A Quasi-Experimental Trial Addressing Family Eating Practices using an Interactive Family-Based Healthy Weights Intervention: Short Term (10-Week) Outcomes

By

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Supervisory Committee

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Abstract

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Background: Evidence-based blended family interventions, those that incorporate both in-person group sessions and on-line sessions, remain understudied; specifically, there is insufficient research that investigates psychosocial and behavioural nutrition outcomes. Thus, researchers and stakeholders across BC worked together to develop the Family Healthy Living Program (FHLP), an evidence-informed blended family-based intervention that addressed parent feeding practices through parent and child behavioural and psycho-social factors (e.g. attitudes, self-efficacy) associated with HE using the Multi-Process Action Control (M-PAC) framework and behaviour change techniques.
Objective: To evaluate the efficacy of the FHLP in improving secondary nutrition outcomes, which include self-reported behavioural and psycho-social measures for parent feeding practices and child dietary behaviours.
Methods: Municipalities across BC participated in this 10-week quasi-experimental wait-list control trial. Participants were parents (n=59) and their children (n=64) aged 8-12 years who had a BMI ≥ 85th percentile for age and sex. Families were allocated to the intervention or a wait-list control group. The FHLP provided a blended intervention consisting of 10 weekly sessions, 4 community activities (14 in-person opportunities) and an online platform with interactive activities. Furthermore, behaviour change techniques introduced during program sessions matched the proposed target constructs of M-PAC. Secondary parent and child nutrition outcomes were evaluated using validated self-report questionnaires to measure: parent feeding practices, the home food environment, parental attitudes and perceived control for supporting child's HE, parent/family healthy eating (HE) habits and identity, regulation of child's HE behaviours, and parents' cooking self-efficacy, as well as children's dietary behaviours, attitudes, outcome expectations and self-efficacy related to HE. Researchers followed an intention-to-treat protocol for participants who did not complete follow-up measures. Repeated measures analysis of variance (ANOVA) (2x2) was used to compare pre and post measures between intervention and waitlist control participants.
Results: Fifty families completed the study. Relative to wait-list controls, regulation of child's HE approached significance (mean= 13.88, SD= 3.66, d= 0.549, p= 0.051) and medium effects sizes were detected for parental attitudes for supporting child's HE (mean= 5.97, SD= 0.957, d= 0.514, p= 0.064) and total parent support of child's HE (mean= 10.55, SD= 1.26, d= 0.510, p= 0.066) among parents in the intervention group at follow up. No significant between group changes in child nutrition outcomes were identified; however, over 50% of children in the intervention group either improved or maintained their fruit and vegetable intake over time.

Conclusions: Blended family-based interventions developed and evaluated according to behavioural theory and corresponding behaviour change techniques can improve parents' regulation of their child's HE and psycho-social determinants of total parent support of child's HE. Future research should investigate how theory-based, evidence-informed blended interventions can further influence family improvements in dietary behaviours and facilitate a home environment that supports children's HE behaviours.

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Thesis Contribution Statement

This contribution statement describes the role I had in the development of this portion of a larger multi-component study. I identified nutrition related data collection instruments and ensured that we selected validated and reliable sub-scales to assess child and parent-level secondary nutrition related outcomes and that they aligned with the M-PAC framework. Additionally, I evaluated the draft FHLP curriculum and aligned program activities with the M-PAC framework in order to ensure that the intervention adequately addressed the constructs in the frameworks. I facilitated and collected child data at multiple program sites and developed the on-line surveys for parents during the 2018-2019 programs and was responsible for data entry, cleaning and analysis of parent and child level data for all quantitative physical activity and healthy eating variables.

Chapter 1: Introduction

1.1 Overview

Childhood obesity is a pertinent global health issue with children worldwide experiencing higher levels of obesity than previous generations (Ash, Agaronov, Young, Aftosmes-tobio, & Davison, 2017). Obesity is currently one of the most common paediatric health problems (A. R. Hughes et al., 2008) and has been linked to multiple physiological and psychosocial problems throughout childhood that often carry on into adulthood (Sacher et al., 2010). Obesity is also associated with numerous short and long term health complications such as type II diabetes, dyslipidaemia, sleep apnea, hypertension, non-alcoholic fatty liver disease, polycystic ovarian syndrome and orthopaedic disorders (Woolford, Sallinen, Clark, & Freed, 2011). Observing the serious health and economic outcomes related to childhood obesity has motivated public health and policy officials to develop treatment and prevention programs (Yackobovitch-Gavan et al., 2018). Nevertheless, developing effective interventions appears to be a difficult task due to the complexity of issues related to childhood obesity.

1.1a Family-based Weight Management Interventions

Researchers and public health policy leaders have identified behavioural family interventions as the most widely studied and successful interventions for addressing childhood obesity, producing favourable short and long-term outcomes for child weight loss (Woolford et al., 2011). Kalarchian and colleagues (2009) also reported that family-based behavioural weight management interventions are the principle approach for achieving long-term weight control in children and adolescents. The success of the family-based intervention model may be related to the whole-family nature of these interventions; encouraging the whole family to make behavioural changes decreases the focus placed on the overweight child's dietary and physical

activity behaviours (Sung-Chan, Sung, Zhao, & Brownson, 2013) and provides a supportive environment for making lifestyle modifications in the home setting.

Furthermore, parents' dietary behaviours, activity levels, and food preferences impact a child's health-related behaviours, nutrition and physical activity knowledge (Birch & Fisher, 1998; Ek et al., 2016). Parents' feeding practices and parenting styles have also been associated with child eating behaviours, which are linked to child weight status (Doherty, Chan, Kong, Gordon, & State, 2012). For example, a study addressing parental feeding styles found that children with indulgent, less-involved parents (authoritarian parenting style) had higher body mass index (BMI) scores than children with authoritative parents (M. E. Thompson, 2010). This could be due to the fact that authoritative parents utilize a more nurturing and supportive parenting style, which helps children develop self-regulation skills (M. E. Thompson, 2010). Conversely, authoritarian parenting, which is characterized by high expectations and less nurturing and support, creates a more controlling and restrictive environment. For example, authoritarian parents often restrict the amount of sweet and salty snack foods their child can eat and will make their child eat fruits or vegetables before leaving the dinner table (Ek et al., 2016). This type of parenting has been linked to an avoidance of healthier foods and an increased preference for the restricted snack foods (Ek et al., 2016; M. E. Thompson, 2010). Additionally, a study relating parenting styles and children's eating patterns found that children of parents using authoritative feeding styles were more likely to drink milk and eat fruits and vegetables than children with authoritarian parents (Patrick, Nicklas, Hughes, & Morales, 2005; Thompson, 2010). Therefore, it is important to encourage parents to participate in weight management programs with their children to provide them with the tools to support their child's eating behaviours in ways that are neither restrictive nor overly lax. For this reason, interventions

targeting parental feeding skills and self-efficacy in addition to the home-food environment may have a strong effect on children's eating behaviours, physical activity, and body weight.

1.1b Intervention Sessions and Nutrition Education Delivery

Interventions generally involve parents and children participating in one to two hours of nutrition and physical activity sessions, with some interventions dividing sessions into parent-only and child-only meetings and then reconvening parents with their children in the last portion of the session. Furthermore, family-based interventions emphasize the importance of adopting long-term healthy eating and physical activity behaviours to achieve a healthier lifestyle, as opposed to modifying behaviours with the primary intent of losing weight (Edwards et al., 2006; Jester, Kreider, Ochberg, & Meek, 2017). In fact, most childhood interventions are shifting away from recommending calorie restriction as a weight-loss strategy; instead, the curriculum emphasizes adopting healthier eating patterns and following portion size guidelines (Edwards et al., 2006; Kalarchian et al., 2009; Yackobovitch-Gavan et al., 2018). Although the majority of interventions use anthropometric data as important outcome measures, program leaders are no longer delivering material in a manner that highlights weight loss as the primary goal. Additionally, interventions implement various strategies for delivering nutrition education to parents and children. For example, many family-based interventions organize nutrition games and activities during the child sessions in order to foster an engaging and interactive environment (Chen, Weiss, Heyman, & Lustig, 2010; Xu et al., 2017). During parent sessions, program leaders emphasize the importance of modifying the home food environment; this includes limiting the availability of pre-packed energy dense foods and increasing the accessibility and availability of fruits and vegetables (Golan & Crow, 2004).

1.1c Intervention Settings and Length

Family-based interventions are generally held in neighbourhood locations for a period between three months and two years, with most being administered for six months or less (Ash et al., 2017). Often, intervention length and the number of scheduled post intervention follow-up appointments influence the sustainability of weight-loss and behaviour change outcomes achieved during the intervention (Ash et al., 2017; Kalarchian et al., 2009). Furthermore, intervention location impacts participants' adherence and ability to enrol in family-based interventions (Woolford et al., 2011). Interviews with families previously participating in childhood weight management programs state that travel time and finding transportation to program sessions are major hurdles to attending all program sessions (Newson, Povey, Casson, & Grogan, 2013; Woolford et al., 2011). Therefore, future family-based interventions should carefully consider selecting easily accessible, central locations to decrease the burden of transportation and travel time on their participants.

1.1d Guiding Behaviour Theories

In addition to centring the program around the whole family, these interventions exercise behavioural change techniques and present the most effective platforms for treating and preventing childhood obesity (Janicke et al., 2011; Smith et al., 2018). Researchers have learned that addressing the family as the component of change and providing parents with behavioural strategies to help children modify their lifestyle behaviours facilitates long-term decrease in bodyweight (Sung-Chan, Sung, Zhao, & Brownson, 2013). Family-based interventions address complex family dynamics and the home food environment, with a focus on learning and implementing behaviour change techniques, as well as how these factors contribute to developing lifestyle behaviours (Ash et al., 2017; Janicke et al., 2011). According to Berry et al. (2017), interventions that help children and parents develop skills in communication, goal

setting, problem solving, conflict resolution and positive reinforcement will enable families to have greater success implementing and maintaining healthy lifestyle behaviour changes.

Behavioural family-based treatments addressing paediatric obesity have evolved into the standard treatment for childhood obesity (Epstein, Valoski, Wing, & McCurley, 1994; Wilfley & Balantekin, 2018). Generally, most family-based weight management interventions are designed according to theoretical frameworks such as the social cognitive theory (SCT), trans-theoretical model (TTM) and the theory of planned behaviour (TPB); in fact, some interventions utilize multiple theories (Ash et al., 2017). Family-based interventions vary in terms of how profoundly behavioural theory is emphasized (Ash et al., 2017) however, the majority of theories implemented represent social cognitive approaches. For instance, interventions following social cognitive models aim to help families modify their health-related behaviours (Bandura, 1991), that previously contributed to an obesogenic home environment. Furthermore, family-based behavioural weight management interventions typically incorporate behaviour change strategies such as goal setting, self-monitoring, and stimulus control strategies (Wilfley & Balantekin, 2018).

Overall, health behaviour change interventions designed and implemented according to theoretical frameworks have proven to be an effective approach for initiating behaviour change (Michie, Johnston, Francis, Hardeman, & Eccles, 2008). However, the theories commonly used throughout these interventions including the SCT (A Bandura, 1991), TTM (JO & WF, 1997), TPB (Godin & Kok, 1996) and the HBM (Rogers & Prentice-Dunn, 1986) all operate under the following assumptions; first, that consciously-formed intentions translate into behaviour enactment and second, behaviours are the result of one's expected outcomes from behavioural enactment and perceived capability to perform that behaviour (Rhodes, 2017). Rhodes and

colleagues (2013, 2015) have identified that intention is a strong predictor of behaviour, but half of those with good intentions fail to follow-through with the target behaviour. However, intention-behaviour relations are asymmetrical, meaning that individuals who follow-through in executing a behaviour have positive intentions. Therefore, having a positive intention is a necessary but insufficient target construct for predicting behaviour among many people and cannot be viewed as the primary determinant of behavioural performance (Rhodes & De Bruijn, 2013; Rhodes & Yao, 2015a; Paschal Sheeran & Webb, 2016). Furthermore, Rhodes and de Bruijin (2013) established the action control framework, which recently developed into the Multi-Process Action Control (M-PAC) framework (Rhodes, 2017).

The M-PAC framework consists of operational constructs depicting the process of behaviour change from intention formation to action control (i.e., the translation of intention into behaviour) adoption and maintenance. These constructs align with the phases of behavioural initiation and continuation (intention formation, action control adoption, and action control maintenance) and correspond with different behaviour change techniques (Michie, S, Abraham, C, Whittington, 2009; Michie et al., 2013) across the framework. The model proposes that first an individual initiates reflective processes including perceived capability (commensurate with the construct of self-efficacy) and instrumental attitude associated with a given behaviour; these constructs contribute to intention formation. Then, affective judgments (i.e., expectations of pleasure, enjoyment) and perceived opportunity (i.e., expectations of time and access available to perform a behaviour) related to the specific behaviour translate an individual's intentions into behavioural execution. Furthermore, the M-PAC model suggests that once an individual performs a certain behaviour, they enter the action control adoption stage; in this stage of behaviour change, an individual's behavioural performance is dependent upon his/her self-

regulatory processes (behavioural regulation). These include tactics such as planning, self-monitoring, seeking support, and regulating emotions to stick to an initial intention despite temptations and stimuli that may motivate the individual toward other behavioural pursuits. Finally, after regularly performing a given behaviour an individual will begin forming habits and an identity related to that behaviour, thus entering the action-control maintenance phase (Rhodes, 2017). Habits are formed through conditioning of repeated exposure to the same stimuli when performing the behaviour. Identity is formed by a self-categorization of ownership of the behaviour through prioritization of the behavioural performance over time compared to other options and the reflection of the investment (e.g., social, affective, behavioural, and financial) into the behaviour. Overall, the M-PAC framework and behavioural change techniques are still emerging concepts in behaviour-change intervention literature. Therefore, future research is needed to determine the validity of applying this framework to family-based weight management interventions.

1.1e Gaps in Family-based Nutrition and Weight Management Interventions

Despite research demonstrating the importance of family eating behaviours and the home food environment on child dietary behaviour and weight outcomes there is insufficient literature examining the psycho-social measures that predict and mediate effective parent feeding practices in addition to parental attitudes, intentions and self-efficacy related to supporting their children's healthy eating (Baranowski et al., 2013; Diep et al., 2014). Additionally, there is a lack of evidence reporting on children's healthy eating motivation, food choices and attitudes regarding healthy options such as fruits and vegetables (Waddingham, Shaw, Van Dam, & Bettiol, 2018). Rhodes and colleagues (2015, 2019) have examined psycho-social measures including parent support behaviours and action control related to children's physical activity, sleep and screen

time behaviours using the M-PAC framework, however these studies have not addressed parent feeding practices (Rhodes et al., 2019; Rhodes et al., 2015). Moreover, the majority of family-based weight management interventions addressing childhood obesity that incorporate a nutrition or healthy eating component, report child BMI and weight-loss as the primary outcomes; generally, these studies only briefly discuss secondary nutrition psycho-social or behavioural outcomes (Janicke et al., 2014; Wilfley et al., 2007).

Some research has investigated parenting practices and parental support related to child fruit and vegetable intake using a behavioural theory approach. For example, Baranowski and colleagues (2013) utilized the Model of Goal Directed Vegetable Parenting Practices (MGDVPP), an extension of the Theory of Planned Behaviour, to examine the following constructs as they relate to parent feeding practices and child dietary behaviours: intention, desire (intrinsic motivation), perceived barriers, self-efficacy, habit, perceived behavioural control and attitudes (Baranowski et al., 2013). Furthermore, Diep et al. (2014) tested the MGDVPP and its ability to predict effective parenting practice associated with child vegetable consumption and reported the strongest predictors of effective parenting practices included parent's habit of actively involving the child in making vegetable choices, the habit of positive encouragement for eating vegetables and habit of creating a food environment with easily accessible vegetables (Diep et al., 2014). However, it is worth mentioning that the aforementioned studies are targeting parents with pre-school children; the majority of published research (70%) addressing effective parent feeding practices for improving child dietary behaviours have included younger children (four to eight years old; (Arredondo et al., 2018; Shloim, Edelson, Martin, & Hetherington, 2015).

Overall, most family-based studies specifically addressing parent feeding practices, intentions and attitudes associated with supporting children's dietary behaviours do not chiefly target overweight and obese children ≥85th percentile BMI for age (N. Crespo et al., 2012; Fulkerson et al., 2015, 2018; Horton et al., 2013a; Wieland et al., 2018). For instance, Fulkerson et al. (2018) focused on improving the family home environment, parents' meal planning and cooking self-efficacy as well as self-efficacy for identifying adequate portion sizes; however, eligibility criteria for this study included children aged eight to twelve years-old with a body mass index-for-age percentile above the 50th percentile. Similarly, Horton and colleagues (2013) addressed parental control of the home food environment and behavioural strategies to increase fruit and vegetable intake among all family members. Nevertheless, this study did not focus on improving parent feeding practices and the home food environment as a strategy for weight management, instead inclusion criteria were Latino families with at least one child between seven and thirteen years old (Horton et al., 2013a). Thus, there is a need for intervention research that examines psychosocial and behavioural factors associated with parent feeding practices, parental support of children's dietary behaviours and the structure of the home food environment among school-aged (eight to twelve years old) overweight and obese children (Shloim et al., 2015).

Regardless of the general success of family-based interventions, research on these interventions contains several important limitations. For one thing, these studies often have high attrition rates (27-73%; Staiano et al., 2017) and low-resourced and ethnic minority families are often underrepresented in the sample populations (Ash et al., 2017). Additionally, the majority of family-based interventions only address the domains of nutrition and physical activity, despite the fact that sleep and media use play a significant role in one's overall health (Ash et al., 2017).

Parents who previously participated in a family-based intervention, stated that more families may have experienced positive outcomes if program staff were better trained to improve their understanding of complex family dynamics, particularly challenges associated with promoting healthy behaviours among children (Lucas et al., 2014; Staiano et al., 2017). Frequently, parents report that they are extremely concerned with their child's eating behaviours and struggle to prepare healthy meals that their children are willing to eat (Staiano et al., 2017). Consequently, interactive interventions encouraging a shared understanding among family members to develop and sustain healthy home environments, may promote long-term improvements in health-related lifestyle behaviours. Moreover, an evaluation of parent's and children's views on weight management programs identified that there are three critical components that interventions should include: opportunities for practical experiences; family involvement; and social support (Burchett, Sutcli, Melendez-torres, Rees, & Thomas, 2017). According to Burchett and colleagues (2017) the presence of all three components resulted in an effective family-based intervention; more often however, the interventions included only one or two critical components, which made them less effective. Finally, because parents repeatedly describe lack of time as the major barrier to their participation in family-based interventions (Newson et al., 2013; Staiano et al., 2017), future research in this area should strive to develop flexible family-based interventions, allowing families to schedule their program sessions in advance and potentially during the weekend, if work or weeknight activities create a time-conflict.

1.1f Digital Health and Blended Interventions

Researchers have explored a blended intervention format, including in-person sessions as well as online supplementary lessons in order to enhance the flexibility and adaptability of family-based weight management interventions. Interventions that incorporate online

components allow participants to access educational materials on their own time and often include interactive games or activities, which may facilitate greater engagement in the face-to-face portion of a behaviour change intervention (Norman et al., 2007). Davis and colleagues (2012) assessed the effectiveness of a standard in-person behavioural weight loss (SBWL) intervention, technology-based (TECH) and TECH plus SBWL intervention among overweight and obese adults. Results from this study demonstrated a larger change in weight loss for those using the technology component and attending regular in-person sessions (Davis et al., 2011). Additionally, Militello et al., (2016) completed a pilot study that included automated text messaging in addition to a face-to-face intervention for parents of overweight and obese preschool children; at post-intervention parents' significantly improved parental knowledge about nutrition and parental behaviours toward engaging in healthy lifestyle choices for their children (Militello, Melnyk, Hekler, Small, & Jacobson, 2016). Potentially, blended interventions incorporating a technological component (e.g. online or mobile component) with an in-person behavioural intervention may provide the additional support needed to ameliorate attrition rates and promote greater weight and behavioural outcomes among overweight and obese populations. Nevertheless, research among overweight and obese children is needed in order to determine the effectiveness of a blended intervention format for delivering family-based weight management interventions.

1.2 Development of the Family Healthy Living Program

Research shows that family-based behavioural weight management interventions are an effective approach for addressing weight control among children and adolescents (Kalarchian et al., 2009). However, there are many factors influencing the adoption and implementation of family-based interventions that must be addressed during the development phase. For example, a

panel of experts reviewing the factors influencing the implementation of youth physical activity interventions found that conducting a community needs assessment, engaging program champions, staff and leaders in addition to considering program adaptability were key components for successful implementation (Lau, Wandersman, & Pate, 2016). Furthermore, a review examining interventions to promote healthier nutrition and physical activity behaviours among youth reported that implementation should utilize available resources while also adapting to local values and limitations (Pate et al., 2000).

After assessing many of the issues associated with implementing family-based weight management interventions, a group of over 300 stakeholders in British Columbia (BC) met to discuss future directions for family-based intervention in the province. In line with the work on implementation (Lau, Wandersman & Pate, 2016; Pate et al 2000) the stakeholders identified the importance of developing an evidence-informed family-based intervention that represented the provincial and local context in terms of alignment with the current BC clinical and public health messaging, addressed physical activity, healthy eating in addition to sleep, screen-time and positive mental health, shifted the focus from weight to healthy lifestyle changes (a core value among stakeholders in BC) met the needs of different communities by providing flexibility for families and a blended intervention (Marques, in press). Further, one face-to-face contact per week with on-line contact and four additional community-specific activity sessions were recommended to both maximize flexibility and reduce the scheduling commitment expected from families.

Consequently, stakeholders and researchers worked together to develop the Family Healthy Living Program (FHLP), a family-based weight management intervention incorporating the aforementioned stakeholder feedback, while also aligning with theory; the multi-process action

control theory (MPAC; Rhodes, 2017) and considering the evidence on effectiveness (e.g. minimum of 26 hours of contact time, addressing physical activity, healthy eating, screen-time, sleep and mental health and well-being) and implementation (compatible and adaptable, easy to use; Janicke et al., 2014). Thus, the FHLP offers a unique theory-based ten-week (30 contact hours; 15 or more hours of in-person contact plus 15 hours of remote contact via family portal activities) blended intervention approach, including weekly in-person sessions that incorporate behavioural change skills such as goal setting and self-monitoring progress (Michie et al., 2013) in combination with interactive web-based educational resources (e.g. recipes, relevant articles) and nutrition, physical activity and positive mental health activities for the family, as well as a discussion forum. The overall purpose of the study was to evaluate the effectiveness of the FHLP ten-week intervention on healthy growth measures (e.g. height, weight) and psycho-social and behavioural outcomes by comparing an intervention group with a waitlist control group. Child BMI and BMI z-scores were the primary study outcomes. Secondary behavioural and psycho-social outcomes were included and addressed parent support for physical activity and healthy eating, dietary behaviours, sleep, screen-time and measures of positive mental health.

