to go back and think. I'm going to add a goal. I'm just thinking for this one, I might have… I don't know if you can switch the order, but I would have, um… the goal, like, the "New Title" [currently at the bottom] the Goal - instead of 'New Title' or… um, and I'd have it at the top. Because I feel like I can't rank my priority - until I've written my goal." [HP1] "Okay, I'm gonna add [clicks on the orange button]… priority deadline alert… is this for goals [confused why 'pick a priority' is at the top]? Pick a priority?" [HP5]
	Zoom on images is confusing (2)	"I'm reading the text, I'm looking at the pictures. I see the Zoom button [under the image on the card], so I want to zoom in [zooms in on the image]. Oh, look, that doesn't do anything interesting. I'm thinking out loud enough? Okay, so then I'm gonna go to the next page. The Zoom wasn't a feature I needed to use." [HP1] "And the Reflections… What is this Zoom thing [looking at the 'Zoom' on the card? Oh - just the picture came up late." [HP5]

	Trackers feature – MVPA and LPA acronyms might be confusing (2)	"Um, type of exercise, moderate to vigorous physical activity. I'm just looking at the acronyms and wondering if they're necessary. Will anybody… even myself, I'm like, ugh, I don't know if… LPA matters, just light…" [HP1] "And I'm gonna hit next. What's the MVPA and LPA?" [HP5]
	Activities feature – not clear if it is supposed to be a physical activity (1)	"Okay, so Selected Activities, I can see that… see that Add Activity button? At least it's bright. I can tell that I want to hit it, although the text is little. Add an enjoyable activity, I'm gonna add it as 'Reading'. Is it supposed to be active?" [HP5]
	My Studies screen – initially not intuitive that the user has to choose a study (1)	"I just swiped the first one over on the first page just to see the card view, but do I want list view [on the My Studies page]? And now I hit list views so I can see the same things, and…I'm gonna hit 'begin', and I'm gonna go to the lumbopelvic one. So I'm swiping through…The introductory and the lumbopelvic pain considerations is the one I want?" [HP5]
	Activities feature – check-in time should updated based on selected reminder time (1)	"Okay, so it would be nice if that automated, then, if my reminder's 9pm, if the check-in just bounced to 10PM or something." [HP5]
	Goals feature – confusion of difference between Completed and Current (1)	"Do you ever… is the completed only ever done? Like, you never add it? Like, maybe it… maybe it's, like…maybe it's a drop-down over here, so the only thing you ever see is 'Current', 'Add', and you can see all the different ones, and then you swipe over to all your 'Completed', or something." [HP5]
3. User Control and Freedom		
Positive Feedback	Navigating back to Home after completing a module is easy (5)	"Right, so that kind of comes to the end of the…module. So we just go back to the main page." [HP3]
	Ellipsis for exiting the module is intuitive (5)	"Exit module [clicked on ellipsis]." [HP1]

	Resources – exited out of a resource by clicking Done (5)	"Yeah, and then… And then if I'm done, then I'll go back, yeah [presses Done]." [HP3]
	References module – able to exit a reference by clicking Done (3)	"And so, clicking on one selected reference…And there's one, and then navigating back, again, clicking on 'Done'." [HP2]
Negative Feedback and Suggestions	References module – pressing Done takes user back to the card with the link rather than back to the document with the references (3)	"And then I can get back out. Oh, it goes right back [to the card that has the link on it]." [HP1] "Then I'll X out of that. And I'm back to that link. It doesn't take you back to the references list, eh?" [HP5] "So I feel like me as a participant, I would love to still go back to that original document where that link is, just so maybe there was something else that I saw through there that I want to just quickly jump back to and not have to do that extra click." [HP4]
	Goals feature – unable to edit a goal once it had been logged (1)	"That, yeah, those buttons are just flipping [and not enabling editing]. Yeah, I did want to edit it. And there's nothing… like, I tried to hold down on the screen - in, like, when the three buttons didn't work, I just tried to hold on the words. And I… when I swipe, it just goes to completed. Um, so I can swipe… when I swipe left and right, it's toggling between the 'Current' and 'Completed' bars, but nothing to edit that goal." [HP1]
	Goals feature – confused by the Goal box in the Trackers feature (1)	"Trackers [clicks on Trackers]… Where are my goals? There we go [typing into the green box under 'Daily goals' in the Trackers feature]. So, in my head, I'm thinking, 'Is this where I put my goals?'" [HP1]
4. Consistency and Standards		
Positive Feedback	Resources – accessed a resource by clicking View (5)	"Okay, there you go. The view [clicked on View], yes. Yep. So it opens up in a separate page. So after that, I'm gonna just scroll through the, writing." [HP3]