Blended, theoretically structured family-based interventions remain understudied; in particular there is a lack of evidence reporting on specific nutrition outcomes other than fruit and vegetable consumption and overall dietary intake. Family-based weight management interventions have minimally examined parent feeding practices, parental attitudes and self-efficacy related to children's eating behaviours in addition to children's healthy eating motivation, attitudes and outcome expectations. Evidence shows that the family home food environment and parenting practices play a crucial role in developing children's dietary behaviours (Fulkerson et al., 2018; Holland et al., 2014; Faught et al 2015); therefore,

developing effective family-based interventions that teach parents how to prepare healthy meals and support their children's healthy eating is an imperative step in decreasing overweight and obesity among children. Furthermore, there are few family-based interventions focusing on parent feeding practices, parental attitudes and self-efficacy related to supporting children's healthy eating behaviours that have targeted overweight and obese children ages eight to twelve years old (Arredondo et al., 2018; Shloim et al., 2015). Thus, the FHLP provided an opportunity to investigate nutrition-related psycho-social and behavioural outcomes such as parent feeding practices as well as parent and child cooking self-efficacy and healthy eating attitudes through the lens of the M-PAC framework.

1.3 Purpose Statement

The purpose of this paper was to specifically examine the impact of the FHLP on the secondary nutrition-related behavioural and psycho-social outcomes: children's healthy eating motivation and behaviours, parents' food-related parenting practices (i.e., perceived control and support behaviours for child's health eating), and parent/family identity and habits related to nutrition (i.e., health eating, healthy food choices). The aforementioned outcomes were assessed using instruments that also aligned with the constructs of the M-PAC framework.

1.4 Research Questions

Five research questions were addressed in the healthy eating secondary analysis:

1. How did the Family Healthy Living Program (FHLP) influence children's eating behaviours (e.g. fruit and vegetable consumption in addition to sugary beverage consumption) relative to a waitlist control group?
2. Did the FHLP improve children's reflective processes (i.e., instrumental attitude, affective judgments, perceived capability) related to healthy eating?

    a. Did the FHLP have a positive impact on children's dietary behaviours self-efficacy (i.e., perceived capability)?
    b. Did the FHLP improve children's outcome expectations and motivation (i.e., instrumental attitudes, affective judgment) related to healthy eating?
3. How did the FHLP influence parents' food-related parenting practices (i.e., regulation processes) relative to the waitlist control group?
    a. Did parents improve the structure of the home food environment (i.e., increase fruit and vegetable and decrease sugary beverage accessibility and availability within the home)?
    b. Did parents improve their parental feeding practices (i.e., modelling healthy eating behaviours, verbal praise/encouragement, setting boundaries in the home food environment, tangible rewards)?
    c. Did parents improve their regulation behaviours (i.e., behavioural regulation) for supporting their child's healthy eating?
4. How did the FHLP impact parents' reflective processes (i.e., perceived opportunity, capability, instrumental attitude, affective judgement) associated with supporting their children's health eating behaviours?
    a. Did parents improve their parental attitudes (i.e., instrumental attitude and affective judgement) for supporting their child's healthy eating?
    b. Did parents improve their perceived control (i.e., perceived opportunity and capability) and for supporting child's healthy eating?
5. Did the FHLP have a positive influence on parent/family reflexive processes (i.e., identity and habit) associated with healthy eating?

1.5 Hypotheses

1. FHLP children will have improved their eating behaviours in comparison to waitlist control children as shown by:
    a. improved fruit and vegetable intake;
    b. decreased sugary drink intake.
2. Children in the FHLP will have improved their reflective processes related to healthy eating as shown by:
    a. improved dietary behaviours self-efficacy for healthy eating;
    b. an increase in healthy eating motivation (intrinsic and extrinsic motivation for healthy eating);
    c. improved perceived cooking skills;
    d. improved outcome expectations related to healthy eating.
3. In comparison to the parents enrolled in the waitlist control group FHLP parents will have improved their food-related parenting practices (i.e., regulation processes) as shown by:
    a. increasing fruit and vegetable and decreasing sugary beverage accessibility and availability within the home food environment;
    b. improved parent feeding practices (i.e., modelling healthy eating behaviours, verbal praise/encouragement, setting boundaries in the home food environment, tangible rewards);
    c. improved behavioural regulation associated with supporting their children's healthy eating behaviours;

    d. an increase in the frequency that the family eats and cooks together (i.e., family eat/cook together).

4. FHLP parents' will have improved their reflective processes (i.e., perceived opportunity and capability, instrumental attitude, affective judgement) associated with supporting their children's healthy eating behaviours relative to the waitlist control group as show by:
    a. improving their parental attitudes for supporting child's healthy eating (i.e., instrumental attitude and affective judgment);
    b. an increase in their perceived control for supporting their child's healthy eating (i.e., perceived opportunity and capability).
    c. increasing their parent meal preparation self-efficacy (i.e. perceived capability).
5. Compared to parents in the waitlist control group FHLP parents will have improved their reflexive processes associated with healthy eating and supporting the family's healthy eating practices as shown by:
    a. improved parent/family healthy eating habits;
    b. improved parent/family healthy eating identity.

1.6 Operational Definitions

Food-Related Parenting Practices: methods of interacting with children and influencing their eating behaviours and food choices. In this study it was measured as accessibility (easy for child to reach or find) and availability of vegetables and fruit as well as cooking and eating family meals together at home (Loth, Friend, Horning, Neumark-Sztainer, & Fulkerson, 2016)

Eating Behaviours: the manner in which one consumes food on a regular basis (Birch & Fisher, 1998).

Healthy Eating: routine consumption of fruits and vegetables, lean meats and whole grains; less frequent consumption of pre-packaged energy dense foods and sugary sweetened beverages as measured by food frequency related to these.

Family: at least one parent/caregiver and one child

1.7 Delimitations

The study was delimited by the following eligibility criteria

1. Children above the 85th percentile BMI-for-age
2. Children aged 8-12 years old, living in British Columbia

1.8 Assumptions

1. Participants will be truthful when responding to questionnaires

1.9 Limitations

2. Measuring dietary intake using a self-reported questionnaire format and asking about usual intake (food frequency) as opposed to conducting a 24-hr recall, which includes frequency and portion size.
3. Participants may over or under report their dietary intake (Burrows et al., 2012)
4. Selective participant attrition may influence results
5. Inconsistent session attendance may impact program outcomes

Chapter 2: Literature Review

Research focusing on childhood obesity interventions has evolved from child-centred weight-management interventions to family-based behavioural interventions that promote healthy lifestyle behaviours for all family members (West, Sanders, Cleghorn, & Davies, 2010). These family-based interventions focus on behavioural modification techniques such as goal setting, self-monitoring, positive reinforcement, problem solving (Ash et al., 2017; Sung-Chan et

al., 2013), and emphasize parents as the exclusive agents of change in their child's eating behaviours since parents manage the home-food environment and regulate key behaviours influencing their child's energy balance (Ash et al., 2017). Furthermore, qualitative studies examining the development of youth eating behaviours have found that opportunities for parents to model healthy eating and the formality and consistency of family meals all influence youth dietary intake (Campbell et al., 2007). Given these past research findings, family-based interventions appear to be the most effective method for addressing childhood overweight and obesity.

2.1 Family Based Weight Management Interventions

Family based interventions encouraging parent and child participation and addressing diet and exercise behaviours have repeatedly supported weight loss and positive changes in health-related lifestyle behaviours in participating families (Janicke et al., 2011; Sung-Chan et al., 2013). For instance, one intervention engaged parents and children in separate knowledge and skill building sessions, then incorporated 15 minutes of parent-child interactive physical activity to conclude the day's session (Xu et al., 2017). Two years after the program's conclusion, follow-up measures demonstrated significant decreases in BMI-z scores, showing that the intervention had a long-lasting effect on participant's dietary and physical activity behaviours. This long-term reduction in BMI z-scores may be associated with parental support and parents positively interacting with their children during program sessions (Xu et al., 2017). Similarly, a six-month family weight management program providing parent-only in-person sessions reported significant improvements in children's dietary intake and BMI z-scores at eighteen months post-intervention (Perry, Daniels, Baur, & Magarey, 2018). Results from the two aforementioned studies demonstrate how interventions focusing on improving parents' health-

related knowledge and parenting skills can facilitate long-term improvements in children's lifestyle behaviours (Perry et al., 2018; Xu et al., 2017). Furthermore, a study comparing a family-group intervention to an individual counselling intervention (not requiring parent participation), found that the weight loss achieved by participants in the family group treatment remained six months after the intervention, while weight loss was not maintained in the individual counselling group (Kalavainen, Korppi, & Nuutinen, 2011).

Researchers promoting family-based interventions argue that obese children will benefit the most from programs providing parents with the necessary skills and resources to establish and maintain a healthy home food environment in addition to healthy dietary and physical activity behaviours (Perry et al., 2018; Sung-Chan et al., 2013). In child-only interventions, too much focus was placed on the obese child losing weight instead of framing the program's purpose as a strategy for improving the family's lifestyle habits together (Sung-Chan et al., 2013). Across four family-based treatment studies, Beckman et al. (2006) stated that child weight-loss outcomes were more successful when both the parent and child were addressed together in an intervention as opposed to when the child was targeted alone (Beckman, Hawley, & Bishop, 2006). Thus, family-based interventions shift the focus and responsibility from the overweight child onto the parents to provide support and encouragement for all family members to adopt healthy lifestyle behaviours (Berry, Mcmurray, et al., 2017). Additionally, child eating and activity behaviours often mirror the behaviours of their parents (M. E. Thompson, 2010), making it necessary for parents to initiate changes in their health-related behaviours in order to facilitate the same changes in their children. For instance, a community family-based intervention targeting at least one overweight parent and child (overweight or obese) determined that there was a significant correlation between changes in parent and child adiposity (Berry,

Mcmurray, et al., 2017).Therefore, family-based interventions present a logical framework for supporting familial lifestyle behaviour modifications and long-term weight-loss in children and their parents. According to Bergmann and colleagues, family-based weight management interventions are currently considered the "gold standard" for treating childhood obesity (Bergmann et al., 2019; Young, Northern, Lister, Drummond, & O'Brien, 2007). Worldwide, researchers agree that interventions that focus on the whole family when modifying lifestyle behaviours is the most effective strategy for treating childhood obesity (Sacher et al., 2010; Young et al., 2007).

2.2 Intervention Session Details

Important factors that shape family-based weight management interventions include the content, delivery, length and frequency of informational and interactive sessions. Intervention sessions generally fall between 20 to 90 minutes, with some interventions dividing the sessions into two or three shorter activities. For example, Xu et al. (2017) describe a family based intervention that included two separate sessions for nutrition education and physical activity; each session was 30 minutes long, which allowed the health professional to maintain the children's attention (Xu et al., 2017). Likewise, a community-based trial known as CATCH included a 60-minute block of time split into nutrition lessons, coping mechanisms and physical activity (Berry, Mcmurray, et al., 2017). In most weight management interventions nutrition education lessons are paired with some kind of physical activity and are completed either in a child-only group of approximately six to eight children or in a combined group consisting of the children and their parents. Furthermore, interventions less than six months often hold sessions on a weekly basis, whereas interventions exceeding six months initially held weekly sessions then decreased meeting frequency to bi-weekly or monthly as the intervention progressed.

In addition, the use of technology to contact participants and monitor their progress has become a common strategy to provide families with additional support outside of the in-person sessions. For instance, the Smart Choices For Healthy Families study utilized automated calling systems including a summary of the previous session's goals, feedback regarding the participants' progress, and instructions for developing a goal to meet before the next session (Pinard et al., 2012). Additionally, web-based interventions have increased in popularity as Internet accessibility and availability has risen substantially for the general public (Cuuen & Thompson, 2008). In fact, researchers report that Social Cognitive Theory-based Internet interventions have resulted in sustained child and adolescent weight loss (An, Hayman, Park, Dusaj, & Ayres, 2009). Technology may provide a new outlet to reach a subset of families who are unable or unwilling to attend regular program sessions due to either a lack of time or transportation difficulties.

2.3 Nutrition Education Delivery Techniques

Each family-based intervention teaches children, adolescents and their parents about nutrition, and how to shop, cook and eat healthy using a variety of approaches. Often, session leaders deliver nutrition education in separate formats for parents and children. Parent sessions typically focus on goal setting and strategizing to improve the quality of the home environment, while children participate in interactive lessons and games covering similar nutrition topics (Ash et al, 2017; Janicke et al., 2014; Sacher et al., 2010). For example, one intervention organized games using the Food Guide Pyramid and MyPlate to teach children about the different food groups and appropriate portion sizes during the nutrition sessions (Xu et al., 2017).

Another common practice in nutrition sessions is to educate parents about the importance of modelling healthy eating behaviours for their child (Stark, Filigno, et al., 2017). Therefore,

providing parents with the skills and knowledge to improve the foods prepared and available at home in addition to changing their own eating behaviours was a primary focus of many nutrition intervention sessions. A particularly common goal promoted throughout many of the interventions included removing foods and beverages from the home that support an obesogenic environment, such as high-calorie snack foods and sugary-sweetened beverages (Golan & Crow, 2004). Role-playing healthy eating behaviours was a unique, but effective approach used during child nutrition sessions, which allowed children to have hands-on practice choosing healthy meals instead of the alternative high-fat, sugary foods (Chen et al., 2010). Similarly, the MEND intervention provided interactive joint sessions for parents and children where they prepared healthy meals and participated in fruit and vegetable tastings (Sacher et al., 2010). According to Burchette et al. (2018), parents and children perceived practical experiences as one of the most important components included in family-based interventions.

More recently, dieticians and other nutrition professionals have turned away from suggesting calorie restriction and dieting methods for children, and instead are taking a more "health-centred" approach, emphasizing eating patterns, food choices, and portion sizes rather than counting calories (Edwards et al., 2006). For instance, family-based interventions often hold sessions focusing on setting new nutritional goals for the upcoming week, such as following the food guide pyramid and eating adequate servings of fruits and vegetables (Kalarchian et al., 2009; Yackobovitch-Gavan et al., 2018). Nutrition education in family-based interventions aims to modify participants' eating behaviours based on the knowledge they gain from nutrition sessions, thus working toward healthier eating behaviours and food choices as a long-term solution for weight loss (Nobles & Mcnamara, 2019; Sacher et al., 2010; Xu et al., 2017).

2.4 Guiding Behaviour Theories

Sessions within family-based weight management interventions are often delivered and designed according to behavioural theories (Ash et al., 2017) such as the Social Cognitive Theory (SCT; Bandura, 1991), the Trans-theoretical Model (TTM; Prochaska & Velicer, 1997), Health Belief Model (HBM; (Rogers & Prentice-Dunn, 1986) and the Theory of Planned Behaviour (TPB; Ajzen, 1991; Godin & Kok, 1996). Each theory comprises its own philosophy and accompanying strategies to initiate health-behaviour changes (Spahn et al., 2010). For instance, the TTM explains that behaviour change is an on-going process occurring throughout multiple stages (pre-contemplation, contemplation, preparation, action and maintenance) that describe a series of cognitive and behavioural steps people take to change behaviour (Prochaska & Velicer, 1997). Within the context of health-behaviour change interventions, the TTM is advantageous as it allows for content to be tailored to an individual's current stage of change (Bridle et al., 2005). Particularly, there are certain strategies for professionals and facilitators to recommend that are dependent upon an individual's stage of change such as motivational interviewing, self-monitoring and demonstration and modelling. For example, a participant who is in the preparation phase has already formed an intention to take action and modify their behaviour, thus this individual would benefit from a strategy such as skill development training and coaching, which will provide him/her with the necessary skills and knowledge to help prepare for change and take action (Prochaska & Velicer, 1997; Spahn et al., 2010).

Furthermore, the HBM consists of constructs that predict and describe an individual's behaviours in response to certain health concerns; four constructs were originally developed to explain the cognitive processes associated with behaviour changes including the following 1.) perceived susceptibility, 2.) perceived severity, 3.) perceived benefits and 4.) perceived barriers (Rogers & Prentice-Dunn, 1986). Positioning the HBM in the context of family-based weight

management interventions involves considering families' perspectives about the intervention process, expected outcomes, the provider or staff involved in delivery, and the intervention setting; all of which impact the extent of families' engagement in an intervention (Ingoldsby, 2010).

Moreover, the TPB explains how a person's attitude, subjective norm and perceived behavioural control regarding a certain behaviour impact his/her intentions to execute that behaviour. Individuals' intentions consist of the motivational factors influencing behaviour, they represent how much effort an individual will put forth to perform a behaviour; generally, the stronger an individual's initial intentions are to perform a behaviour, the more likely that behaviour will be executed (Ajzen, 1991). However, a person's intentions to perform behaviour do not alone predict behaviour enactment. The execution of a given behaviour is also dependent upon availability of necessary resources and opportunities such as time, money and skills relevant to the behaviour (Ajzen, 1991; Godin & Kok, 1996). Thus, behavioural enactment depends on an individual's intentions and behavioural control. For example, if children are participating in a nutrition intervention and working toward increasing their fruit and vegetable consumption, the likelihood that they will begin eating more fruits and vegetables depends upon the motivation (intention) they have to execute this behaviour in addition to the degree of fruit and vegetable availability and accessibility in the home environment.

SCT is another influential theory utilized throughout family-based weight management interventions. A recent systematic review of family-based interventions reported that the SCT was more frequently implemented when developing program sessions in comparison to other behavioural theories (Ash et al., 2017). Bandura describes SCT in relation to self-regulatory systems and states that people develop their own customary behaviours that guide and regulate

their actions (Bandura, 1991). Self-efficacy is a main principle behind the SCT, which is the belief in oneself that he/she can execute a specific behaviour. However, according to the SCT, an individual's social surroundings also influence behaviours. Overall, environmental factors interact with personal determinants to influence outward behaviours (Bandura, 2004). Throughout the home environment, parent's behaviours, the structure of the food and physical activity environment in addition to children's personality traits and their self-efficacy and self-regulation skills determine health behaviours (e.g. dietary intake; physical activity). Family-based interventions incorporating the SCT aim to prepare parents and children by teaching self-regulatory skills that will help them establish and maintain healthy habits, as well as facilitating the adoption of healthy habits within a strong social support system (Bandura, 1998; Berry, McMurray, et al., 2017) . Thus, by using the social cognitive perspective family-based interventions intend to modify families' customary behaviours that contribute to obesity.

Behavioural theories used throughout family-based weight management interventions share similar objectives, which include helping parents and children develop skills in communication, goal setting, problem solving, conflict resolution and positive reinforcement in order to help them successfully implement health-related lifestyle behaviour changes (Berry, McMurray, et al., 2017). Rhodes et al. (2017) suggests that the aforementioned theories differ in their specific constructs, however they are repetitive in terms of measurement capacity and operate within the same assumptions regarding the ultimate causes of behaviour. Collectively, SCT, TPB, HBM and TTM all describe behaviour as a result of positive and negative expected outcomes associated with a person's belief and confidence in their ability to perform a behaviour in addition to their deliberate intention formation to execute the behaviour (Rhodes, 2017). Additionally, the SCT, TPB, HBM and TTM represent intention-based theories, where intentions

are recognized as a proximal precursor to behaviour execution (Rhodes & De Bruijn, 2013; Rhodes & Yao, 2015a). Nevertheless, research examining intention-behaviour relations for physical activity behaviours shows considerable discordance between intention and behaviour, which is now labelled as the "intention-behaviour gap" (Rhodes & Yao, 2015a; Paschal Sheeran & Webb, 2016).

Rhodes and de Bruijn (2013) proposed the action control framework as a model to examine intention-behaviour discordance. The action control framework separates intention and consequent behaviour into different quadrants according to physical activity criteria and public health guidelines (Rhodes & De Bruijn, 2013). The framework depicts four quadrants showing the intention-behaviour relationship, including four possibilities: 1.) non-intenders (people who are not active), 2.) successful intenders (people who initiate activity), 3.) non-intenders who begin initiating activity, and 4.) unsuccessful intenders, which represents people who intend to engage in physical activity, but do not follow through. Moreover, a meta-analysis investigating the action control framework and physical activity behaviours found that 21% of participants were non-intenders who did not engage in physical activity, while 36% of samples represented individuals who intended to participate in physical activity, but did not follow through in executing the behaviour. These results are similar among a wide range of behaviours and demonstrate that intention plays a role in behaviour enactment, however intentions to engage in a particular behaviour are inadequate for many individuals to initiate and sustain behaviour changes (Rhodes & De Bruijn, 2013; P. Sheeran, 2002; Paschal Sheeran & Webb, 2016).

Future research in physical activity behaviour enactment led Rhodes, De Brujin and Yao to investigate additional constructs that could be helpful in clarifying intention translation models (Rhodes & De Bruijn, 2013; Rhodes & Yao, 2015a) such as instrumental attitude, affective

attitude and perceived control constructs including ability and opportunity. Moreover, Rhodes and colleagues (2013, 2015) identified that behavioural regulation (i.e., goal setting, planning, monitoring) and reflexive processes such as identity and habit are also important constructs that could be useful in explaining intention formation and action control (i.e., adoption, maintenance). After thorough exploration of the potential constructs predicting and describing physical activity behaviour, Rhodes (2017) presented the Multi-Process Action Control (M-PAC) framework, a model assimilating behavioural theories and critical constructs for explaining physical activity behaviour change.

The M-PAC model provides a meta-theoretical approach for health-related behaviour change interventions by offering specific targets for intervention that can be tailored to where an individual or group of people fall within the process of the behaviour change schematic. Furthermore, the M-PAC model integrates phases of behavioural initiation and continuation with operational constructs; ultimately, operational constructs determine an individual's likelihood of achieving a certain behaviour. Operational constructs are also referred to as reflective, regulation and reflexive processes, all of which signify an individual's current phase of behavioural initiation or continuation and subsequent behaviour execution (Rhodes, 2017). Reflective processes incorporate an individual's intentions, judgements and decisions associated with a certain stimulus, all of which can influence behaviour through decisions about the viability and attraction of a specific behaviour. Further, regulation processes refer to an individual's ability to utilize strategies such as planning or self-monitoring to supress impulses to perform a behaviour that conflicts with that individual's beliefs or knowledge; these processes are a series of strategies that assist someone in sticking to their intentions amidst additional stimuli and motives for competing behaviours (Deutsch, Strack, Deutsch, & Strack, 2009; Rhodes, 2017). Lastly,

reflective and regulation processes should direct the formation of reflexive processes (i.e., habit, identity) however according to Rhodes (2017) over time the aforementioned processes are expected to have reciprocal deterministic relationships.

Reflective processes describe motivational constructs such as perceived opportunity and affective judgment, which impact an individual's decisional choice (formed intention) to perform a behaviour, while regulation processes include the behavioural regulation (incorporates conscious thoughts and behaviours) construct, which influences action control and taking action to perform a behaviour. Reflexive processes, which include the habit and identity constructs are associations formed across time. For example, an individual will begin executing a behaviour habitually once the behaviour is practiced under the same stimuli, thus establishing stimulus-response bonds. Additionally, an individual begins forming identities in the presence of prioritizing one behaviour over another and by reflecting on that behaviour as a categorization of who they are in regard to social, affective and behavioural choices. Under the right circumstances, once an individual has spent sufficient time in the action-control adoption phase for a particular behaviour, he/she will begin executing that behaviour unconsciously (habitually), and will have formed conscious associations concerning their role or categorization as it relates to the behaviour; thus, entering the action-control maintenance phase (Rhodes, 2017).

Even though the M-PAC framework is still in its infancy, there are a few studies that have tested its efficacy. For example, a trial in 2016 examined a community sample of dog owner's intention-behaviour profiles regarding walking their dogs (Rhodes & Lim, 2016). The intervention observed the constructs of affective judgment, behavioural regulation and habit. Results from the study demonstrated that 33% of the sample included unsuccessful intenders; individuals who intended to walk their dogs, but did not follow through. Interestingly, analysing

the study findings showed that affective judgment, which involves the pleasure associated with walking one's dog, could close the intention-behaviour gap. Overall, behavioural regulation (e.g. tracking and planning walking), habit (walking as part of routine), identity (feelings of responsibility to walk one's dog) and affective judgment (feelings of pleasure experienced while walking dog) were all a factor in the discriminant function (represented the intention-behaviour gap), thus predicting intention-behaviour profiles (Rhodes & Lim, 2016). Rhodes and colleagues (2015) also explored action control of parental support behaviour of child physical activity by applying the M-PAC framework. Results from the discriminant analysis identified that affective attitude, perceived behavioural control and behavioural regulation had noteworthy correlations with the discriminant function and predicted the three intention-behaviour profiles (non-intenders, successful intenders, and unsuccessful intenders; Rhodes et al., 2015). Additionally, Rhodes and Yao (2015)'s review analysing models accounting for the intention-behaviour gap in physical activity demonstrated that constructs such as behavioural regulation, perceived control (i.e., perceived capability and opportunity) and habit were all reliable predictors of post-intention physical activity behaviour (Rhodes & Yao, 2015b). Existing research testing the M-PAC framework exhibits the capacity to explain the constructs necessary for intention to behaviour translation (Rhodes et al., 2019; Rhodes et al., 2015; Rhodes & Lim, 2016). Nevertheless, additional research is needed to test the M-PAC theory throughout a wider variety of health behaviour-change interventions.

Furthermore, all of the M-PAC constructs correspond with the various behaviour change techniques described throughout Michie et al.'s behaviour change taxonomy (Michie et al., 2013). Behaviour change techniques (BCTs) are standardised definitions of techniques or the 'active ingredients' implemented in the intervention setting to initiate and support behaviour

changes (Michie, Hardeman, et al., 2008; Michie et al., 2013). Michie and colleagues' (2008) BCTs fill in an existing gap in many theory-based behavioural interventions by providing recommended targets for behavioural interventions. For instance, theories such as the SCT (Bandura, 1991) and TPB (Ajzen, 1991) allow researchers to identify behavioural determinants however, these theories do not explain how to modify behavioural determinants in an intervention setting. Thus, Michie and colleagues (2008) proposed using evidence-based behaviour change techniques (BCT) within the intervention context; BCTs can address behavioural determinants and validate their part in behaviour change (Michie, Hardeman, et al., 2008). Abraham and Michie (2013) define BCTs as intervention components used to redirect, regulate or modify behaviours. Several interventions have reported effective BCTs for increasing physical activity and improving eating behaviours (Michie, Abraham, & Whittington, 2009; Michie et al., 2013).

Programs incorporating BCTs are advantageous because they allow the researcher to tailor the intervention according to each participant's needs and preferences (Beckman, Hawley, & Bishop, 2006). Behaviour change techniques also allow researchers to use a common reference for their intervention techniques that can be replicated in future studies. For instance, a systematic review of interventions using BCTs to improve healthy eating and/or physical activity behaviours identified that the most effective interventions were those incorporating self-monitoring and at least one additional self-regulatory technique such as prompt goal setting, feedback on performance and reviewing previously set goals (Michie et al., 2009). Beckman et al. (2006) adapted BCTs for a community-based obesity prevention program targeting fifth and sixth graders (11-12 years old) and their families by developing interactive, age-appropriate content; games, worksheets and encouraging child participants to share relevant experiences.

Findings from this program showed that an intervention incorporating BCTs in an age-appropriate manner has the potential to improve health-related behaviours among youth at risk for childhood obesity (Beckman et al., 2006).

Effective family-based interventions implement BCTs by emphasizing self-efficacy for parents and children, directing them to set realistic, achievable goals and providing them with the necessary skills to master these goals and improve self-monitoring behaviours (J. L. Chen et al., 2010). For example, WATCH IT, a community-based program for obese children and adolescents, works with participants to develop strategies to reduce sedentary behaviours and increase active lifestyle habits. Activities in these sessions focus on making associations between thoughts and emotions that contribute to poor eating behaviours (Rudolf et al., 2006). According to Danielsen and colleagues (2013), programs that target lifestyle behaviours and use BCTs are considered to be the best evaluated, most effective treatment method available for childhood obesity.

Therefore, future family-based interventions should strive to incorporate innovative theoretical models, such as the M-PAC framework in conjunction with BCTs in order to present a logical and replicable intervention for modifying familial lifestyle health-related behaviours contributing to childhood obesity.

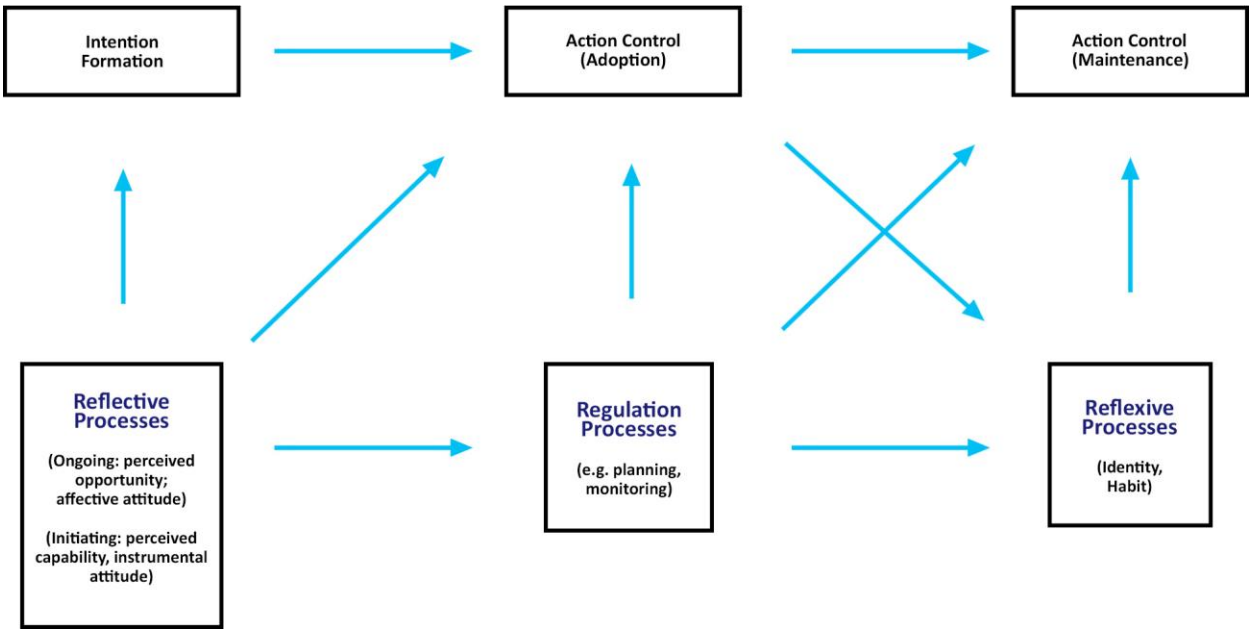


*Figure 1***.** Adapted from "The Evolving Understanding of Physical Activity Behaviour: A Multi-Process Action Control Approach" by Rhodes, 2017.
Retrieved June 20, 2019, from https://onlineacademiccommunity.uvic.ca/mpac/resources/.

2.5 Intervention Length

Family-based interventions often differ in their length of delivery and subsequent follow-up or maintenance periods. The intervention's duration may impact its effectiveness in sustainable long-term outcomes. Weight loss can occasionally be achieved over a short duration; however it is rarely sustained unless an individual has improved his/her eating and activity behaviours as well, which are typically time-consuming tasks. Family-based interventions tend to range from three months to two years, with most of the studies occurring over six months or less. Ash and colleagues (2017) found that interventions of three months or less are not long enough to promote and implement sustainable lifestyle changes. For instance, a brief 12-week intervention in low-income areas involving ethnic minorities demonstrated no difference between pre and post treatment weight and BMI (Janicke et al., 2011). While there are several potential reasons why this intervention did not deliver on its objectives, its brevity was likely a

contributing factor. On the other hand, studies exceeding one year often experience a decline in attendance the longer the study continues (Mameli et al., 2017). For example, in a longitudinal multidisciplinary weight loss intervention in overweight and obese children, 49% of subjects attended over one year and only 22% attended for two years or more (Mameli et al., 2017). As such, intervention length should be determined with the primary objective being to maintain high attendance while also delivering sufficient input to change behaviour. Moreover, after completing a meta-analysis review of family-based lifestyle interventions Janicke and colleagues (2014) reported that interventions of high intensity, including 26 or more treatment contact hours were largely effective in reducing children's excess weight compared to lower intensity interventions of 10 or less treatment contact hours (Janicke et al., 2014). Additionally, many family-based interventions have been successful in conducting follow-up measurements at six months, one year and again at 2 years post-intervention (Berge & Everts, 2011). Interventions capable of showing sustained weight loss over time in children advocate for the effectiveness of family-based interventions and are critical for preventing the negative health outcomes associated with adult obesity (Berge & Everts, 2011). Further research is required to determine whether an optimal intervention duration exists to facilitate weight loss and support long-term lifestyle behaviour modifications in overweight and obese children.

2.6 Outcome Measures

Researchers administering family-based interventions use a variety of outcome measures to monitor participants' progress. BMI and BMI z-scores are frequently used outcome measures among family-based interventions. Child and adolescent BMI measurements are assessed using growth charts developed by CDC or the WHO, with a BMI above the 85^{th} percentile being defined as overweight and a BMI above the 95^{th} percentile defined as obese. However, some

researchers choose to use waist circumference or adiposity as their primary outcome measure (e.g., Sacher et al., 2010). While waist circumference and total adiposity are less common outcome measures used in this field, they may be more meaningful measurements given the nature of family-based weight management interventions and the fact that BMI does not differentiate between fat and lean muscle mass. Interventions including regular physical activity could lead to an increase in lean mass that would counteract a fall in fat mass, thus leading researchers to interpret an intervention as having a limited effect when in reality participants' ratio of lean mass to fat mass shifted (Sacher et al., 2010). Additionally, it is important to consider the population evaluated in family-based interventions. Because young children are still growing, their BMI is likely to fluctuate with or without a change in lifestyle behaviours. Nevertheless, BMI has become a popular outcome measure because it only requires a child's weight and height, is non-invasive, and does not require expensive equipment (Pecoraro et al., 2003). If BMI is interpreted with caution, it can still be a useful and convenient outcome measure for research. Thus, waist circumference, total adiposity and BMI can provide valuable insight regarding an intervention's impact on anthropometric markers.

Cardiorespiratory fitness and strength are outcome measures analysed in many family-based interventions including a physical activity component. There are a few ways researchers evaluate improvements in fitness and strength. For instance, participants can wear advanced accelerometers to collect information on physical activity and sedentary time. In one randomized controlled trial, participants were asked to wear accelerometers continually over the course of seven days. The accelerometer provided a total activity score by estimating moderate and vigorous physical activity as well as duration of sedentary behaviour (A. R. Hughes et al., 2008). Researchers have also found less expensive technology capable of performing functions similar

to the accelerometer. Chen et al. (2009) used the Caltrac personal activity computer (Chen et al., 2009) to assess children's level of physical activity. Readings from the Caltrac use an individual's age, height and weight during exercise to predict oxygen consumption and net caloric expenditure during exercise (Chen et al., 2009), which enables the researcher to determine whether the participant was engaging in light, moderate or vigorous physical activity. Another method used to evaluate cardiorespiratory fitness improvements is to monitor heart rate through a range of activities. For example, Sacher et al. evaluated cardiovascular fitness by measuring the recovery heart rate one minute after a validated three-minute step test (Sacher et al., 2010). Furthermore, some interventions have estimated participants' physical activity using questionnaires asking general questions about physical activity behaviours. For instance, the Smart Choices for Healthy Families intervention measured child physical activity using the SNAP-ED evaluation tool (designed to measure multiple health behaviours in addition to physical activity such as screen time, fruit and vegetable consumption versus sweetened beverage consumption) and used the Rapid Assessment Physical Activity Scale to measure parents' physical activity (includes nine yes/no items assessing the type and amount of physical activity adults complete) (Pinard et al., 2012). Interestingly, not all family-based weight management interventions selected parent physical activity behaviours as a measurement outcome; however, parent physical activity is a major determinant of child physical activity, and thus could prove to be a meaningful result to measure.

Throughout family-based weight management interventions there are numerous secondary outcomes that can demonstrate an intervention's effectiveness. At baseline evaluations, researchers have the opportunity to distribute questionnaires or hold interviews to assess parent and child dietary intake, child behaviours, self-esteem and family habits. Family-

based interventions often include a nutrition education component, time for structured physical activity, in addition to counselling and parenting sessions. Thus, after families complete the intervention they are given a survey or questionnaire identical to the forms completed at the baseline evaluation; this allows researchers to analyse how much progress participants have made concerning their dietary intake, self-efficacy and health-related behaviours. Because weight and BMI fluctuate throughout peoples' lives, assessing whether or not they have improved their lifestyle behaviours may be a more meaningful measurement for predicting long-term health outcomes from an intervention. Frequently, researchers used the Paediatric Quality of Life Survey 4.0 (PQOL 4.0) to measure a child's physical and psychosocial health. The PQOL 4.0 survey contains a child portion and a "parent proxy" including the same questions regarding the child's health, activities, feelings, and experiences at school (Hughes et al., 2008).

Researchers often administer food frequency questionnaires to measure usual dietary intake. However, in family-based research, a standard reliable and valid questionnaire for evaluating overweight and obese children's dietary intake has not been identified. It is challenging to find a comprehensive questionnaire capable of drawing accurate conclusions about children's diets, while not being so long that children lose interest. In an intervention that administered the 152-item Youth Adolescent FFQ, investigators decided to find a shorter questionnaire after receiving participants' feedback concerning its length. For phase two they therefore began using the Kids Food Screener FFQ, which contains only 45 items and includes a similar dietary assessment of macro- and micronutrient consumption such as usual daily calorie, protein, carbohydrate, saturated fat, sodium and added sugar intake (Xu F. et al, 2017). Twenty-four-hour recalls and food diaries are additional methods used for measuring dietary intake that may provide more accurate information about individual dietary patterns. Nevertheless, in the

case of family-based interventions, researchers do not always have the time and staff to individually interview a large sample of children to obtain 24-hour recalls. Some interventions have alleviated this issue by administering 24-hour recalls using the multiple pass method over the phone, in which the interviewer asks the participant for more detailed information than the individual first reported (Boutelle et al., 2015, Stark et al., 2016). Moreover, three-day food records allow participants to record their intake as they go, which could provide valuable information about an individual's dietary patterns and food preferences (Wake et al., 2013). Unfortunately this method is often associated with participants modifying usual eating patterns and underreporting intake (Hulshof, Ovesen, Amorim, Biró, & Amorim Cruz, 2002). Numerous methods can be used to assess healthy eating in children and families, and the inclusion of multiple measures can improve the ability of researchers to determine an intervention's efficacy.

2.7 Intervention Settings

Family-based weight management interventions occur in a variety of community settings. Primary care centres, paediatric clinics, faith-based venues and community recreation centres are among the most common intervention settings (Ash et al., 2017). However, less frequent intervention settings include elementary schools (Sacher et al., 2010) or families' homes (Stark, Filigno, et al., 2017). Intervention location proved to be a critical factor in determining participants' attendance. For instance, parents of overweight and obese children identify travel time as a major barrier to attending weight management programs (Woolford, Sallinen, Clark, & Freed, 2011). Furthermore, researchers often-cite low parental attendance as a problem in delivering face-to-face family-based treatments, however parents have explained that transportation becomes a significant barrier to attending program sessions (Dunn, Lackey, Kolasa, & Mustian, 2003; White et al., 2004). Parents and guardians report that the most

convenient program location (besides home) would be a local school, clinic or recreation centre (Staiano et al., 2017). Overall, lack of time and transportation are the foremost barriers to program attendance for families, thus choosing intervention settings close to schools or neighbourhoods could attenuate this issue by reducing travel time and enabling families to use other modes of transportation such as walking, biking or public transit.

High attrition rates are a widespread barrier to success among family-based weight management programs (Jensen, Aylward, & Steele, 2012). Therefore, researchers have begun seeking alternative platforms for delivering interventions that decrease travel time, encourage participant engagement and are convenient for families. The home environment has become one alternative platform for implementing family-based weight management interventions (Knowlden & Sharma, 2012). Mirotta and colleagues (2018) explains that the home environment is an important determinant of childhood obesity. For instance, a home-based intervention targeting families with preschool-aged children reported after a six-month intervention the "home visit" groups (received two to four home visits) had significantly higher fibre and fruit intake (Mirotta et al., 2018). Moreover, the LAUNCH program was a dietary family-based obesity treatment intervention that alternated clinical-based group sessions and individual home sessions; results from this study showed that children in the intervention group had significantly lower energy-intake and higher dietary quality compared to those in the standard care group (Simon et al., 2019; Stark et al., 2017). Additionally, families in the intervention group significantly decreased the number of 'red' foods (e.g. sugary sweetened beverages, sweet and salty snack foods) available in their homes (Simon et al., 2019). Thus, family weight management interventions delivered in the home setting could improve attendance rates by providing more convenient and less time-consuming sessions, and may contribute to

improvements in the home food environment, ultimately improving children's food choices and dietary behaviours.

Telehealth (also referred to as eHealth or mHealth) is another emerging platform for delivering family-based weight management interventions. Interventions utilizing video-conferencing, streaming media and wireless communication (text-messaging, phone calls etc.) are featuring telehealth modalities (Health Resources and Services Administration, 2019). Telehealth is defined as "the use of electronic information and technologies to support and promote long-distance, clinical health care, patient and professional health-related education, public health, and health administration" (Health Resources and Services Administration, 2019). Programs using online, mobile or wireless platforms are becoming increasingly popular because they allow for larger-reach, convenient data-collection procedures, and have the capacity to offer tailored interventions for participants in their immediate environment (Bala, Price, Horan, Gerber, & Taveras, 2019; Turner, Spruijt-Metz, Wen, & Hingle, 2015). Overall, telehealth and home-based interventions offer multiple advantages to group-based sessions such as convenience and accessibility.

2.8 Digital Health Interventions

Media and technology use have emerged as promising intervention platforms for treating and preventing childhood obesity. The use of mobile technology (mHealth) in weight management interventions appears to be a popular strategy particularly for reaching children and adolescents (Carlson et al., 2012; Gustafson et al., 2019; Quelly, Norris, & Dipietro, 2016). Electronic health (eHealth) is an umbrella term referring to any form of electronic learning about health, while mHealth is an extension of eHealth and includes the use of smartphones and other wireless devices (World Health Organization, 2018). Mobile technology and Internet based

health interventions allow for greater reach, enable researchers to provide personalized feedback, decrease stigma, assist in monitoring lifestyle behaviours and are convenient for the participant (Griffiths et al., 2006; Quelly et al., 2016; Turner et al., 2015). According to Quelly and colleagues (2016), the use of mobile apps both alone and in conjunction with school-based interventions have led to positive dietary changes among children and adolescents such as increases in fruit and vegetable consumption, healthier snack choices and a decrease in junk food and sugary beverage intake. Additional research shows that interventions delivered electronically may combat the issues of time, travel and geographical barriers. Furthermore, Davis and colleagues (2011) compared the effectiveness of a technology based versus an in-person behavioural weight-loss intervention among an adult population and reported that significant weight losses and increased physical activity were observed in both groups at post-intervention (Davis et al., 2011). Throughout the literature, it is less clear whether technology based interventions are equally effective compared to in-person programs targeting overweight and obese children (Griffiths, Lindenmeyer, Powell, Lowe, & Thorogood, 2006). However, it appears that some technology use and study designs are more effective than others for prevention and treatment of childhood obesity (Turner et al., 2015).