		"I'm gonna hit 'View', and that's nice that it opens up in browser, that it doesn't take me to a Safari or anything like that." [HP4]
	Social Forum feature – typed in the bottom right away (5)	"Okay, so we're gonna hit social forum, and seeing all of these different topics. Okay, so I'm just gonna click the first one for questions. And I'm going to hit test, or type test, in the bottom - box there." [HP4]
Negative Feedback and Suggestions	Tracker feature – how hard were you working has numbers and words (1)	"[Yeah, so it goes back and forth between] Oh, yeah [Words and numbers]." [HP2]
5. Error Prevention		
Negative Feedback or Suggestions	Tracker screenshot image is confusing (3)	"Pinch to zoom in [zooming in on screen shot of the pain tracker]. I can't do it." [HP5]
	Goals feature – pressing save doesn't work (1)	"Okay, I'm gonna add the goal - to a medium [priority], and then I'm gonna pick… try it for a Sunday. And then I'm gonna do, time, weekly. And I'm just gonna go for… put walking [under New title]… And… press save [but it isn't advancing]…" [HP3]
	Pressed something accidentally (1)	"Oh! [swiped out of the Activities feature and took her out of the program to the 'My Studies' page]. Oh, interesting. I don't know why I went back." [HP1]
	Swiping error (1)	"So, yeah - it might make sense to… not allow you to swipe out without hitting the go-to-home page button." [HP1]
	Trackers feature – scroll bars run off the edges of the cards (1)	"How much did you enjoy it? I'm gonna say a lot. This is really far off the edge eh? [either side of the tracker scroll bar]" [HP5]
	Trackers feature – keypad that pops up is dysfunctional (1)	"Yeah. So again… oops, that says rest [instead of test], but that's okay. Clicking… Entering numbers [number of exercise minutes]… on these [the How much did you enjoy it? Card]…It gives you a keypad, but I just scroll over with my fingers, because if you hit anything on the keypad, it doesn't… I was like, I don't think I entered that for my time [on the log exercise summary, time came up as 20255896532 minutes – must've

		included the numbers as she was typing for the other questions instead of using the scroll bar].” [HP2]
6. Recognition Rather than Recall		
Negative Feedback or Suggestions	Suggestion for “In Progress” labels for modules not yet completed (1)	“Yeah, and if I go back to that one, which was…here - it takes me to the start again.” [HP2]
	No need to have traffic light image a second time (1)	“I don't know if this is a repeat slide, but me…right away, I would just want to skip and slide that finger over, because I feel like I had visually just seen that.” [HP4]
7. Flexibility and Efficiency of Use		
Negative Feedback or Suggestions	Allow the user to change the layout of features (1)	“Then the only other thing that I would say, just as a thought, whether other people agree with me on this or not, is something that you want them to access often and frequently, I would just put that as part of the home screen. So instead of having, like, the Tracker on the bottom that I have to go in and track, this dead pink space at the top where it says Menu, if we were to have that tracker along there, or, like, a button that says add an activity or something like that right at the top, just so I can quickly access it.” [HP4]
	Suggest ability to sort modules as they are completed (1)	“I would change ‘Current’ to, ‘New’, and then all to be all of them, and again, shift all of the completed ones to the right. Under “Current”, just have the ones that are new…And then under the “All” category to have the old ones as well, because the fact” [HP2]
	Postpartum physical activity guidelines are long (1)	“They're nice and long [laughing].” [HP5]
8. Aesthetic and Minimalist Design		
Positive Feedback	References module – easy to find (5)	“Okay, so I'm scanning down to find those References Module. I'm clicking on the module.” [HP5]

	References module – easy to access document and click in link to one of the references (5)	“Okay, so I'm gonna click the link. And then it's gonna bring me over to this document, where then I can open one of the links here. So I'm just gonna pick the postpartum physical activity recommendations, which is the one that I just viewed anyways, and then go down through.” [HP4]
	Social Forum feature – easy to look through different discussion topics (5)	“So again, from this screen, seen on the bottom, there's a Social Forum option. Clicking on there, there's different topics, so going to postpartum runners and speakers, hitting View Topic, and then adding a comment of ‘test’ by typing and posting.” [HP2]
	Navigating to a module is easy (4)	“Um, but yeah, just reading the text, continuing to swipe, reading the text. Swiping, um, not difficult to navigate.” [HP1]
	Tracker feature – intuitive to find at the bottom of the screen (2)	“Okay, so at the bottom, looking and there's a Trackers button. And there's one that says Exercise Logging. Pressing log an exercise…” [HP2]
Negative Feedback or Suggestions	Consider changing app banner colour (2)	“I try not to use pink, just because there's lots of moms who are not female. I kind of… I've been trying to stay kind of neutral recently, like greens” [HP5] “I love the pink, but I feel like I would make these buttons larger [the feature buttons at the bottom], or I would make them have, like, a background so they seem a little bit more contrasting. I feel like that would have pulled my vision a little bit.” [HP4]
	Prefer larger font size in some places (2)	“Oof, I can't see anything [the text is too small]. Fabulous. Okay, so I went up and down because I cannot see that to save my life [the row of features at the bottom].” [HP5] “Totally. Totally. So, if anything, if I were to vocalize and say, I love the pink, but I feel like I would make these buttons larger [the feature buttons at the bottom]” [HP4]
	Forgot what the app logo looked like (1)	“I just haven't used it on this phone yet, so I'm just looking for it. I'm still looking… What does it look like again?” [HP5]