The degree of interactivity, educational components and specific type of technology used throughout eHealth interventions differs throughout the literature addressing childhood obesity. For example, Kay et al. (2018) evaluated the feasibility of a digital weight-loss intervention among parents of children being treated for obesity; the intervention included weekly text-message prompts regarding participants' adherence to their behaviour goals and requests for self-monitoring data. Results from this study showed that over half of parents were engaged in tracking their behaviour goals each week. Additionally, highly engaged participants experienced

significant weight-loss from baseline to post-intervention (Kay et al., 2018). Another study testing the effectiveness of caring for a mobile-based virtual pet as a strategy to change youths' breakfast consumption reported improvements in health-related knowledge and behaviours (Retelny, Lee, Wansink, Gay, Gonzales, Byrne, & Pollack, 2011). For instance, youth caring for a virtual pet that provided positive and negative feedback were motivated to care for their pet, felt that healthy eating was important and more frequently consumed breakfast compared to the other experimental conditions (Retelny et al., 2011). Moreover, the previous two studies incorporated self-monitoring and goal-setting components, which appears to contribute to interventions' effectiveness (Baird et al., 2017; Gustafson et al., 2019; Retelny et al., 2011). Mobile apps and wireless technologies allow participants to revise and set goals over longer interventions (e.g. six months to one year in length) and may also be beneficial during short-term (e.g. six to twelve weeks in length) interventions (Quelly et al., 2016). A systematic review addressing digital health interventions for overweight and obese adolescents stated that pairing self-monitoring and goal setting led to at least one significant improvement in a physical activity or diet-related behaviour across interventions that included these components (Baird et al., 2017). These findings align with the constructs of Social Cognitive Theory, which states that personal goal setting directly influences health behaviours and setting short-term attainable goals can help individuals improve their current health behaviours (Bandura, 2004; Quelly et al., 2016).

According to An et al. (2009), health behaviour theories and the social influence theory are fundamental to Internet weight-loss interventions. Particularly, the Social Cognitive Theory (SCT), the Theory of Reasoned Action, in addition to the Theory of Planned Behaviour (TPB) and the Transtheoretical model (TTM) are often incorporated into technology-based

interventions (An et al., 2009). Additionally, web-based behavioural interventions implementing SCT and TTM allow researchers to deliver personalized and tailored interventions (An et al., 2009), which may be the key to initiating and sustaining lifestyle behaviour changes. For instance, web-based childhood obesity treatment and prevention programs designed using the SCT and TTM have demonstrated significant weight-loss and behaviour changes such as increased FV intake and physical activity (Chen et al., 2011; Winett, Anderson, Wojcik, & Winett, 2005). Furthermore, Quelly et al. (2015) found that across multiple mobile-based technology interventions, increases in child physical activity were only reported when the mobile app incorporated regular encouraging messages along with social support from peers and parents. Research has confirmed that perceived support from family and friends has been associated with improved health behaviours such as increased physical activity and healthy eating (Brunet et al., 2014; St. George & Wilson, 2012). These results are uniform with TPB's constructs which demonstrate that positive attitudes toward a behaviour and perceived social support from others can impact an individual's participation in a behaviour (Godin & Kok, 1996).

Furthermore, a systematic review assessing web-based childhood obesity programs reported that interventions incorporating a parental component were effective in supporting child weight-loss (An et al., 2009; Curioni & Lourenço, 2005; Snethen, Broome, & Cashin, 2006).For instance, an intervention comparing a parent-child group versus child-only group, found that the parent-child group was more successful in weight-loss compared to the child-only group (Haerens et al., 2006). Additionally, a family based Internet intervention for weight loss in African-American girls reported improvements in eating behaviours and attitudes toward healthy eating at post-intervention (White et al., 2004). This study also discovered that the family context

had a significant impact on treatment effectiveness (White et al., 2004). Similar to findings from in-person family based weight management interventions, technology based programs appear to be most effective when the intervention incorporates health behaviour theories or models and facilitates family involvement (Goldfield, Epstein, Kilanowski, Paluch, & Kogut-Bossler, 2001; McLean, Griffin, Toney, & Hardeman, 2003).

Furthermore, systematic reviews and meta-analyses show that web-based weight-management interventions delivered in the absence of a face-to-face component have resulted in significant weight-loss post-intervention; however, most findings were small to modest and thus may lack clinical significance (Okorodudu, Bosworth, & Corsino, 2015). Reed and colleagues (2012) completed a systematic review and meta-analysis examining blended randomized controlled trials incorporating an in-person and web-based component. Results from the review demonstrated that when a web-based component was used in conjunction with an in-person intervention, adults experienced additional weight loss compared to individuals only receiving the in-person component (Reed, Schifferdecker, Rezaee, O'Connor, & Larson, 2012). Moreover, when comparing an in-person only versus web-based only intervention, the web-based only intervention experienced statistically significant less weight-loss than the in-person intervention (Reed et al., 2012). Therefore, web-based weight management interventions in the absence of in-person sessions are less effective than standard in-person interventions.

Nevertheless, despite the success observed when combining in-person and web-based components for weight-management interventions there are limited interventions targeting school-aged children (ages of 8-12 years old) that have attempted to blend these two components (Gorely, Nevill, Morris, Stensel, & Nevill, 2009; Mangunkusum et al., 2007; Pérez-Rodrigo et al., 2005; D. Thompson et al., 2009). Ash et al. (2017) reported that out of 119 family-based

childhood obesity interventions, only fourteen (12%) combined face-to-face and technology components. Tripicchio and colleagues (2017) evaluated the effectiveness of using technology components as adjuncts to family-based paediatric obesity treatment and observed statistically significant reductions in BMI z-scores among the treatment group receiving "Telemed" health coaching sessions in addition to in-person sessions (Tripicchio et al., 2017). However, the in-person only and in-person plus fitness application groups had no significant decreases in BMI z-scores at post-intervention (Tripicchio et al., 2017). Additionally, Thompson et al. (2009) tested a Boy Scout troop and Internet intervention (5-a day badge program) aiming to improve fruit juice and low-fat vegetable intake. The intervention incorporated nine weeks, approximately thirty minutes of weekly troop time and twenty-five minutes of weekly Internet activities. Significant treatment effects were observed at post-intervention for fruit juice consumption, but not low-fat vegetable intake (Thompson et al., 2009).

After reviewing the available literature, it appears that there is non-conclusive evidence regarding the effectiveness of blended interventions targeting weight-management and health-related behaviours. Particularly, there are limited blended interventions addressing child weight-management and obesity (Tripicchio et al., 2017) . Because family-based behavioural weight-management interventions have proven to be an effective strategy for treating and preventing childhood obesity, it is worth considering the advantages technology could provide when implemented as an adjunct to in-person sessions. Websites or mobile applications used in addition to in-person sessions could diminish the burdensome time commitment that typical family-based intervention require and may provide social support for behaviour changes in the home environment. Therefore, future research should investigate how the platform of blending

technology components with face-to-face sessions could decrease many of the barriers to attending family-based interventions and overall improve intervention effectiveness.

2.9 Family-based Nutrition Interventions

As the obesity epidemic continues to impact children worldwide, family-based nutrition interventions are beginning to play a critical role in childhood obesity prevention. According to Black and colleagues, family participation is essential in programs that aim to improve children's eating behaviours as it reinforces and supports their healthy dietary patterns (Black, D'Onise, McDermott, Vally, & O'Dea, 2017). Specifically, nutrition interventions are increasingly targeting the home food environment since children consume approximately 65-72% of their daily calorie intake at home (Nepper & Chai, 2016b). Family-based nutrition interventions primarily address child-eating behaviours, parent feeding practices, cooking skills, family mealtime and the home food environment. Because parents are known as crucial moderators of their children's dietary intake (Faught, Vander Ploeg, Chu, Storey, & Veugelers, 2015; Nepper & Chai, 2016), intervention facilitators often work with parents to develop parenting practices that support healthier eating behaviours among their children (Golan & Crow, 2004). Occasionally, family-based nutrition interventions are similar to weight management interventions in that they incorporate a physical activity component in addition to lessons focusing on a broader spectrum of lifestyle behaviours. Nevertheless, the principal objective of family-based nutrition interventions is to improve a family's ability to make healthier food choices, improve the availability and accessibility of healthful foods within the home as well as prepare home-cooked meals (Fulkerson et al., 2015). Unlike family-based weight management interventions, nutrition interventions generally focus on obesity prevention and include healthy weight, overweight and obese children and typically do not set BMI requirements as participant eligibility criteria.

Family-based nutrition interventions often incorporate a hands-on cooking component during which children and parents have the opportunity to practice their cooking skills and prepare recipes together (Fulkerson et al., 2010, 2015). Nutrition interventions typically provide separate parent and child education sessions where children complete interactive nutrition games and parents learn about strategies to use at home for improving their child's eating behaviours, such as making fruits and vegetable easily accessible at home and modelling health dietary behaviours (Wieland et al., 2018). More current nutrition interventions offer taste-testing activities that expose children to flavours and textures of various fruits and vegetables that they may rarely consume at home (Cunningham-Sabo et al., 2016; Fulkerson et al., 2018, 2010; Seguin et al., 2017). According to Blanchette and Brug (2005) taste preferences and the availability and accessibility of fruits and vegetables in the home environment significantly influence children's fruit and vegetable consumption (Blanchette & Brug, 2005). Moreover, research shows that the eating habits and food preferences developed as a child and adolescent typically persist into adulthood (Faught et al., 2015), which reinforces the need to address nutrition during childhood. Furthermore, throughout the literature there are numerous nutrition interventions for preventing childhood obesity that target parents of preschool-aged children, however, there appears to be few family-based interventions for school-aged children (ages 5 to 12 years old) that explicitly address eating behaviours and overall nutrition (Shloim et al., 2015).

2.10 Gaps In Family-based Nutrition & Weight Management Interventions

The vast majority of childhood obesity prevention programs targeting school-aged children have been implemented in school settings with little parental engagement (Hingle, O' Conner, Dave, 2010). Research shows that school-based nutrition interventions improve children's eating behaviours in the short-term, but these behaviour changes are not sustained

long-term; nonetheless, interventions promoting parental engagement and support, notably family based interventions, have had long-term success in improving child eating habits and BMI (Kothandan, 2014). Nutrition interventions result in positive child dietary outcomes when parents invest time and effort in the process and provide continuous support for their child's dietary modifications by offering easily accessible healthy foods at home (Nowicka & Flodmark, 2011). According to Faught and colleagues (2015) children between the ages of 5 and 12 years old are capable of improving their eating behaviours when they are surrounded by an encouraging and supportive family unit, however in situations where there is a lack of parental support changes in eating behaviours are fleeting (Nowicka & Flodmark, 2011). Thus, more family-based nutrition interventions targeting school-aged children are needed to positively impact children's eating behaviours and prevent the onset of obesity.

There are multiple gaps that overlap between family-based weight management and family-based nutrition interventions. These gaps must be addressed in order to improve participants' long-term health outcomes, attendance rates and overall satisfaction with the intervention. Researchers have completed qualitative studies incorporating interviews and focus groups with families who have considered participating or have participated in a family-based intervention. The intentions behind these qualitative studies have been to identify the barriers that prevent families from participating in interventions; for instance, common barriers include families' busy schedules and the absence of free time, travel time and finding transportation to intervention sessions (Woolford et al., 2011). Additionally, families frequently report the higher cost, particularly the cost and short shelf-life associated with purchasing fresh produce, as one of the largest barriers to healthy eating (Cassady, Jetter, & Culp, 2007; Nepper & Chai, 2016b). Similarly, many families state that they have avoided participating in family-based interventions

due to a lack of financial means to regularly purchase healthy foods (Staiano et al., 2017; Williden et al., 2006). A common topic addressed in many nutrition interventions' curricula includes smart grocery shopping strategies (e.g. creating shopping lists, meal planning) intended to encourage families to purchase more fruits and vegetables (Fulkerson et al., 2015; Wieland et al., 2018). However, nutrition interventions have neglected to address the concern of cost as a barrier to purchasing fresh fruits and vegetables. Thus, future interventions should address the costs associated with following a healthy diet and provide guidance for shopping healthfully on a budget, such as purchasing fruits and vegetables in season combined with eating frozen fruits and vegetables. In addition, interventions should educate participants about resources in their communities where they can find free healthful foods, like non-profit food banks or pantries.

Another gap in the current literature includes the lack of diverse multicultural, ethnic, and low-income populations represented in study sample populations. According to Ash et al., non-traditional (single-parent household) and multi-ethnic families are underrepresented in family-based interventions, which is particularly concerning since these families are at an increased risk for obesity (Ash et al., 2017). Researchers have learned that societal and cultural beliefs within the family unit largely influence families' eating and mealtime behaviours; knowing this makes it imperative for future family-based interventions to consider particular customs and traditions associated with eating as well as food practices and meal preparation in different cultures (Black et al., 2017). However, a few family-based nutrition interventions targeting the Latino (Mexican-American immigrant) population have provided intervention content tailored to the Latino mealtime culture (N. C. Crespo et al., 2012; Horton et al., 2013b). For instance, the *Entre Familia* and *Para Ninos* studies were organized as home-visits delivered by a *promotora*. *Promotoras* are trained volunteers from the community who closely represent the target Latino

population, which allowed the *promotora* to deliver nutrition education that considered various Latino traditions and customs. Participants involved in the *Entre Familia* study attributed the support and confidence they felt throughout the intervention to the similarities and understanding shared between the *promotora* and their families (Horton et al., 2013; Schmied, Parada, Horton, Ibarra, & Ayala, 2015).

Furthermore, there has been an absence of interventions targeting families with overweight or obese adolescents (14-17 years old); in fact, fewer than 10% of family-based interventions within a recent review included families with adolescents, with most focusing on younger children (Ash et al., 2017). Finally, there are not enough interventions targeting domains other than diet and physical activity. Future research should also address sleep hygiene and media, which substantially influence physical and mental health (Ash et al., 2017).

Numerous family-based programs have struggled to maintain weekly or monthly attendance for the duration of an intervention. In fact, 75% of participants registering for family-based lifestyle interventions drop out before the program concludes (Kelleher et al., 2017). A decline in session attendance could be attributed to participants' busy schedules, since researchers have identified a lack of time as a significant barrier preventing families from staying enrolled in an intervention (Kelleher et al., 2017). Families with two working parents and single-parent households may find it exceedingly difficult to prioritize time for driving to program sessions that generally last an hour, especially if there are multiple children to consider (Staiano et al., 2017). Stainano et al. (2017) reported that parents felt the program location played a significant role in their decision to participate in a family-based intervention. Parents stated that the best program location would be a school, clinic, or recreational facility that is both local and convenient. After interviewing families previously participating in the MEND intervention,

Lucas et al. (2014) found that parents believed the personalities and attitudes of trained staff were critical to their success in the program; in particular, they felt supported by staff who encouraged them to attend future sessions. Additionally, parents emphasized that recruiting staff members who are parents or have experience working with children would be important for future sessions, as some parents stated that their session leaders did not seem prepared to work with children (Lucas et al., 2014). Parents also emphasized concerns about their child's eating habits and mentioned that interventions should focus on strategies parents can use to promote the consumption of more fruits and vegetables in the home (Staiano et al., 2017). Fortunately, researchers discovered that parents were motivated by the nutrition knowledge gained during an intervention to prepare and provide healthier options for their families (Lucas et al., 2014). However, the higher cost of fresh produce became a significant burden to many families and prevented them from maintaining these healthier food choices (Stainano et al., 2017).

Future researchers planning family-based weight management interventions should develop flexible and time-sensitive programs. Researchers must also improve adherence to intervention protocols by recruiting and training personable session leaders who have had previous experience working with families and understand the complexity of family dynamics. Future intervention planning should also focus on choosing sensible community locations where families can either walk to the program or utilize public transportation. In reviewing prior research, Burchett et al. (2017) identified three important mechanisms addressed in the most effective family-based interventions: 1) instructing leaders and health professionals to show families how to change rather than just telling them, 2) ensuring that all family members are "on board", and 3) locating social support for parents and children. All of this suggests that providing interactive program sessions where family members can interact with session leaders and one

another is imperative for families to gain practical knowledge that will help them initiate healthy lifestyle modifications.

Evidently, there are several gaps that future family-based interventions should address. Research shows that families benefit from interactive interventions that emphasize behavioural changes skills among parents and children (Sung-Chan et al., 2013). Families also report that they are more likely to attend interventions that have flexible sessions with a supportive team (Lucas et al., 2014). In addition, family-based interventions providing extra support during the program and access to community social supports post-program lead to long-term improvements in eating and physical activity behaviours.

Addressing the childhood obesity epidemic requires consideration of the aforementioned gaps within the family-based intervention literature as well as making efforts to improve knowledge translation, adoption and continued implementation throughout various contexts. Researchers sometimes focus only on primary health outcomes such as weight loss and dietary changes, however it is equally important to evaluate an intervention's implementation within the context it was delivered in order to provide an intervention format that can be delivered across multiple domains and different populations (Damschroder et al., 2009). Numerous community and organizational level elements influence the processes of knowledge translation and initiating and sustaining intervention implementation. Thus, when designing a family-based weight management intervention it is imperative for researchers to collaborate with stakeholders, conduct needs assessments and interact with community leaders and staff prior to intervention development.

Recognizing the need for an interactive, compatible and flexible family-based intervention addressing school aged children; an evidence-based research model was developed

with the goal to improve knowledge translation and sustained implementation across British Columbia (BC) (Marques, in press). Over 300 stakeholders throughout the province provided feedback according to their current professional or clinical practices and past experiences relevant to the implementation of previous family-based lifestyle interventions in BC. Feedback from stakeholders and findings from a thorough needs assessment led researchers to focus on specific factors to address in the research model including compatibility with community resources, placing the focus on healthy lifestyles rather than weight loss, flexible platform able to adapt to different community's needs and one in-person contact per week to decrease the time commitment expected from families.

The Family Healthy Living Program intended to fill gaps within family-based intervention research by delivering a positive, interactive, flexible and supportive intervention program to overweight and obese children and their parents. The purpose of the FHLP was to support children and families in developing behavioural change skills in order to improve eating and physical activity behaviours, parenting practices and their mental health. Additionally, aimed to promote long-term lifestyle modifications by using a meta-theoretical intervention approach that incorporated online and community-based delivery and supports.

The purpose of this research was to evaluate the impact of the FHLP on the nutrition related attitudes, self-efficacy, motivation and behaviours of both children and parents enrolled compared to non-enrolled families.

Chapter 3: Methods

The following chapter outlines the methodology that was used including recruitment to the program and study, research design, intervention details, measurement instruments and procedures and final analysis.

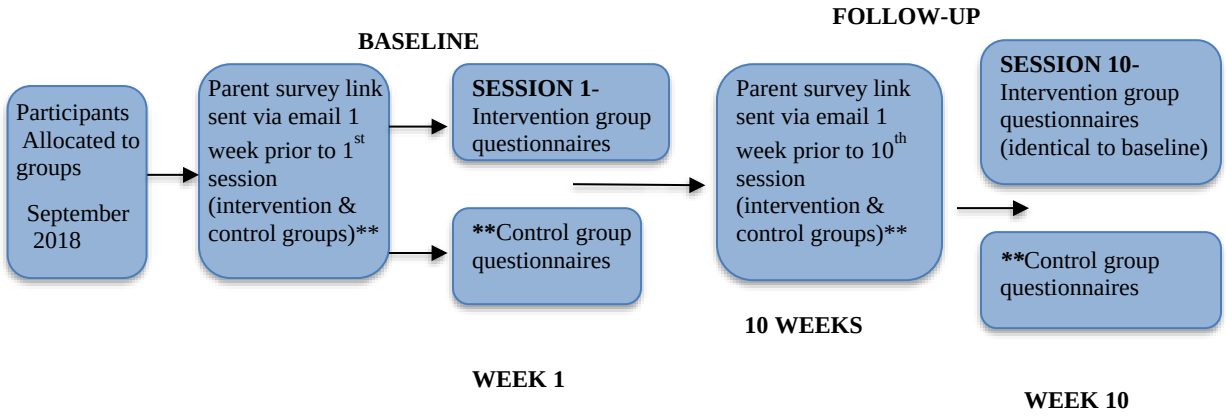
3.1 Participants and Research Design

This quasi-experimental trial assessed the effectiveness of a flexible 10-week blended family-based weight management intervention (consisting of four flexible community sessions, ten scheduled face-to-face sessions and ten interactive online session), in B.C., Canada from September 2018 to April 2019. Participants were recruited through social media platforms, stakeholder engagement, and on-ground promotion including posters, rack cards, and word-of-mouth. Parents showing an interest in the Family Healthy Living Program (FHLP) were directed to a centralized website with local program and registration information. Eligibility screening and program registration were completed centrally by the FHLP evaluation team through a twenty to thirty-minute screening phone call. Child eligibility criteria included the following: (1) 8-12 years old (2) at or above 85th and below 97th percentile BMI-for-age and sex (3) no known health issues such as cardiovascular disease, mental health issues or eating disorders, and (4) one parent or guardian willing to attend program sessions with the child. Parents were informed that eligible children would be allocated to either a treatment or wait-list control group prior to baseline measurements. Ineligible children and their families were either referred to the Shapedown BC© or Healthy Eating and Activity for Kids program (if they were over the 97th percentile) or offered access to the online family portal (if they were under the 85th percentile), which provided similar intervention lessons, activities and resources. Prior to baseline measurements parents provided a signed consent form and children signed the child assent, confirming that they had discussed the intervention with their parents and understood that by signing they were agreeing to take part in the program and its evaluation piece.

3.2 Data Collection & Instruments

The research team administered pre- and post-intervention questionnaires to gather outcome measures from program participants (figure 2). Separate parent and child questionnaires were developed, evaluating measures related to nutrition and eating practices (refer to table 1 for more details). Nutrition-related measures paralleled constructs presented throughout the Multi-process Action Control (MPAC) framework. The following sections describe the specific data collection procedures and measures used to assess the FHLP.

Figure 2. **FHLP Data collection process and timeline**



*First program phase held from September – December 2018; same measurement process occurred for the second phase held from January – April 2019
**Measurements for control children were completed on the same day either before the intervention group sessions or after; control parents received the questionnaires via email one week before their children completed measurements

3.2a Data collection Procedures

3.2a.i Children

The intervention and waitlist control group children both attended the first program session to obtain baseline measurements. During the initial session, children participated in a health fair-like measurement session (The Healthy Living Workshop) where they rotated between various stations, including alternating between measurement and interactive nutrition lessons and physical activity games. During the rotations the healthy eating and physical activity

questionnaires were incorporated into two stations. Questionnaires were designed to take only 10-15 minutes to maintain children's attention and motivation to complete. Initially, the questionnaires were administered in paper format however in an effort to simplify data collection and deal with children's attention and interest, the data collection for follow up was collected using an electronic format SurveyMonkey© application on iPads©. Furthermore, in an effort to avoid any missing data the research team checked each child participant's questionnaire after completion and flagged any unanswered sections or questions where the responses did not align. Any flagged questions were addressed with the children participants before they moved onto the next workshop station. All parents attended an Introduction to Healthy Lifestyles session while children participated in the health fair. Child post-measures were collected at the 10^{th} session using the same methods implemented during the first session.

3.2a.ii. Parents/Caregivers

Prior to the first session, parents were asked to complete an online survey by accessing a link they received via email. The following questionnaires were carefully designed to keep them concise, since participants had limited time. Thus, each questionnaire only required 15 to 20 minutes to complete. Parent post-measures were collected at the 10^{th} session using the same methods implemented at baseline.

3.2b Parent Level Data Collection Instruments

Appendix B provides the parent nutrition questionnaire including the outcome measures, reliability coefficient (i.e., Cronbach's α, Interclass Correlation Coefficient), and in addition associates the measures with the M-PAC construct(s). Each instrument is described in brief specifically in relation to question format, content, validity and reliability and the M-PAC construct it measures.

3.2b.i Parent and Family Demographics

Parent and family demographics were assessed in the parent nutrition questionnaire. Demographic measures included: household income, primary earner employment status, family ethnicity, highest education level of parent/caregiver and participating parents' relationship to their child (e.g. mother versus father).

3.2b.ii Parent Behavioural Outcomes

Parent Feeding Practices and The Home Food Environment

Parent questionnaires evaluated two primary outcomes including structure of the food environment (fruit and vegetables availability and accessibility in the home) and parent feeding practices (parents' use of intrinsic and extrinsic motivation to facilitate children's healthy eating behaviours). The structure of the home food environment was assessed using the Fruit and Vegetable at Home Survey for parents by Robinson-O'Brien et al. (2009); this survey was developed using a theoretical framework (Social Cognitive Theory) and questions adapted from existing instruments, which were previously tested for validity and reliability (Haines, Neumark-sztainer, Perry, Hannan, & Levine, 2006; Neumark-Sztainer, Wall, Perry, & Story, 2003; Robinson-O'Brien, Neumark-Sztainer, Hannan, Burgess-Champoux, & Haines, 2009; Story, Sherwood, Himes, Davis, & Jr, 2014). Additionally, parent feeding practices were assessed using questions drawn from the FLASH-E surveys (Mâsse & Lytle, 2017). The FLASH-E surveys included questions such as, "I have to make sure that my child eats enough fruits and vegetables" or "I encourage my child to try different kinds of fruits and vegetables"; parents answered these questions using a basic 5 point-Likert scale (e.g. strongly agree, agree, neutral, disagree, strongly disagree).

Parent Fruit and Vegetable Intake

One subscale was drawn from the FLASHES-EAT survey to assess parents' FV intake (Mâsse & Lytle, 2017). The subscale included a separate section for parents to select how many servings of fruits versus servings of vegetables they eat on a typical day (response options ranged from none, to five or more servings per day).

Parental Behavioural Regulation of Child's Healthy Eating

Questions adapted from Rhodes et al. (2015) subscale for measuring action control of parent support behaviours for child physical activity were adapted for the purpose of evaluating parent support behaviours for child healthy eating (Rhodes et al., 2015). This subscale assessed parents' regulation of their children's healthy eating behaviours by measuring parents' goals and plans to facilitate their children's healthy eating during the past month. Moreover, this outcome addressed the M-PAC construct behavioural regulation and included questions such as, "I set short-term (daily or weekly) goals for how I could support my child's healthy eating behaviours last month" and "I made plans regarding what to do if something made it difficult to support my child's healthy eating last month; parents responded using a basic 5-point Likert scale.

3.2b.iii. Parent Psycho-social Outcomes

Parental Attitudes and Perceived Control for Supporting Children's Healthy Eating

Parents' attitudes regarding supporting their children's healthy eating behaviours were assessed using questions adapted from Rhodes et al.'s (2006) tool to assess parent support of child physical activity (Rhodes, Blanchard, & Matheson, 2006). Questions adapted from the Rhodes et al. (2006) parent physical activity support survey specifically addressed the M-PAC constructs affective judgment and instrumental attitude and measured parents' support of their child's healthy dietary behaviours such as, "for me, regularly supporting my child's healthy eating over the next two weeks would be: (a) extremely unenjoyable, (b) quite unenjoyable, (c)

slightly unenjoyable, (d) neutral, (e) slightly enjoyable, (f) quite enjoyable, (g) extremely enjoyable (answers were on a 7-point scale but differed for each question). Additionally, subscales drawn from the FLASHES-EAT survey (Mâsse & Lytle, 2017) were used to evaluate parent self-efficacy for supporting their child's healthy eating, which include, "I have the ability to support my child's healthy eating over the next two weeks" and "I am capable of supporting my child's healthy eating over the next two weeks". Parents responded to the aforementioned questions using a 5-point Likert scale (strongly disagree, disagree, neutral, agree and strongly agree).

Parent Meal Preparation Self-Efficacy

Furthermore, parents' self-efficacy for preparing meals was assessed using two questions from the FLASHES-EAT survey (Mâsse & Lytle, 2017). The two questions included, "how confident do you feel preparing and cooking a variety of vegetables for your family?" and "how confident are you that you and your child could prepare a meal together" (responses were definitely not confident, not very confident, not sure, pretty confident, very confident).

Parent Healthy Eating Habits and Identity

Secondary outcomes included the parents' healthy eating habits and identity. Parent healthy eating habits addressed the M-PAC construct of habit and was measured using The Self-Report Index of Habit Strength (Verplanken & Orbell, 2003), which included a 5-point Likert scale and questions such as, "preparing and eating healthy meals and snacks is something I do automatically…". Furthermore, the Psychometric Properties of the Exercise Identity Scale (Wilson & Muon 2008) was modified to evaluate parents' healthy eating identity; for example, "I consider myself an individual who prepares healthy food and makes healthy beverage choices" and "others see me as someone who regularly eats healthy foods".

3.2c Child level data collection instruments

The primary nutrition-related behavioural outcome measure was child dietary behaviours (seven-day recall). Secondary psycho-social outcome measures aligned with the M-PAC framework and included healthy eating outcome expectations, dietary behaviours self-efficacy, healthy eating motivation and perceived cooking skills. To see which variables aligned with which M-PAC component and for further information about the instruments (i.e., reliability coefficients), see Appendix A.

3.2c.i. Child Behavioural Outcomes

Child Dietary Behaviours

Child dietary behaviours such as weekly fruit and vegetable intake, sugary beverage and pre-packaged (non-nutritious) food consumption were assessed using questions drawn from the Centre for Disease Control and Prevention Behavioural Risk Factor Surveillance System (BRFSS) nutrition questionnaires (Behavioural Risk Factor Surveillance System Survey Questionnaire, 2018). The BRFSS survey included a 7-day recall incorporating questions such as "in the last 7 days how many times did you eat a green leafy or lettuce salad, with or without other vegetables" and "in the last 7 days how many times did you eat doughnuts, brownies, pies, or cakes?" responses were scored out of 7-points with a higher score representing a greater intake of fruits and vegetables. Questions regarding less-nutritious foods or sugary drinks were reverse coded before data analysis in order to allow the variable scores to be interpreted similarly to child fruit and vegetable intake.

3.2c.ii. Child Psycho-social Outcomes

Child Healthy Eating Outcome Expectations

To address reflective processes questions from the PowerPlay! survey (Keihner et al.,

2011) that addressed children's healthy eating outcome expectations were included. These aligned with the concept of instrumental attitude; the overarching question was prefaced with "what do you think will happen if you eat fruits and vegetables every day?" responses included a basic Likert scale (1-I disagree very much, 2-I disagree a little, 3-I am not sure, 4-I agree a little, 5-I agree very much).

Child Dietary Behaviour Self-efficacy

Dietary behaviour self-efficacy addressed the M-PAC construct perceived capability and was measured using questions from the 2001 Physician-based Assessment & Counselling for Exercise (PACE) Adolescent Psychosocial Measures (Hagler et al., 2005). The 2001 PACE assessed child participants' confidence that they could consume fruits and vegetables each day (e.g. "how sure are you that you could…eat 5 servings of fruits and vegetables every day, or eat fruits and vegetables as a snack instead of chips and candy").

Child Healthy Eating Motivation

Healthy eating motivation questions (which aligned with the MPAC constructs of instrumental attitude, affective judgment, and identity) were adapted from the Family Life, Activity, Sun, Health and Eating (FLASH-E) study (Mâsse & Lytle, 2017) and the Modified Child Nutrition Questionnaire, which was previously tested for validity and reliability in measuring child dietary patterns associated with positive energy balance (Wilson, Magarey, & Mastersson, 2008). Modified questions from the FLASH-E study assessing healthy eating motivation asked children to respond based on how much they agree or disagree with a statement regarding fruit and vegetable versus sugary beverage consumption; for example, "I would feel bad about myself if I didn't eat enough fruits and vegetables" and "others would be upset if I didn't limit junk food and sugary drinks". Additionally, questions drawn from the Modified

Child Nutrition Questionnaire ask how strongly children agree or disagree with statements like, "in my home vegetables are served at dinner most nights" and "it is easy to prepare vegetables to eat" (questions were scored on a 5-point Likert scale; 1-strongly disagree, 5-strongly agree).

Child Perceived Cooking Skills

Finally, perceived cooking skills were evaluated using a sub-scale selected from the *Cooking with Kids* questionnaire validated by Lohse and colleagues (2011). The questions assessed children's ability to prepare and cook food, for example, "I can make a snack with fruit" and "I can make a salad" (responses included 1-NO!, 2-No, 3-Not sure, 4-Yes, 5-YES!). Appendix A provides an overview of the child nutrition questionnaire including the aforementioned outcome measures and the M-PAC construct(s) aligning with each outcome.

3.2d Nutrition Outcomes and Alignment with M-PAC

The parent and child nutrition questionnaires were carefully constructed in order to align with the various M-PAC constructs. Each subscale selected from an existing survey needed to assess nutrition-related behavioural and psycho-social outcomes in alignment with the M-PAC theoretical framework. Figure 3 provides an overview of the phases of behavioural initiation and continuation (blue text boxes), operational constructs (black text boxes) and corresponding parent and child nutrition outcomes.

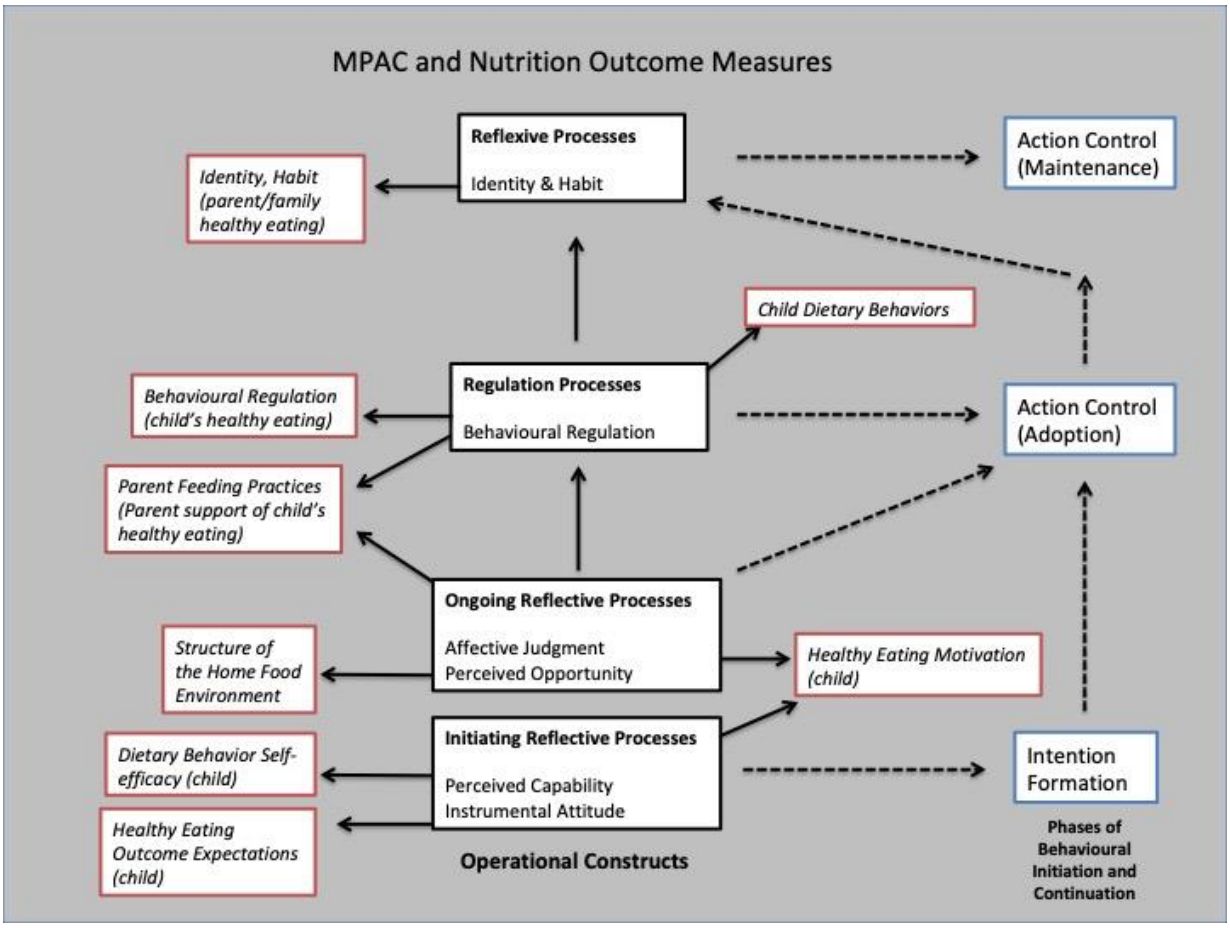


Figure 3. **M-PAC Framework and Nutrition Outcome Measures.** Adapted from "The Evolving Understanding of Physical Activity Behaviour: A Multi-Process Action Control Approach" by Rhodes, 2017.

3.2e Program Fidelity Measures

Program fidelity was described by tracking dropouts and collecting weekly attendance at face-to-face sessions for each site. A process evaluation was completed for the FHLP (reported elsewhere), however for the purpose of this paper a dose response analysis was not completed.

3.3 Intervention: The Family Healthy Living Program

The FHLP was a theory-based blended intervention that addressed physical activity, healthy eating and screen-time in addition to sleep and positive mental health. This evidence-informed intervention modified the focus from weight to healthy lifestyle changes, which was a

fundamental value among stakeholders in BC. Overall, the FHLP provided thirty contact hours through ten weekly face-to-face (90-minute) sessions, four flexible community activities and an interactive online family portal (included self-directed family activities and additional program content for parents). Furthermore, the FHLP design represented a community-based delivery model and intervention development was guided using the Multi-process Action Control (M-PAC) framework and corresponding behavioural change techniques such as goal setting, feedback and monitoring and behavioural practice (Michie et al., 2013). The M-PAC theory emphasizes social cognitive approaches to intention formation, adoption of action control through self-regulation and lastly action control maintenance once a behaviour becomes habitual; the M-PAC framework incorporates specific behavioural change techniques that are targets for intervention (Rhodes, 2017). Table 3 provides a breakdown showing how intervention sessions, activities and topics aligned with the M-PAC constructs.

Intervention activities were designed to support children and parents in learning behavioural change techniques, which provided them with the skills necessary to improve their lifestyle behaviours. For instance, during the weekly sessions parents and children were given time to set family healthy living S.M.A.R.T goals, an important component of this program. A S.M.A.R.T goal refers to a goal that is specific, measurable, achievable, realistic and time sensitive (Beckman et al., 2006). Program facilitators provided encouragement and guided families as they worked together to establish a set of goals each week related to the home food environment, family mealtime, eating and physical activity behaviours. Then, between program sessions families were instructed to track their progress with each S.M.A.R.T goal and at the following session they would discuss any barriers or facilitators to their specific goals.

The FHLP also provided an online portal, which supported face-to-face sessions and provided additional content on the lifestyle topics (e.g. positive parenting strategies, food marketing awareness) as well as interactive family-based activities. Each week families were encouraged to sign into their online portal and complete "homework" tasks and activities. Overall, the content and activities available on the portal provided at least 15 additional contact hours. The FHLP intended to create an engaging environment during face-to-face sessions and community activities while also giving participants' access to an interactive online portal that provided additional resources, support and guidance to keep families on track as they worked to improve their health-related behaviours.

3.4 M-PAC Constructs

The intervention was based on the multi-process action control (M-PAC) constructs while developing the FHLP's curriculum because these constructs will help introduce and direct participants in making long-term lifestyle behaviour changes. All of the M-PAC constructs correspond with the various behaviour change techniques described throughout Michie et al.'s behaviour change taxonomy (Michie et al., 2013). These constructs are known as reflexive processes, which represent an individual's intention then conscious decision to execute behaviour. The M-PAC postulates that once an individual performs a certain behaviour they enter the action control adoption stage. When adopting a new behaviour, one's actions are dictated by regulation processes incorporating conscious thoughts and behaviours that initiate the new behaviour (Rhodes, 2017). Ideally, after spending adequate time adopting a behaviour an individual will begin performing that behaviour habitually (action-control maintenance phase).

Translating the M-PAC theory into the context of this intervention, program leaders initially supported, informed and provided activities for participants that target healthier lifestyle

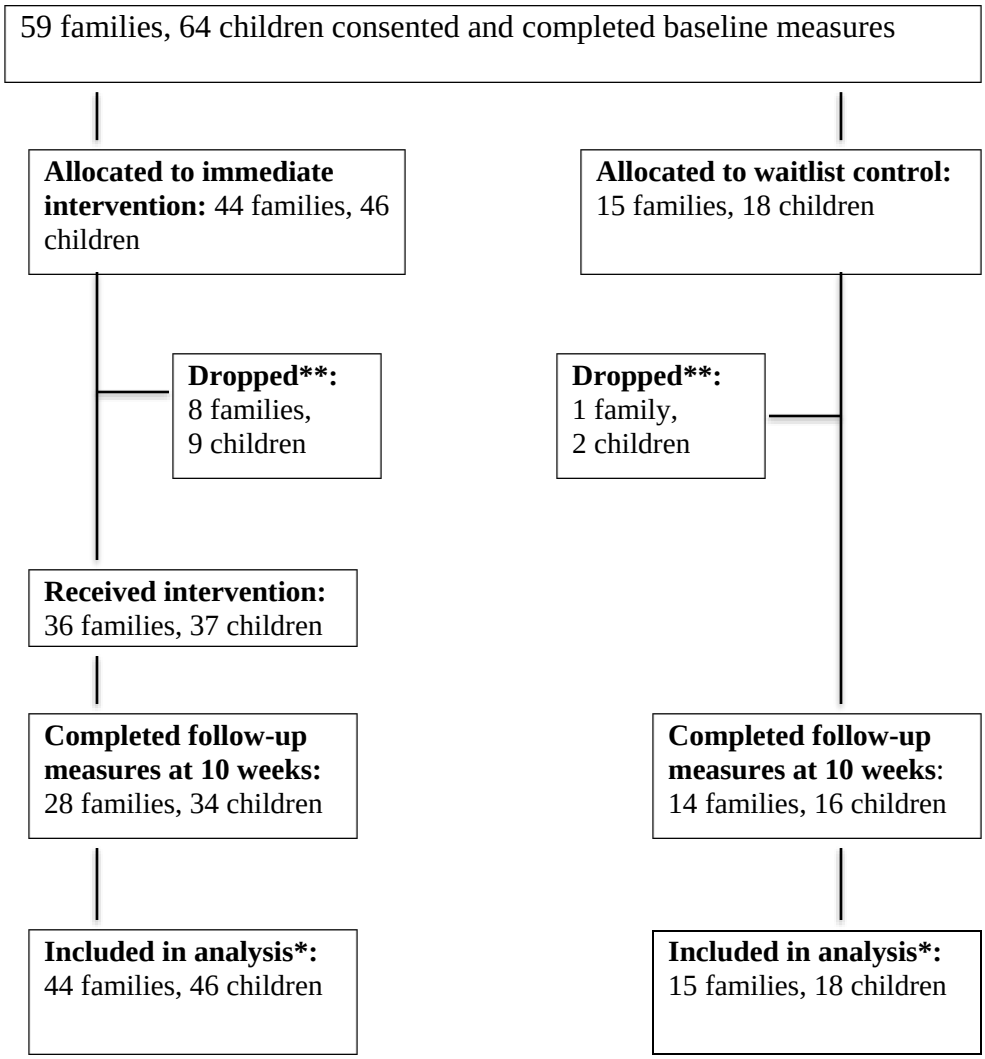
behaviours such as eating fruits or vegetables for snacks. These activities (e.g. self-assessment against known guidelines, goal-setting, taste-testing and/or situational role playing) assisted participants in forming intentions and helped them initiate one or more healthy behaviours. Then, through continued support, on-going self-assessment processes (e.g. tracking goals), problem solving and continued goal setting during intervention sessions, participants were encouraged to adopt and maintain healthy behaviours. Over time it was anticipated that participants would be at a stage where they were maintaining this healthy behaviour on their own, thus forming a new habit.