	Tracker feature – initially difficult to find (1)	"Totally. Totally. So, if anything, if I were to vocalize and say, I love the pink, but I feel like I would make these buttons larger [the feature buttons at the bottom], or I would make them have, like, a background so they seem a little bit more contrasting. I feel like that would have pulled my vision a little bit." [HP4]
	Module card word alignment could be improved (1)	"I just find those words a little harder to pull out, maybe because they're at the same line, like, almost indenting them - just a thought in my head." [HP1]
	Navigating to modules took a bit of time (1)	"Yeah. I just go through the, so if I go back… do this… Oh, nope, not this one. Yeah, I usually, like, go to the menu, And then…not Current, I just do All [at the top], and then I just, getting started, just go to the Lumbopelvic Considerations, yeah." [HP3]
	Consider changing font (1)	"I think just from an aesthetic standpoint, like, some of the… if I can stay, actually, on the app, just as some of the text, fonts, I feel like just need a little bit more of a…I have a hard word formulating my thought here. I'm trying to make it so it's a little bit more grabby, or a little bit more, like, whether there's an image associated with, like, these topics, for example [looking at the discussion topics under Social Forum], or they're just used in different fonts just to make it seem a little bit more modern. I feel like moms are very tired and very squinty, and having text that kind of, makes you excited to be learning about this stuff often helps. Whereas this does seem like a little bit more of, like, an Arial Times New Roman situation, so something like that." [HP4]
	Suggest minimizing white space from module cards (1)	"I do notice some blank space, like, some areas that feel like there's only a little bit of text, or specifically - when we were doing that initial module, like, through this slide [Activity Pacing, card 11 of 25], like, obviously we have what we need to say through that area, but even if we were to center that on the screen to make it seem like there's not more to scroll down and find, sometimes I find people are unsure if that's the end of it. So either fill that space with an image or center that text." [HP4]

9. Help Users Recognize, Diagnose, and Recover from Errors		
Negative Feedback or Suggestions	Embedded videos are not working and therefore unable to access videos at all (4)	“The videos… videos are not working, the other ones were also not working.” [HP3]
10. Help and Documentation		
Negative Feedback or Suggestions	Menu difficult to access directly from the module (5)	“Okay, so I'm going to the three little dots… Oh - menu…I'm swiping up and swiping down, I'm hitting the three dots [unsure how to access the Menu]…” [HP2]
Additional Overall feedback	App is on the right track (5)	“Everything else seems to be pretty cool. Yeah, I like the… I like how it has, like… like, how… It's very clear - the app is really clear. There is definitely a lot of reading, but it's important to be understanding also, rather than just, like, an app just with exercises.” [HP3] “I think it's coming together really nicely. And you know what? A new app, it always takes you a second to kind of figure out - just those little things that make it a bit more intuitive.” [HP5] “Yeah, I think that's… good. I think it's getting, like, things are… clean and tidy.” [HP1]
	Suggestion to have audio for modules (1)	“Or could it just be, like, a…like, an audible kind of a thing?” [HP3]
	Additional exercise videos (1)	“Oh… I… when I was looking through my, through the recommendation, like, exercises [the module with exercise videos] - there's some videos… We, like this one, the examples of beginners postpartum exercise, we don't have, like, like a yoga video, like a yoga… Like, there are a lot of relaxation, strengthening, core workout, like, Pilates, like, there's a lot of, like… I see the 15-minute chair work… yoga, right? Yoga for pelvic floor, but there's no general, like - like a mobility, I would say. Yeah, right?

		Rather than, like, naming it yoga, I would say, like, mobility, like, just like a beginner's, stretching exercise, or something like that. Yeah." [HP3]
	Liked the modules (1)	"I feel like the actual modules themselves are really good, though." [HP4]