Table 1. ***FHLP sessions, nutrition topics covered, and activities; intervention alignment with the M-PAC constructs***

Session Name	Nutrition Topics	Activities & Take-Home Tasks	M-PAC Construct(s) Addressed	Behaviour Change Techniques
Within multiple sessions	SMART goal setting focusing on the following: sugary beverages, servings of fruits and vegetables, hunger scale, family meals	Healthy Living Goal Tracker; SMART goal setting; Think Pair Share Activities (accomplishments and challenges from weekly tracking)	Behavioural Regulation; Affective Judgment	Goal setting; Social support (emotional)
Session 1	What a Healthy Lifestyle Looks Like –5-2-1-0+ Introduction	Think Before You Drink (family)	Instrumental Attitude; Perceived Opportunity	Information about health consequences; Social support (practical)
Session 2	Introduction to Healthy Eating; Tracking and behavioural change		Behavioural Regulation	Goal setting; Self-monitoring of behaviour; Action planning
Session 3	Discuss healthy Eating and Weekly Goal Setting	Healthy Eating & Weekly Goal Setting & Tracking Chart/Handouts; Family Contracts	Behavioural Regulation	Goal setting; Problem Solving; Behavioural Contract
Session 4	Portion sizes vs. serving sizes; What a balanced meal looks like; Reading Nutrition Labels; Your Guide to Healthy Food Choices	Exploring Canada's Four Food Guide Groups; Family Fun at the Supermarket	Instrumental Attitude; Perceived Capability & Opportunity	Information about health consequences; Social Support; Restructuring the physical environment; Instruction on how to perform a behaviour

Session 5	Creating a Positive Healthy Family Mealtime (strategies to improve the environment); Mindful Eating (support children in becoming self-regulators of intake)	Smart Talk About Mindful Eating; Wait Stop Walk Guide—Hunger Scale	Affective Judgment; Perceived Capability	Social support (emotional); Behavioural practice; Instruction on how to perform a behaviour
Session 6	Importance of Family Mealtimes and Family Eating Style	Plan family mealtimes for upcoming week; Set SMART goal to work on family eating style	Instrumental Attitude; Perceived Capability & Opportunity; Behavioural Regulation	Information about social & environmental circumstances; Restructuring the physical environment; Goal setting; Action planning
Session 7	Family and Food Culture; family mealtime and eating style; dinner time conversation	Feeding My Family –Everyone Has a Job Worksheet (families complete together); Ants on a log recipe (group snack time)	Perceived Capability & Opportunity; Affective Judgment	Behavioural practice; Graded tasks; Social support (practical); Social support (emotional)
Session 8	Positive Parenting Skills (Parent Feeding Practices)	Discussion based	Perceived Capability; Affective Judgment	Social support (emotional); Social comparison; Instruction on how to perform a behaviour
Session 9	Cooking with Children	Cooking together; Portion Distortion	Perceived Capability	Demonstration of the behaviour; Behavioural practice; Instruction on how to perform the behaviour
Session 10	Family recipes and review	Where are you at now? – Healthy eating habits tracker; Letter of Support	Behavioural Regulation; Identity & Habit	Self-monitoring; Behavioural contract; Identity associated with changed behaviour; Prompt/cues

Figure 4. **Diagram depicting participant flow through FHLP evaluation**



**Intention to treat protocol was followed for analysis; baseline data was carried forward for participants with missing data at follow up*
***Reasons for dropouts (n= number of families): scheduling issues (n=5); lost interest (n=2); medical (n=1); unknown (n=1)*

3.5 Participant Enrolment and Group Allocation

Participant enrolment and group allocation occurred in two phases; the first phase of enrolment took place in the fall of 2018 (September-October) where participants were recruited and allocated to the fall intervention or waitlist control group. The sample size calculation was initially based on a meta-analysis assessing the effectiveness of family-based interventions on reducing child BMI. Participants were randomized 2:1 in order to maintain group sizes for the 'real-world' trial and account for a 20% drop out. The predicted sample sizes were n=70 for the intervention group and n=35 for the waitlist control group (using a two-parallel group design, type 1 error= 5% and 80% power). Randomization was completed using a random permuted block design within each program site in British Columbia: Prince George (YMCA of Northern BC); Kelowna (YMCA of the Okanagan); Surrey (Tong Louie YMCA); Surrey (City of Surrey); Burnaby (City of Burnaby); Greater Victoria (Westshore Recreation and Parks Society). Although originally, a 2:1 allocation was selected to allow for the number of participants required to run the intervention at each site, where a site's recruitment was too low (a minimum of five participants were needed to run the intervention at each program site), some participants were allocated to the intervention group instead of the control to allow the program to run. Additionally, some families were allocated to the waitlist control if their program site had too few participants for the program to run in the cycle they registered for and there were also some cases where families could not attend the fall program so they were allocated to the waitlist control group. Thus, blinding participants was not possible and this trial evolved into a quasi-experimental design.

The first ten-week programs were run from September or October to December 2018, with the final measurement sessions being held before the holidays. Then, the second ten-week

programs were held from January or February to April 2019. Overall, fifty-nine families (sixty-four children) participated in the interventions' evaluation; forty-four families (forty-six children) were allocated to the intervention group and fifteen families (eighteen children) were allocated to the waitlist control. Eight families (nine children) and one control family (two children) dropped out before follow-up measurements. Thirty-six intervention families (thirty-seven children) completed the program; in the control group, fourteen families (sixteen children) completed the ten-week program. A detailed summary showing participant flow from group allocation to ten weeks, throughout both phases of the FHLP is provided in Figure 4.

3.6 Demographic Characteristics

Data was also collected for family characteristics such as annual household income, ethnicity, and education. Forty-four percent of families were white (n=26), 18% were Asian (South Asian, East Asian and South East Asian; n=11) and 14% were categorized as other, which included Black, Latin American and Indigenous families (n=8). Twenty-one percent of families reported multiple ethnicities (n=12), and 3% of participants provided no response (n=2). Overall, 30% (n=18) of the sample had an annual household income less than $59,000 and 55% (n=33) had an annual income greater than $59,000; 15% (n=8) of participants preferred not to report their annual household income. Furthermore, primary caregivers were asked to report their highest level of education; 30% (n=18) received their high school diploma, 50% (n=29) have earned a non-university certificate or diploma from a community college or a two-year university, 15% (n=9) have earned a Bachelor's degree and 5% (n=3) have earned a graduate degree. Independent t-tests were run in order to test for baseline difference between the intervention and control groups. No significant between-group differences were found for annual household income (p=0.193) or education of primary caregiver (p=0.097). Table 2 provides an

individual summary of the aforementioned demographic characteristics for the intervention and waitlist control groups.

Table 2. ***Family Demographic Characteristics for Intervention versus Waitlist Control groups***

Primary Earner Income	**Intervention (n=44)** *% (participants)*	**Control (n=15)** *% (participants)*	**Sample (n=59)** *% (participants)*
Less than $59,000	31.7	26.7	30
$59,000 or more	53.7	60.0	55
Prefer not to answer	14.6	13.3	15

Education	**Intervention (n=44)** *% (participants)*	**Control (n=15)** *% (participants)*	**Sample (n= 59)** *% (participants)*
High-school diploma	29.3	33.3	30
2-year college	46.3	60.0	50
University	17.1	6.7	15
Graduate degree	7.3	0	5

Ethnicity	**Intervention (n=47)** *% (participants)*	**Control (n=15)** *% (participants)*	**Sample (n=59)** *% (participants)*
White	40.5	53.3	44
Asian*	19.0	13.3	18
Other**	14.3	13.3	14
Multiple Ethnicities	21.4	20.0	21
Unknown	4.8	0	3

*Asian = South Asian, East Asian and South East Asian **Other = Black, Latin American, and Indigenous

3.7 Data Analysis

Quantitative data were entered and analysed using the Statistical Package for the Social Sciences version 21.0 (SPSS IBM Corp., Armonk NY, USA) to describe group demographic characteristics and test for significant differences between group means on outcome measures. First, means and standard deviations were conducted on all variables to describe the overall sample and groups. Second independent t-tests were run on all demographic and baseline outcome measures to determine if there were significant differences between groups at baseline. Additionally, descriptive statistics and measures of normality were used to determine if the dataset was normally distributed and appropriate for analysis. Results showed that there were no significant baseline differences in outcome measures between intervention and waitlist control groups; also, outcome measures were normally distributed at baseline.

An intention-to-treat protocol was used for parents and children who did not complete follow-up measurements. There was approximately 30% of missing data and data was missing at random; thus, baseline measurements were carried forward for participants with missing follow-up measures. Repeated measures analysis of variance (ANOVA) (2x2) was used to compare pre and post measures between intervention and waitlist control participants. The repeated measures ANOVA analysed ordinal and interval level data including but not limited to: nutrition-related seven-day dietary intake (fruit and vegetables, sugary beverages and non-nutritious foods), healthy eating motivation, dietary behaviours self-efficacy and perceived confidence with cooking skills. Pre- and post-intervention differences in parent nutrition-related outcomes such as structuring the food environment and family meal and eating habits were also analysed using the repeated measures ANOVA test. A statistical cut-off point based on an alpha level of 0.05 was

used to determine significant intervention effects. Furthermore, before completing the repeated measures ANOVA analysis, the assumptions for statistical tests were verified.

Evidence shows that sometimes underpowered intervention studies produce statistically nonsignificant results, not necessarily because of a lack of clinically significant findings, but due to studies' small sample sizes (Kraemer, Mintz, Noda, Tinklenberg, & Yesavage, 2006; Leon, Davis, & Kraemer, 2011). Given the FHLP's small sample size, it was potentially underpowered; thus, mean changes were computed and used to determine frequencies (tally and percentages) for each variable in order to observe the number of participants that improved, stayed the same or decreased from baseline to post-intervention. This procedure ensured that no hypotheses were rejected without thorough investigation. Finally, effect size was calculated for each variable using Cohen's d equation and Hedge's g, which accounted for the unequal sample sizes between groups (Rosnow, Rosenthal, & Rubin, 2000). Effect sizes were interpreted as follows; 0.20 = small, 0.50 = medium, and 0.80 =large effect size (Cohen, 1992).

Chapter 4: Results

4.1 Descriptives

Out of the fifty-nine families (sixty-four children) that participated and completed baseline measures forty-three were mothers and seven were fathers (this number includes intervention and waitlist control group parents); nine parents did not respond to the question. Twenty-one percent of the overall sample included single parents (n=12). At baseline, the children in the intervention group consisted of twenty-six females and twenty males with an average age of 10.01 years (SD=1.59; age range 7.92-13.25 years old); also, there were eight females and ten males in the control group with an average age of 10.17 years (SD=1.32; age

range 8.42-11.58 years old). No significant differences between groups were identified for child age (p=0.805) and gender (p=0.591).

4.2 Parent and Child Nutrition Outcomes

The following sections will provide a summary of the findings for each nutrition-related parent and child outcome. Separate sections were developed to help differentiate each variable, its meaning and overall findings.

4.2a Parent Outcomes

This section provides an overview of the repeated analysis of variance findings from each parent nutrition-related variable.

4.2a.i. Parent Behavioural Outcomes

Parent Feeding Practices and The Home Food Environment

No significant differences between conditions were observed for parent feeding practices (intrinsic or extrinsic motivation used related to child feeding) over time. However, a significant effect for time was identified for parents' intrinsic feeding practices, which increased in both groups (see table 3 and 4). Although not significant there was a small to medium effect size detected in the between group comparison for extrinsic feeding practices (see table 3). Furthermore, mean change in extrinsic parent feeding practices increased among the intervention group, while the control group decreased over time (see table 4).

A repeated measures ANOVA showed no significant group by time interactions for fruit and vegetable availability and accessibility (food environment FV, see table 3) and the effect size was minor, however there was a main effect for time whereby availability and accessibility increased in both groups (see table 3). Additionally, there were no significant between group differences for sugary drink availability and accessibility in the home environment (food

environment sugary drinks), but again a main effect for time was detected (see table 3). Overall, there was no significant group-by-time interaction for the structure of the home food environment (food environment, see table 3) and the effect size was trivial, nevertheless a main effect for time was observed with both groups increasing fruit and vegetables and decreasing sugary beverage availability and accessibility within the home (see table 3).

Parent Behavioural Regulation of Child's Healthy Eating

Parents' self-reported behavioural regulation of their child's healthy eating approached significance in the intervention group relative to the waitlist control. Additionally, the effect was medium with the intervention group improving across time. There was also a greater percentage of participants in the intervention group that improved their behavioural regulation of child's healthy eating compared to the control group (see table 4). No significant effect for time was detected (see table 3).

Parent Fruit and Vegetable Intake

No significant group-by-time interaction was identified for parent's fruit and vegetable intake and the effect size was small. However, there was a main effect for time with fruit and vegetable intake improving by a small effect size in all participants (see table 3). There was also a higher percentage of intervention participants that improved their fruit and vegetable intake compared to the control (see table 4).

Family Eat/Cook Together

There were no significant between group differences for family eat/cook together and the effect size was inconsequential (see table 3). In addition, there was no significant effect for time. Nevertheless, there was a greater percentage of participants in both groups that either improved

or maintained their frequency of family eating and cooking together from baseline to post-intervention (see table 4).

4.2a.ii. Parent Psycho-social Outcomes

Parental Attitudes and Perceived Control for Supporting Child's Healthy Eating

Overall scores, which represented total parental support of children's healthy eating (scale ranged between 2 and 12) combining parental attitudes and self-efficacy for supporting children's healthy eating (subscales ranged from 1-7 and 1-5 respectively), approached significance with a medium effect size in favour of a positive intervention effect. Additionally, there was a positive mean change and greater percentage of improvement among the intervention group compared to the control, whereby there was a negative mean change (see table 4). However, there was no main effect for time.

Assessing the subscales separately demonstrated there was a medium effect for parental attitudes (instrumental attitude and affective judgment) for supporting child's healthy eating with parents in the intervention group increasing their scores compared to the waitlist control (see table 3 and 4). Additionally, although it appeared that the intervention group's self-efficacy (perceived capability and opportunity) for supporting their child's healthy eating improved from pre to post-intervention this finding was not significant compared to the control and no main effect for time was observed. However, a small effect size was identified.

Parent Meal Preparation Self-Efficacy

There were no significant group-by-time interactions for parents' meal preparation self-efficacy scores; however, a main effect for time was observed with both the intervention and waitlist control groups improving their mean scores over time (see table 3 and 4).

Parent Healthy Eating Habits and Identity

There were no significant differences between the intervention and control groups' healthy eating habits, but a small effect size was detected as well as a main effect for time whereby both groups improved by the equivalent of a small effect size (see table 3). Furthermore, no significant differences were observed in parents' healthy eating identity when comparing conditions across time, however a small effect size was detected in favour of the intervention group (see table 3). There was no time effect.

4.2b Child Outcomes

This section provides an overview of the repeated analysis of variance findings from each parent nutrition-related variable.

4.2b.i. Child Behavioural Outcomes

Child Dietary Behaviours

No significant effects were detected for child fruit and vegetable intake and sugary drink intake across time or by condition. However, a small effect size was observed for vegetable and fruit intake with the intervention group maintaining a higher mean fruit and vegetable intake from pre to post intervention compared to the waitlist control (see table 5). Additionally, a higher percentage of participants in the intervention group either improved or maintained their fruit and vegetable intake compared to the control, whereby the majority of participants decreased across time (see table 6).

4.2b.ii. Child Psycho-social Outcomes

Child Healthy Eating Outcome Expectations

There were no significant effects between groups or across time for children's healthy eating outcome expectations.

Child Dietary Behaviour Self-efficacy

There were no significant differences found between the intervention and control group overtime for children's dietary behaviour self-efficacy and no significant time effects were observed. A small effect size was detected whereby the control group increased over time (see tables 5 and 6).

Child Healthy Eating Motivation

No significant intervention effects were observed for child healthy eating motivation scores overall or specifically for the intrinsic and extrinsic motivation sub-scales; also, no significant effect for time was detected for child healthy eating motivation.

Child Perceived Cooking Skills

There were no significant intervention effects for children's perceived cooking skills nor was there a main effect for time. However, a medium effect size was observed for children's perceived cooking skills with the waitlist control improving over time (see tables 5 and 6). Additionally, the majority of participants in the intervention and control groups improved or maintained their perceived cooking skills across time (see table 6).

4.2c Program Fidelity Outcomes

The attendance rate at the weekly face-to-face sessions was fifty-eight percent, which included participants that dropped out of the program (ninety-two percent of children that dropped out did so during the first three weeks). Eighty-five percent of the children that completed the program attended seventy percent or more of the weekly sessions. Lastly, ninety-two percent of the children that dropped out of the program did so during the first three weeks (two children dropped out after week four).

Table 3. ***Parent Nutrition-Related Outcomes***

			Baseline		Follow-up						
Variables (scoring range)	INT (n=44)		CON (n=15)		INT (n=44)		CON (n=15)		ANOVA (time * group)	ANOVA (time)	Effect Size (time * group)
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	**P-value**	**P-value**	**(n^2, Cohen's *d*)**
Parent Feeding Practices *(Intrinsic Parenting)* (1-5)	3.822	0.565	3.507	0.543	4.024	0.632	3.640	0.599	0.615	0.027*	0.005, 0.142
Parent Feeding Practices *(Extrinsic Parenting)* (1-5)	3.665	0.464	3.788	0.361	3.721	0.458	3.703	0.350	0.170	0.792	0.035, 0.381
Parental Attitudes for Supporting Child's HE (1-7)**	5.780	0.934	5.500	0.856	5.970	0.957	5.300	1.074	0.064	0.930	0.062, 0.514
Parental Perceived Control For Supporting Child's HE (1-5)	4.476	0.499	4.250	1.026	4.583	0.523	4.267	1.033	0.481	0.355	0.009, 0.191
Total Parent Support of Child's HE (2-12)	10.256	1.163	9.750	1.590	10.553	1.257	9.567	1.749	0.066	0.575	0.061, 0.510
Food Environment FV (1-4)	3.222	0.443	3.044	0.618	3.304	0.491	3.193	0.619	0.556	0.017*	0.006, 0.155
Food Environment sugary drinks (1-4)	3.378	0.712	3.600	0.611	3.566	0.541	3.733	0.476	0.647	0.018*	0.004, 0.127
Food Environment (2-8)	6.600	0.843	6.644	0.821	6.870	0.837	6.926	0.832	0.974	0.002*	0.000, 0.000
Parent FV Intake (servings/day of FV; 2=none to 12=5 or more of both)	6.59	1.884	6.33	1.633	7.262	1.862	6.667	1.988	0.384	0.018*	0.014, 0.238
Family Eat/Cook Together (2-20)	11.90	5.024	10.93	5.311	12.405	4.340	11.800	5.609	0.798	0.189	0.001, 0.063

Parent Meal Preparation Self-efficacy (2-10)	8.460	1.380	7.87	1.685	8.881	1.310	8.267	1.534	0.881	0.002*	0.000, 0.000
Parent/Family HE Habits (4-20)	12.70	4.020	11.47	2.973	14.000	3.876	12.133	3.292	0.407	0.012*	0.013, 0.230
Behavioural Regulation (Child's HE) (4-20)	11.98	3.657	11.79	3.867	13.881	3.664	11.333	3.539	0.051	0.119	0.070, 0.549
Parent/Family HE Identity (3-15)	10.07	2.573	9.40	2.354	10.619	2.575	9.533	2.642	0.366	0.136	0.015, 0.247

*Significant outcome ($p \leq 0.05$)**Healthy Eating

Table 4. ***Parent Change in Nutrition-Related Outcomes***

	Mean Change				**Frequency & Percent[1]**					
Variables (scoring range)	INT (n=44)		CON (n=15)		INT			CON		
					Improved[2]	No Change[3]	Decreased[4]	Improved	No Change	Decreased
	Mean Δ	SD	Mean Δ	SD	**(N; percent)**	**(N; percent)**	**(N; percent)**	**(N; percent)**	**(N; percent)**	**(N; percent)**
Parent Feeding Practices *(Intrinsic Parenting)* (1-5)	0.196	0.480	0.111	0.471	4; 8.7	21; 45.7	21; 45.7	2; 11.1	10; 55.6	6; 33.3
Parent Feeding Practices *(Extrinsic Parenting)* (1-5)	0.054	0.334	-0.071	0.290	0	20; 43.5	26; 56.5	0	9; 50.0	9; 50.0
Parental Attitudes for Supporting Child's HE (1-7)**	0.241	0.691	-0.167	0.728	7; 15.2	24; 52.2	15; 32.6	1; 5.6	10; 55.6	7; 38.9
Parental Perceived Control For Supporting Child's HE (1-5)	0.114	0.538	0.014	0.201	6; 13.0	27; 58.7	13; 28.3	0	13; 72.2	5; 27.8
Total Parent Support of Child's HE (2-12)	0.318	0.939	-0.153	0.728	7; 15.2	25; 54.3	14; 30.4	1; 5.6	11; 61.1	6; 33.3
Food Environment FV (1-4)	0.086	0.309	0.124	0.307	0	22; 47.8	24; 52.2	0	9; 50.0	9; 50.0

Food Environment sugary drinks (1-4)	0.182	0.465	0.111	0.300	4; 8.7	31; 67.4	11; 23.9	1; 5.6	13; 72.2	4; 22.2
Food Environment (2-8)	0.268	0.589	0.235	0.430	5; 10.9	20; 43.5	21; 45.7	1; 5.6	9; 50.0	8; 44.4
Parent FV Intake (servings/day of FV; 2=none to 12=5 or more of both)	0.659	1.45	0.278	1.07	16; 34.8	22; 47.8	8; 17.4	5; 27.8	11; 61.1	2; 11.1
Family Eat/Cook Together (2-20)	0.546	3.95	0.722	1.53	13; 28.3	21; 45.7	12; 26.1	5; 27.8	12; 66.7	1; 5.6
Parent Meal Preparation Self-efficacy (2-10)	0.409	0.897	0.333	0.594	13; 28.3	28; 60.9	5; 10.9	5; 27.8	13; 72.2	0
Parent/Family HE Habits (4-20)	1.21	2.77	0.556	0.984	14; 30.4	24; 52.2	8; 17.4	5; 27.8	13; 72.2	0
Behavioural Regulation (Child's HE) (4-20)	1.73	3.31	-0.177	2.86	17; 37.0	22; 47.8	7; 15.2	2; 11.1	11; 61.1	5; 27.8
Parent/Family HE Identity (3-15)	0.500	1.47	0.111	1.18	14; 30.4	26; 56.5	6; 13.0	5; 27.8	11; 61.1	2; 11.1

*Significant outcome ($p \leq 0.05$)**Healthy Eating [1]Number of participants that improved, did not change or got worse (decreased) from baseline to follow-up [2]Improved = score increased by ≥ 1 unit [3]No change = score did not increase or decrease by ≥ 1 unit [4]Decreased = score decreased by ≥ 1 unit

Table 5. ***Child Nutrition-Related Outcomes***

	Baseline				**Follow-up**						
Variables (scoring range)	INT[A] (n=46)		CON[B] (n=18)		INT (n=46)		CON (n=18)		ANOVA (time * group)	ANOVA (time)	Effect Size (time * group)
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	**P-value**	**P-value**	**(n^2, Cohen's *d*)**

Fruit Intake (1-7)	3.167	1.702	3.067	1.450	2.989	1.608	2.583	1.061	0.549	0.154	0.006, 0.155
Vegetable Intake (1-7)	2.570	1.022	2.267	0.866	2.341	1.006	2.296	0.615	0.430	0.516	0.007, 0.168
Sugary Drink Intake (1-7)[C]	1.744	0.981	1.433	0.372	1.678	0.942	1.472	0.401	0.647	1.00	0.004, 0.127
HE* Outcome Expectations (8-40)	32.60	5.687	31.87	5.167	32.311	5.815	31.111	4.945	0.888	0.702	0.000, 0.000
Dietary Behaviours Self-efficacy (7-35)	29.36	4.057	27.93	4.992	28.844	4.913	28.111	4.418	0.518	0.777	0.007, 0.168
Intrinsic Motivation for HE (12-60)	47.36	8.116	44.60	9.334	47.000	8.318	44.833	7.115	0.859	0.790	0.001, 0.063
Extrinsic Motivation for HE (6-30)	24.40	3.852	25.13	3.777	24.422	3.870	24.611	3.987	0.649	0.681	0.004, 0.127
Perceived Cooking Skills (4-25)	21.44	3.494	21.33	3.811	21.378	3.400	22.167	3.552	0.074	0.108	0.054, 0.478

A = Intervention group; B = Control group; C= Sugary drink scores were reverse coded; *HE = Healthy Eating; ** = significant outcome ($p \leq 0.05$)

Table 6. ***Child Change in Nutrition-Related Outcomes***

	Mean Change		**Frequency & Percent[1]**					
Variables (scoring range)	INT[A] (n=46)	CON[B] (n=18)	INT			CONT		
			Improved[2]	No Change[3]	Decreased[4]	Improved	No Change	Decreased

	Mean Δ	SD	Mean Δ	SD	(N; percent)	(N; percent)	(N; percent)	(N; percent)	(N; percent)	(N; percent)
Fruit Intake (1-7)	-0.178	1.52	-0.433	1.07	8; 17.4	21; 45.7	17; 37.0	3; 16.7	3; 16.7	12; 66.7
Vegetable Intake (1-7)	-0.230	1.14	0.022	0.792	6; 31.0	19; 41.3	21; 45.7	3; 16.7	3; 16.7	12; 66.7
Sugary Drink Intake (1-7)[C]	-0.067	1.08	0.067	0.495	2; 4.3	25; 54.3	19; 41.3	1; 5.6	4; 22.2	13; 72.2
HE* Outcome Expectations (8-40)	-0.289	3.79	-0.133	3.31	11; 23.9	21; 45.7	14; 30.4	4; 22.2	5; 27.8	9; 50.0
Dietary Behaviours Self-efficacy (7-35)	-0.511	3.52	0.200	4.11	10; 21.7	23; 50.0	13; 28.3	5; 27.8	4; 22.2	9; 50.0
Intrinsic Motivation for HE (12-60)	-0.356	5.13	0.067	5.22	11; 23.9	21; 45.7	14; 30.4	6; 33.3	3; 16.7	9; 50.0
Extrinsic Motivation for HE (6-30)	0.022	3.19	-0.400	3.318	11; 23.9	22; 47.8	13; 28.3	4; 22.2	7; 38.9	7; 38.9
Perceived Cooking Skills (4-25)	-0.067	2.21	1.20	2.68	12; 26.1	23; 50.0	11; 23.9	7; 38.9	5; 27.8	6; 33.3

A = Intervention group; B = Control group; C= Sugary drink scores were reverse coded; *HE = Healthy Eating [1]Number of participants that improved, did not change or got worse (decreased) from baseline to follow-up [2]Improved = score increased by ≥ 1 unit [3]No change = score did not increase or decrease by ≥ 1 unit [4]Decreased = score decreased by ≥ 1 unit

Chapter 5: Discussion

Literature reporting on family-based weight management and nutrition interventions addressing overweight and obese children shows that there are a lack of interventions that maintain parental and child engagement, session attendance and provide an interactive and flexible program atmosphere (Kothandan, 2014). Additionally, there are few programs targeting multiple dimensions of lifestyle behaviours such as healthy eating, physical activity, sleep consistency and quality, sedentary behaviour (i.e., screen-time) and mental health or that blend face-to-face with online engagements (Ash et al., 2017; J. Chen & Wilkosz, 2014; Erbe et al., 2017; Reed et al., 2012). Furthermore, implementation science shows that conducting a community needs assessment, stakeholder engagement and consideration of program adaptability are crucial components for successful implementation (Pate et al., 2000). Thus, the FHLP was theory and evidence-based and developed with extensive stakeholder input to be aligned with the BC context, to accommodate for local delivery flexibility and to address the gaps highlighted in the literature (incorporating screen-time, sleep and mental health in addition to physical activity and healthy eating). It is one of very few interventions designed and evaluated using a meta-theoretical approach, the M-PAC framework (Rhodes, 2017) to address the systematic development of behavioural change skills.

Furthermore, there is a need for a greater understanding of family-oriented interventions addressing childhood overweight and obesity among children ages eight to twelve years old and their impact on eating behaviour outcomes and psycho-social determinants (Faught et al., 2016). Children's unhealthy dietary behaviours and inadequate consumption of fruits and vegetables are a widespread problem associated with the onset of childhood overweight and obesity (Snuggs, Houston-price, & Harvey, 2019). Knowing how poor dietary behaviours can impact children's

risk of obesity, it is imperative that interventions address children's food choices, attitudes and motivation for healthy eating in addition to parental support for healthy eating, parent feeding practices and the structure of the home food environment (Snuggs et al., 2019; Waddingham et al., 2018). In order to establish effective interventions for improving parenting practices, attitudes and self-efficacy for supporting child eating behaviours, intervention research must be evidence-informed, theory-based and contain a thorough evaluation that aligns with the theoretical foundation of the intervention (Michie et al., 2011). Behavioural theory provides a structure for systematically studying and evaluating parent and child healthy eating behaviours and psycho-social factors (Diep et al., 2014). Nevertheless, few family-based weight management interventions aiming to improve lifestyle behaviours have evaluated parent and child psycho-social factors related to child eating using a comprehensive behavioural framework.

The purpose of this study was to specifically evaluate the impact of the FHLP on children's reflective processes (i.e., instrumental attitude, affective judgment, perceived capability and opportunity) related to healthy eating, child dietary behaviours (i.e., fruit and vegetable consumption), in addition to food-related parenting practices (i.e., regulation processes such as the structure of the home food environment, modelling healthy eating behaviours and setting goals to support child's healthy eating) and the psycho-social correlates of behaviour change related to parental support for their child's healthy eating behaviours (i.e., reflective and reflexive processes related to healthy eating). Additionally, this was the first study to evaluate behavioural and psycho-social nutrition-related outcomes using measures aligned with the M-PAC framework (Rhodes, 2017) and behaviour change techniques (Michie et al., 2013).

Overall, results from the intervention evaluation were mixed, with several positive outcomes noted when observing parent nutrition-related outcomes in contrast to little

improvement throughout the child nutrition-related outcomes. Parents participating in the FHLP improved regulation of their children's healthy eating compared to the waitlist control group, whereby a medium effect was identified in favour of the intervention group. Additionally, a medium effect size was detected for parental attitudes and self-efficacy for supporting children's healthy eating. No significant intervention effects were found in children's eating behaviours or psycho-social variables. However, there were a few interesting findings observed regarding the frequency of participants in each group that improved, maintained or decreased their fruit and vegetable consumption over time. Furthermore, the positive changes identified in parent nutrition-related outcomes are noteworthy and critical for initiating and maintaining any changes in child dietary behaviours.

5.1 FHLP Strengths

To our knowledge this was the first study to address the M-PAC framework for nutrition-related behaviours; this framework has only previously been used to predict and explain physical activity behaviour change. As of 2017, the M-PAC approach was proposed as a testable schematic that would likely be modified and further improved in its ability to explain physical activity behaviour change (Rhodes, 2017). Knowing this, it is important to recognize that parent's nutrition-related reflective processes and self-regulation behaviours appeared to change similarly to the M-PAC framework's predictions. For example, our results demonstrated that intervention parents improved their instrumental attitude, affective judgment, perceived capability, and perceived opportunity (reflective processes) associated with supporting their child's healthy eating behaviours. The aforementioned constructs make up an individual's intention formation, which is an imperative step toward behavioural enactment. Furthermore, the process that follows intention formation and leads to action control and the adoption of a

particular behaviour are regulation processes (i.e., behavioural regulation), which helps translate an intention into a behaviour (Rhodes, 2017; Rhodes & Yao, 2015a). Throughout the FHLP parents in the intervention group trended toward significantly improved behavioural regulation in supporting their child's healthy eating behaviours in comparison to the waitlist control. These results show that the M-PAC framework can explain some degree of behaviour change associated with nutrition-related behaviours (e.g. parent feeding practices and behavioural regulation of their child's healthy eating).

Multiple psycho-social outcomes related to nutrition were also included in the FHLP evaluation, such as healthy eating outcome expectations and motivation, parental attitudes and perceived control for supporting children's healthy eating, and dietary behaviours self-efficacy. These psycho-social variables represent constructs that align with the M-PAC framework, including instrumental attitude, perceived capability, perceived opportunity and affective judgement; all of which impact intention formation, intention translation into behaviours, behaviour regulation and habit formation (Rhodes et al., 2006). Unfortunately, no significant outcomes were found for the child nutrition-related variables that aligned with the M-PAC schematic; however, few studies have attempted to examine the aforementioned variables among an overweight or obese child population (McClain, Chappuis, Nguyen-Rodriguez, Yaroch, & Spruijt-Metz, 2009). According to Black et al. (2017) determinants of fruit and vegetable intake and healthy eating behaviour changes have been reported by a small number of studies. Existing research shows non-conclusive evidence regarding the association between instrumental attitude, perceived capability/self-efficacy, outcome expectations and child fruit and vegetable consumption (McClain et al., 2009). Thus, future research is needed to test the M-PAC framework for explaining nutrition-related behaviour change among children.

Furthermore, the FHLP is one of the few family-based weight management interventions utilizing a blended intervention format (Gorely et al., 2009; Mangunkusumo et al., 2007; Okorodudu et al., 2015; Tripicchio et al., 2017). Web and technology-based interventions are on the rise for addressing childhood obesity by targeting the family unit, however research has shown that, in the absence of a face-to-face component, technology-based interventions have a limited impact on behaviour and weight change (Davis et al., 2011; Tripicchio et al., 2017). Therefore, the FHLP incorporated weekly in-person sessions in addition to an online portal. The weekly in-person sessions provided an engaging atmosphere for group discussion and interactive parent-child lessons; then, the online portal offered additional educational activities to complete as a family, recipes and a discussion forum, all of which created a network of support outside of the in-person sessions. The following discussion will provide an overview of the findings from the nutrition portion of the FHLP and will align them with existing literature.

5.2 Program Impact on Parent Nutrition-Related Outcomes

5.2a Parent Psycho-social Outcomes

Findings from the analysis of nutrition-related parent variables demonstrated that the intervention group improved their *total parent support of child's healthy eating* as evidenced by a medium effect size. Particularly, the outcome *parental attitudes for supporting child's healthy eating* approached significance, with a medium effect. Parents' total support of their child's healthy eating included measures of their attitudes and perceived control (perceived capability or self-efficacy and perceived opportunity) related to supporting their child's healthy eating. Parents participating in the FHLP increased their instrumental attitude (utility of a particular behaviour), affective attitude (enjoyment of a behaviour) and perceived control (opportunity and ability to perform the behaviour if desired) related to supporting their child's healthy eating behaviours.

According to Nepper and Chai (2016), improving parental attitudes and perceived control for supporting children's healthy eating is the first step toward modifying child dietary behaviours and food choices (Nepper & Chai, 2016b).

Moreover, during the FHLP parents and children participated in sessions where they worked together to set goals within the home to decrease sugary beverage consumption and improve the foods available throughout the home. Providing an opportunity for parents and their children to work together may have contributed to parents' improvement in parental attitudes and perceived control for supporting their child's healthy eating. For example, the *Home Plus* intervention provided interactive family sessions where parents and their children were encouraged to work together in cooking activities or nutrition education lessons (Fulkerson et al., 2018) and results from this intervention demonstrated that parental self-efficacy (perceived capability) to support their child's healthy dietary behaviours significantly increased among intervention parents.

Overall, the positive intervention effect on *total parent support of child's healthy eating* (assessed parental attitudes and perceived control) is a meaningful finding given previous health behaviour-change and healthy eating research showing that attitudes and perceived control are predictors of intention formation (Larsen et al., 2018; Rhodes & Yao, 2015a). Multiple behavioural theories describe individual's intentions to execute behaviour as a vital predictor of behaviour performance, such as the theory of planned behaviour and protection motivation theory (Paschal, Milne, Webb, & Gollwitzer, 2008). Correlational studies have demonstrated that intentions are consistently associated with behaviour enactment (Webb & Paschal, 2006). Andrew et al. (2010) examined the role of parental attitudes and perceived behavioural control (perceived ability and opportunity) related to providing healthy foods for their children and

tracking children's eating behaviours; results from the study showed that parents' attitudes (instrumental and affective attitude) and perceived behavioural control predicted behavioural intentions (Andrews, Silk, Eneli, & Silk, 2010). Andrew and colleagues (2010) also found that parents' attitudes regarding providing healthy foods and limiting unhealthy foods as an effective strategy for preventing obesity, predicted parental regulation/tracking of children's eating behaviours. Thus, because the FHLP improved two constructs that predict intention formation, it is possible that at post-intervention, parents will have the ability to form strong intentions for supporting their child's healthy eating, which under the right circumstances could result in parents executing plans or providing opportunities for their children to eat healthfully.

Nevertheless, a large body of literature explains that individuals intending to engage in or change a particular behaviour, do not necessarily follow through with their intention; this is known as the intention-behaviour gap (Paschal Sheeran & Webb, 2016). According to Larsen and colleagues (2018) there may be an intention-behaviour gap between parents' intentions to support their child's healthy eating and their actual behaviours. Parents' responses to their child's food cues, emotions and eating behaviours may influence the food-parenting intention-behaviour gap (Larsen et al., 2018). Circumstantial cues and children's present behaviours and emotions can trigger parental habits and unwanted food parenting practices that do not align with parents' initial intentions. For example, if a parent is grocery shopping with their child and their child begins to get upset when a parent denies him/her junk food, that parent may eventually capitulate to the child's request in order to ameliorate the child's misbehaviour. Larsen et al. (2018) hypothesizes that modifying key reflexive and regulation processes such as parent's habits and behavioural regulation will fundamentally influence parent-feeding practices, more so than improvements in parental attitudes and perceived control (i.e., reflective processes).

5.2b Parent Behavioural Outcomes

Interestingly, the results from the FHLP showed that parents' self-reported regulation of their child's healthy eating behaviours approached significance, with the intervention group increasing by a medium effect size compared to the waitlist control. According to Rhodes and de Bruijn (2013) the translation of intentions into behaviours are mediated by action control, which is dependent upon individuals' use and quality of regulation behaviours (e.g. planning, enlisting support, self-monitoring; Rhodes & De Bruijn, 2013). Furthermore, a study implementing the M-PAC framework to examine parental support for child physical activity, reported that parents who were successful intenders (parents who successfully supported their child's physical activity) were more likely to use regulation behaviours such as goal setting and planning than unsuccessful intenders (Rhodes & Lim, 2016). The FHLP improved intervention parents' regulation behaviours related to setting goals and making plans to support their child's healthy eating behaviours, potentially this improvement could bridge the intention-behaviour gap and enable parents to actively support their child's healthy eating behaviours.

Another important parent behavioural outcome included the structure of the home *food environment*. Structuring the home food environment can include fruit and vegetable availability and accessibility, parent fruit and vegetable consumption, mealtime eating practices as well as monitoring and restriction of certain foods or beverages (Fulkerson et al., 2018). The FHLP evaluation showed that there was a main effect for time for the availability and accessibility of fruits and vegetables as well as decreased sugary drinks within the home environment. Similarly, there was a significant time effect for parent fruit and vegetable intake, whereby both groups improved from baseline to post-intervention. Although these findings do not necessarily support the effectiveness of the intervention, it is not unusual given the study's waitlist control design.

The purpose of using a waitlist control is to enable researchers to evaluate the intervention's effectiveness by comparing the intervention group to the waitlist at post-intervention; additionally, it ensures that the waitlist has an opportunity to receive the treatment or intervention. However, some research has shown that this type of design can inflate intervention effects because participants originally assigned to the waitlist control condition appear to improve less than would be predicted for individuals wanting to take steps to change their behaviours (Cunningham, Kypri, & Mccambridge, 2013). Contrary to these findings, the FHLP reported multiple significant time effects for some of the outcomes where intervention and waitlist control groups both improved their nutrition-related behaviours or psychosocial factors. This finding aligns more with studies implementing standard controlled designs, where control participants tend to improve (Jenkins, Mcalaney, & Mccambridge, 2009; Moyer, Ph, Finney, & Ph, 2002).

Nevertheless, any positive change in the structure of the home food environment is noteworthy and could lead to improvements in a child's nutrition. Research has demonstrated that improving the home food environment can have a profound effect on child dietary behaviours (Berge, Jin, Hannan, & Neumark-Sztainer, 2013; Fulkerson et al., 2015; Jackson et al. 2015). For instance, the *Healthy Habits* randomized controlled trial completed an intervention aiming to improve children's fruit and vegetable intake by helping parents modify the home food environment, particularly their own fruit and vegetable consumption in addition to parent providing behaviours (Wyse, Wolfenden, & Bisquera, 2015). Findings from the *Healthy Habits* trial showed that parents' fruit and vegetable intake and parent providing behaviours mediated the effect between children's group allocation and their fruit and vegetable intake at post-intervention. Specifically, children with parents that reported higher fruit and vegetable intake

and frequent provision of fruits and vegetables during mealtimes increased their post-intervention fruit and vegetable consumption (Wyse et al., 2015). Thus, parents actively working to develop a healthier food environment will likely be able to support their children in establishing healthier dietary behaviours.

Furthermore, there was a small to medium effect size for *parent feeding practices (extrinsic motivation)*, with parents in the intervention group increasing their use of parenting practices to motivate and facilitate children's healthy eating behaviours. Despite the fact that there were no significant improvements among intervention children's dietary behaviours, this improvement in parent-feeding practices is likely to have a positive influence on children's eating behaviours and food choices post-intervention. For instance, in a family-based health-centred intervention primarily targeting parents of overweight and obese children, children in the parent-focused group (parents were addressed as agents of change) maintained significant weight loss at one and two years follow-up compared to children in the child-only group (Golan & Crow, 2004). According to Golan and Crow (2004), the greater percentage of initial weight reduction and better sustained weight-loss among children in the parent-only group may be attributed to parents in the parent-focused group modifying "obesogenic" factors in the child's environment such as decreasing the quantity of sweets and snacks available in the household. In fact, at the 12-month follow-up children in the parent-only group had a larger decrease in problematic eating behaviours in the presence of sweets, soda and snack foods at home (Golan & Crow, 2004). Research has repeatedly shown that parents largely influence their children's food preferences and eating behaviours, including children's dietary intake and their overall attitudes toward food (Nepper & Chai, 2016a; Roach et al., 2017). Nonetheless, because the FHLP evaluated self-reported parent feeding practices it is possible that parenting practices did not

actually improve among intervention parents, which would explain the lack of change in child dietary behaviours. Potentially, parents in the intervention group had a positive response bias or there was a gap between parents' self-reported feeding practices and their children's perception of these behaviours (Melbye, Øverby, & Øgaard, 2011).

Further, reliable and validated instruments for measuring parent feeding practices and support behaviours related to child's eating are limited (Lauzon-guillain et al., 2012). A review examining tools developed for assessing parenting support behaviours and practices for children's dietary behaviours reported that out of twenty-one tools only four had been analysed for test-retest reliability and validity had only been measured in one (Lauzon-guillain et al., 2012). Additionally, the majority of literature on parent feeding practices and their association with child dietary behaviours has targeted controlling or restrictive parenting practices; thus, moving forward the concept of parent feeding practices should incorporate positive forms of control such as encouraging healthier child food choices and increasing the availability and accessibility of healthy foods within the home (S. O. Hughes et al., 2013). Research has shown that parental feeding practices impact child intentions and behaviour related to fruit and vegetable consumption; parental modelling and active parental encouragement are positively associated with children's healthy eating intentions and behaviours (Melbye et al., 2011). Therefore, future research is needed to develop valid and reliable measures of parent feeding practices that encompass a broader range of positive food parenting behaviours (e.g. reducing unhealthy snack options available in the home, providing healthier snacks) that may support children's healthy dietary intake.

5.3 Program Impact on Child Nutrition-Related Outcomes

5.3a Child Psycho-social Outcomes

There were no significant intervention effects for child nutrition-related psycho-social outcomes such as attitudes and self-efficacy for healthy eating. However, a small effect size was identified for children's *dietary behaviours self-efficacy* and a medium effect was found for children's *perceived cooking skills.* The FHLP is one of very few studies that has investigated psycho-social predictors of dietary behaviours and there is no single theory that has been used to predict and explain eating behaviours among school-aged children (Vereecken, Damme, & Maes, 2005). According to Melynk and colleagues (2006, 2009), psychosocial factors such as children's self-efficacy to make healthy food choices can inhibit or create barriers to children's efforts to engage in healthier dietary behaviours (Melnyk et al., 2009; Melnyk et al., 2006). For instance, Jacobson et al. (2011) examined psycho-social correlates associated with lifestyle behaviours in overweight and obese school-aged children and reported that children's healthy lifestyle beliefs and choices were significantly and positively correlated, demonstrating that as a child's healthy lifestyle beliefs increased the child's healthy lifestyle choices increased; additionally, a significant negative relationship was identified for children's BMI and their intention to lead a healthy lifestyle (Jacobson, Melnyk, & Pmhnp, 2011). Thus, it is important for family-based weight management interventions to address and evaluate psycho-social factors related to dietary behaviours and food choices in order to help children modify their beliefs and intentions to support engagement of healthier behaviours.

The lack of change observed in the FHLP's child psycho-social outcomes was not unique when compared to similar research. For instance, a community-based family focused intervention incorporating an emphasis on healthy eating administered self-report surveys to assess child dietary behaviours and healthy habits (Jung, Bourne, & Gainforth, 2018). Survey results showed no change in children's psycho-social nutrition outcomes, such as self-efficacy

and beliefs associated with healthy eating behaviours. According to McClain and colleagues (2009) the literature is not conclusive concerning the association between psycho-social variables such as children's outcome expectations, motivation and attitudes regarding fruit and vegetable consumption and healthy eating behaviours (McClain et al., 2009). Thus, future family-based interventions for childhood obesity should target the psycho-social factors that influence overweight and obese children with the aim of gaining a better understanding of how to modify the lifestyle behaviours that contribute to obesity (Jacobson et al., 2011).

5.3b Child Behavioural Outcomes

Overall, there were no significant improvements in child fruit and vegetable or sugary drink consumption when comparing the intervention and waitlist control groups. However, a greater percentage of children in the intervention group either improved or maintained their fruit and vegetable intake compared to the control group over time, whereby the majority of participants' fruit and vegetable intake declined. Though this finding is not significant, it is still worth mentioning given evidence reporting on youth and adolescents' trends in fruit and vegetable consumption. For instance, a study examining trends in adolescent fruit and vegetable consumption reported that adolescents reduced their daily fruit and vegetable intake by 0.7 servings during the transition from early to middle adolescence (Story, Larson, Neunark-Sztainer, & Hannan, 2007). Additionally, there is some research showing that children's fruit and vegetable consumption declines throughout elementary and middle school (Baranowski et al., 2000; Moore, Thompson, & Demissie, 2016). Thus, it is promising that over 50% of intervention participants improved or maintained their fruit and vegetable intake, while 67% of control participants' fruit and vegetable intake decreased from baseline to post-intervention.

Nevertheless, there are a few reasons that may explain why our findings for children's dietary behaviours were non-significant. For the purpose of the FHLP, researchers used self-report 7-day recall to assess child fruit and vegetable, sugary sweetened beverage and sweet/dessert intake in the form of a questionnaire. Children were asked to individually complete the healthy eating questionnaire during the first and final program sessions without the assistance or supervision of a parent; also, child participants only received assistance while completing the questionnaire if they asked the research assistants for help.

According to the available literature on child nutrition interventions, self-report measures to assess dietary intake are not considered the most accurate method for obtaining dietary information (Chai et al., 2019; Janicke et al., 2019). For example, after conducting family-based and parent-only obesity treatment programs in rural communities, Janicke and colleagues (2019) stated that self-report measures of dietary intake (e.g. FFQs, usual intake questionnaires) often underreport and misrepresent children's caloric intake and may not appropriately portray changes in children's dietary intake throughout an intervention period. Additionally, children sometimes find dietary intake questionnaires overwhelming because completion requires them to rely on memory to account for food patterns and intake over an extended period of time (Collins, Watson, & Burrows, 2010; Merson, Pezdek, & Saywitz, 2017). Furthermore, participant weight status can impact the validity of dietary intake data. For instance, evidence from dietary intake studies among children and adolescents shows that there is a positive association between increased BMI and under-reporting (Magarey et al., 2011). Interestingly, Rennie et al. (2005) found that over time, under-reporting of dietary intake among children has increased, which is consistent with the increased rates of childhood obesity (Rennie, Jebb, Wright, & Coward, 2005).

Nevertheless, many researchers continue to utilize this method due to its low cost, minimal time requirement and the ease of administering questionnaires (Merson et al., 2017). Furthermore, a systematic review examining the effectiveness of family based interventions stated that they were not able to find any meta-analyses reporting on child dietary quality due to the heterogeneity of study methods and outcome measures used to assess diet, including total energy intake, nutrient intake and differences between measurement units used to report certain foods (e.g cups, grams, ounces, servings etc.; Chai et al., 2019). Finally, it is important to recognize that dietary intake cannot be estimated without some form of error; each methodology has multiple advantages and disadvantages when used in the context of child overweight and obesity research (Collins et al., 2010). Moreover, a systematic review assessing the effectiveness of institutional and family-based nutrition interventions on improving child diet found that out of the twenty-five studies reporting on fruit and vegetable intake, five studies observed no intervention effect on fruit or vegetable intake, and eleven studies identified an insignificant to small effect on fruit and vegetable intake (Black et al., 2017). Thus, methods used for measuring dietary intake among overweight and obese children participating in family-based weight management interventions may require further investigation.

Perry et al. (2018) raises awareness regarding the difficulties associated with measuring dietary behaviours among children, including the issue of underreporting and the large range of measurement tools described in the literature, including many with varying levels of validity, reliability and repeatability (Perry et al., 2018). Magarey and colleagues (2011) suggested that children above ten years old generally have the literacy and numeracy skills, memory, attention span and cognition required to provide reliable information on usual intake, serving size and/or frequency of intake behaviours. Additionally, nutrient specific FFQ's or dietary recalls do not

typically alter participants' dietary habits and they have a low burden on the participant (Magarey et al., 2011). Therefore, given the age range of children eight to twelve years old that participated in the FHLP, a 7-day recall appeared to be an appropriate choice for measuring fruit and vegetable, sugary sweetened beverage and sweet/dessert intake (at least for most of the children). Overall, there are limited available validated tools used to assess the paediatric population, particularly among overweight and obese children (Burrows et al., 2012; Collins et al., 2010). In addition, there is currently no standard, age-appropriate method for measuring children's dietary intake and nutrition-related behaviours; in fact, self-report questionnaires remain the most widely used tool for assessing child dietary intake even though they are not considered the most accurate method for attaining children's usual dietary intake (Chai et al., 2019; Janicke et al., 2019). Thus, future research is needed in order to determine viable and age-appropriate methods for evaluating child dietary behaviours in the context of family-based weight management interventions.

5.4 FHLP Limitations

The results of the FHLP should be viewed with caution given a number of limitations that are common to other family-based weight management interventions (Hull et al., 2018; Janicke et al., 2019; Kelleher et al., 2017). Maintaining program attendance and preventing attrition were two primary obstacles faced during the FHLP. Initially, the sample size of individuals recruited to participate in the FHLP was smaller than researchers had hoped; then, prior to baseline measures participants allocated to the waitlist control group often dropped out or requested to transfer to the intervention group due to time conflicts with the second program running in the winter-spring of 2019. Throughout the two phases of the program, eighteen families, including twenty-four children (38% of the sample) that commenced the program dropped out within the

first five weeks of the intervention. An attrition rate of 38% is high in comparison to similar family-based interventions for childhood obesity. For instance, a meta-analytic review of interventions addressing childhood obesity calculated an average attrition rate of 19.7%, with studies ranging from 5% to 46% attrition (Wilfley et al., 2007). Berge et al. (2011) reported that 25% of the studies in a systematic review of family-based interventions for childhood obesity had significant attrition including 25% to 33% of the sample (Berge & Everts, 2011). However, the FHLP's higher attrition rate is similar to results described by Dishman et al. (1986), whereby 50% of individuals agreeing to participate in physical activity programs or exercise interventions dropped out before the programs' completion (Dishman, 1986).

FHLP researchers were faced with additional attendance difficulties during post-intervention data collection. For example, multiple control families did not attend the post-intervention measurement sessions. Researchers attempted to follow-up with control participants who failed to attend the final measurement sessions, however site facilitators and the research team lost contact with many of these families. Furthermore, there were multiple intervention participants who attended most of the program sessions but did not attend the final post-intervention measurement session or a make-up measurement session organized by the research team. Thus, when preparing the data for the final evaluation, multiple questionnaire responses were missing at follow-up. Overall, there was approximately 30% missing data, which may have impacted the significance of the programs' outcomes. For the purpose of this paper an intention-to-treat protocol was followed, and baseline data was brought forward to account for the missing data at post-intervention. However, intention-to-treat protocols are considered a highly conservative approach for analysing intervention effects, thus a per-protocol analysis whereby

only participants that completed a large proportion of the intervention are analysed may contribute more fully to understanding the efficacy of the program.

After completing the repeated-measures ANOVA, many parent and child nutrition-related outcomes were not statistically significant. For example, it is likely that this study was underpowered due to its small sample size. Evidence shows that in the field of medical research null hypothesis significance testing (NHST) may not be the best way to examine the efficacy of a study, particularly if a study's sample size is too small (Kraemer et al., 2006; Leon et al., 2011). For instance, Kraemer et al. (2006) describes how even when NHST is properly executed, if studies following these methods are underpowered statistically non-significant results may occur not because the hypothesis being tested is clinically nonsignificant or untrue, but because the sample size is too small to produce a statistically significant change. Further, it is possible in some studies utilizing the NHST that a nonsignificant *p* value does not accurately indicate whether or not a treatment can facilitate clinically meaningful outcomes; thus, observing the effect size and direction can sometimes be a more useful practice when determining an intervention's effectiveness (Wainer & Robinson, 2000). Because the FHLP was underpowered, effect size and direction were determined for each variable. Additionally, mean changes and frequency (number and percentage) of participants in each group that improved, stayed the same or decreased were identified. The aforementioned procedure ensured that among statistically nonsignificant outcomes no clinically meaningful results were overlooked.

The FHLP was a 'real-world' trial that required a certain number of participants to be recruited for each site in B.C. to run the ten-week program. Therefore, not all participants were able to be randomly assigned to intervention or waitlist control groups as was intended, instead some participants that had originally been randomized to the waitlist control condition were

allocated to the intervention in order to reach the minimum number of families needed to run the intervention. Waitlist control designs in behavioural intervention research are seen as ethically advantageous because it allows waitlist participants to receive a delayed-treatment while also facilitating a non-intervention evaluation. However, some evidence shows that a waitlist design may inflate intervention effects (Cunningham et al., 2013). Additionally, Barkauskas et al. (2005) explains that during a within-participant (modified crossover) model such as an experimental wait-list controlled trial participant expectancy (a placebo-type influence) can affect study outcomes (Barkauskas, Lusk, & Eakin, 2005). In a waitlist trial participants allocated to the control group are aware that they will be receiving a delayed-intervention, so when initially agreeing to participate in the intervention some participants may have already formed intentions to improve the target behaviours. For instance, Hart et al. (2011) described how at the conclusion of a waitlist control trial for alcohol addiction, participants allocated to the wait-list control had decreased their alcohol intake; a possible explanation for this outcome is that the wait-list control group's knowledge of the intervention and increased-awareness about their alcohol intake may have led to decreased intake among both groups (Hart et al., 2011). Thus, prior to the FHLP wait-list control receiving their intervention, it is possible that families' raised awareness of the intervention may have led to improvements in nutrition-related behaviours, or these families may have started seeking information on their own to help improve their eating behaviours. In the FHLP evaluation, some nutrition-related variables increased over time in the wait-list control and intervention groups, which decreased the likelihood of identifying any significant intervention effects when comparing groups.

Furthermore, the 2:1 randomization allocation may have impacted the ability to show significance due to the loss of statistical power that occurs when allocating an unequal number of

participants to the intervention and control groups. As was previously mentioned, the few significant outcomes reported for this study could also be attributed to the small sample size and related lack of statistical power, which has been observed in other small-scale pilot trials (Fulkerson et al., 2010). Additionally, in many of the parent nutrition-related outcomes that were assessed using Likert scales, there was a potential ceiling effect; for example variables such as parent feeding practices, parental perceived control for supporting child's healthy eating and the structure of the food environment (see table 3).

Another possible reason for the small number of significant outcomes may be due to families not receiving the recommended twenty-six or more hours of contact time with program facilitators (Janicke et al., 2011). For instance, observing the weekly attendance data shows that less than sixty percent of participants attended all ten-week sessions. However, program sessions only accounted for fifteen of the contact hours provided by the FHLP. The remaining eleven hours were expected to come from both completing activities on the interactive online platform outside of the weekly sessions and attending group "field trips" such as grocery store tours or outdoor adventures (e.g. hikes, agents of discovery activities). According to Janicke et al. (2014) a minimum of twenty-six contact hours for family-based obesity treatment is necessary for reaching long-term improvements in child health-related outcomes. An analysis of the FHLP weekly session attendance and online usage data showed most families did not receive the intended twenty-six hours of contact time. Further, the quality of program implementation was not assessed for this analysis. Thus, participants likely did not receive enough in-person or online contact time; also, there is no information about the quality of the intervention content delivered by each facilitator, which depending on the quality could ultimately decrease the intervention's effect on participants' nutrition-related behaviours. For instance, anecdotal discussions post-

program indicated that some facilitators had not integrated or encouraged participants to engage in the online family-based physical activity and healthy eating content and activities, which were intended to support behaviour changes throughout the intervention. Overall, researchers should explore strategies for improving and sustaining participant engagement in both the face-to-face sessions and technology-based lessons and activities. Additional research is needed to examine the implementation of family-based blended interventions and possibly learn how a blended intervention approach can be used to support consistent session attendance.

5.5 Future Directions

It remains clear that future family-based weight management interventions addressing school-aged children (eight to twelve years old) must explore new delivery agents and strategies for maintaining family engagement and attendance throughout an intervention's duration. In addition, interventions aiming to modify health-related lifestyle behaviours should work to establish a supportive environment that encourages families to reach out when they need help post-intervention. Also, providing incentives (e.g. gift cards, free passes to local pools or recreation centres) to attend maintenance sessions may motivate families to continue improving health-related behaviours.

Furthermore, researchers developing future family-based interventions should focus on implementing innovative theoretical approaches such as the M-PAC framework (Rhodes, 2017) or COM-B Michie's (2013) behaviour change techniques. Because sustaining behaviour and weight changes post-intervention are re-occurring difficulties for numerous family-based weight management interventions, it is imperative that researchers understand how to effectively facilitate and maintain health-related behaviour changes. Moreover, investigators should consider different methods for assessing children's dietary behaviours in order to determine a

valid and reliable protocol for measuring their dietary intake as well as their attitudes and motivation for healthy eating.

Moving forward, researchers designing and implementing family-based interventions should learn more about behaviour-change within the context of the family. Likewise, it is necessary for researchers to learn how to create interventions that look appealing to families and that have realistic expectations given many families' demanding schedules. For instance, it is important to recognize that families with school-aged children often have numerous time commitments such as dance practice, boy/girl scout meetings, church-related engagements and homework, which make it difficult and sometimes even impossible to fit in weekly in-person sessions. In considering families' busy schedules, the FHLP utilized a blended intervention approach, which allowed for more flexibility and only required families to attend in-person sessions once per week. However, the FHLP maintained lower adherence than MEND, a similar family-based intervention that incorporated in-person sessions twice per week (Sacher et al., 2010). Nonetheless, a blended intervention that incorporates in-person and on-line components has the potential to minimize the overall time-burden on participants and reach families in more remote locations. Mobile technology and the Internet offer an opportunity to support families remotely throughout the in-person component and post-intervention. Overall, future interventions should consider families' needs and design interventions that are accessible, adaptable and flexible depending on the target community and families.

5.6 Conclusion

The Family Healthy Living Program demonstrated the potential of a blended family-based weight management intervention for children ages eight to twelve years old who are off the healthy weight trajectory. Parents participating in the FHLP improved some aspects of their

food-related parenting practices compared to the waitlist control group. Specifically, a borderline significant intervention effect was observed for parent's regulation behaviours related to supporting their child's healthy eating compared to the waitlist control. Additionally, a medium effect size was detected for parents' affective judgment and instrumental attitude related to supporting their child's healthy eating behaviours, relative to the waitlist control group. Because parents are critical influences on children's dietary behaviours, motivation and attitudes, it is promising to see that the intervention had a positive impact on parents' food-related practices and this may be an important primary outcome for future studies given the challenges of measuring children's attitudes and behaviours. Furthermore, the FHLP supported maintenance and improvement in intervention children's fruit and vegetable consumption despite finding no statistically significant outcomes relative to the waitlist control group. There are a few recommendations for future research following a similar protocol to the FHLP quasi-experimental study:

- Improve recruitment efforts and extend timeline for recruiting participants
- Enhance strategies used to recruit participants of diverse socioeconomic status and ethnicity, it is often difficult to reach participants of lower socioeconomic status and aboriginal descent
- Researchers and facilitators should work to maintain contact with participants throughout the intervention in order to maintain attendance at in-person sessions
- Utilize more rigorous methods for obtaining children's dietary intake such as 24-hour recalls, 3-day food log or in-person 24-hour recall interview
- Find additional valid and reliable methods for evaluating psycho-social factors that influence parent feeding practices and child dietary behaviours

- Provide incentives to encourage participants to attend baseline and post-intervention measurement sessions
- Provide incentives for participants to attend maintenance sessions post-intervention

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Appendix A: Detailed breakdown of the child nutrition questionnaire developed for the Family Healthy Living Program (FHLP)

Question numbers	Outcome Measure	Reference(s)	Reliability (Cronbach's α; ICC)	M-PAC construct
1-8	Dietary Behaviours (7-day recall)	From *FLASHE* (originally adapted from BRFSS & CCHS)	ICC = 0.50	N/A
9 (a-h)	Healthy Eating Outcome Expectations	Power Play! Survey (Keihner et al., 2011)	α = 0.76	Instrumental Attitude
10 (a-g)	Dietary Behaviours Self Efficacy	Hagler, A., Norman, G.J., Radick, L.R., Calfas, K.J., and Sallis, J.F. (2005).	α = 0.87; ICC = 0.81	Perceived Capability
11 (a-h)	Healthy Eating Motivation	*FLASHE Questions* (Mâsse & Lytle, 2017)	ICC = 0.18	Instrumental Attitude, Affective Judgment, and Identity
12 (a-l)	Healthy Eating Motivation *(why do you eat fruits and vegetables)*	*Modified Child Nutrition Questionnaire* (Wilson et al., 2008)	α = 0.74 - 0.80	Affective Judgment, Perceived Opportunity, Perceived Capability
13 (a-e)	Perceived Cooking Skill (Food Preparation Skills)	*Cooking with Kids* (Lohse, Cunningham-Sabo, Walters, & Stacey, 2011)	α = 0.78	Perceived Capability

Appendix B: Detailed breakdown of the parent nutrition questionnaire developed for the FHLP.

Question numbers	Outcome Measure	Reference(s)	Reliability (Cronbach's α; ICC)	M-PAC construct
10-12	Parent Feeding Practices *(intrinsic and*	Items drawn from FLASHE and Project-EAT surveys; Newark-	Not provided	Identity (parenting style); Affective judgment (10d, providing child

	extrinsic motivation)	Sztainer et al 2004 & Fulkerson et al 2006		emotional support); Perceived capability; Behavioural Regulation (e.g. regulation of food environment)
13-17	Parental Attitudes and Self-efficacy for Supporting Child's Healthy Eating	**Adapted from:** Rhodes, R.E., Blanchard, C.M., & Matheson, D.H. (2006). A multicomponent model of the theory of planned behaviour.	$\alpha = 0.67 – 0.91$	Affective judgment (12,15), instrumental attitude (13,14), perceived capability (16a &b), perceived opportunity (16c & d)
22-25	Structure of the home food environment	Robinson-O'Brien et al., 2009 F & V at home survey for parents Story et al., 2014, The Minnesota GEMS Pilot Study	Fruit scale (α = 0.53); Vegetable scale (α = 0.73); Sweetened beverage scale (α = 0.20)	Perceived opportunity (child's opportunity to eat healthfully or un-healthfully); Affective judgment (19b & c; child receiving emotional support from parent to eat more fruits and vegetables)
25	Parent's dietary behaviours (FV intake)	FLASHE	Not provided	N/A
26	Parent Meal Preparation Self-efficacy	FLASHE	Not provided	Perceived Capability
27	Parent/Family Eating Habits	Verplanken, B., & Orbell, S. (2003). Reflections on Past Behaviour: A Self-Report Index of Habit Strength	$\alpha = 0.91$	Habit
29	Family/Parent Healthy Eating Identity	Wilson, M. Muon, S. (2008). Psychometric Properties of the	$\alpha = 0.82 – 0.95$	Identity

		Exercise Identity Scale in a University Sample.		
30-39	Behavioural Regulation of Child's Healthy Eating	Rhodes, R. et al., 2016. Understanding action control of parent support behaviour for child physical activity	$\alpha = 0.79$	Behavioural Regulation

Appendix C: Family Healthy Living Program Parent Consent Form

Healthy Living Program Evaluation Study – Eligible participants

You are invited to participate in the **Healthy Living Pilot Program Evaluation Study** because you have expressed interest in participating in the Healthy Living Program pilot and the evaluation is a core component of the pilot program. If you join the program you are agreeing to participate in the evaluation component of the Healthy Living Program study, because the purpose of the pilot is to evaluate whether the Healthy Living Program is effective and feasible for families. The Healthy Living Program pilot is being conducted by the Childhood Obesity Foundation through funding from the BC Ministry of Health. The evaluation component is being carried out by Dr. PJ Naylor, in collaboration with Dr. Sam Liu, of the University of Victoria. You may contact them by phone or e-mail (Dr. Naylor: 250-721-7844, pjnaylor@uvic.ca; Dr. Liu: 250-721-8392, samliu@uvic.ca) if you have further questions.

Purpose and Objectives
The purpose of the study is to evaluate how feasible and effective the Healthy Living Program is for families, as well as gain an understanding of the issues involved in the implementation of this intervention across the province.

Importance of this Study
Evaluation studies of this type are important because they help us understand how to help families adopt a healthy lifestyle that keeps them on a healthy lifestyle and healthy weight path.

What is involved?
Together, eligible children and siblings and their parent(s)/caregiver(s) will be randomly assigned to a program starting either in January 2019 or April 2019.

Families in the **January 2019 program start date** will participate in a 10-week program with one in-person session and one online-session each week, followed-up by four one-hour maintenance sessions approximately every two weeks beginning in January 2019.

Families in the **April 2019 program start date** will participate in a 10-week program with one online session every week and one in-person session approximately every two weeks.

Sessions will cover topics such as: healthy eating, physical activity, behaviour change skills, positive mental health, parenting practices, and sleep hygiene. Participants in both start date programs will also engage in additional choice-based activities with family members each week.

Caregivers and children in both groups will be asked to complete measures on three separate occasions: January 2019, March 2019, and June 2019. Children will be asked to complete written questionnaires and physical measures (height, weight, fundamental motor skills) and parents will be asked to complete online questionnaires. Video recording will be used for the fundamental movement skills measurement.

If you consent to voluntarily participate in the Healthy Living Program evaluation, the research team will collect the information on the three dates listed above. Your information will be combined with others for evaluation purposes. There will be no information in the research results that will be personally identifiable. These measures are all planned to be a normal part of

the Healthy Living Program activities. In addition to these you may be asked to participate in a post-program telephone interview to get your opinion on the program.

Inconvenience

Participation in this research may cause some additional inconvenience to you as we are collecting the caregiver data using a pre-program on-line questionnaire and we may ask you to take additional time to participate in a 30 minute post-program interview. All of the rest of the data collection will occur during program delivery hours.

If your family is scheduled for the second program delivery time you and your children will be asked to participate in two measurement sessions prior to the program delivery which will take additional time. Compensation for childcare and parking will hopefully mitigate this inconvenience.

Risks
None.

Benefits
The potential benefits of your participation in the Healthy Living Program include increased self-esteem and increased health and wellness for you and your child. By participating in the research study you are contributing to the evidence of the Healthy Living Program's ability to help children and families adopt a healthy lifestyle and stay on a healthy weight path.

Voluntary Participation
Your participation in this program and evaluation study is completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. If you do withdraw from the study you can choose to allow us to use your/your child's data collected to date or to not use it. If at any time you choose to withdraw consent, your preference for the use of your data will be documented and your request honoured.

Since participation in this study requires a child and caregiver to participate together, if you or your child/children decide to withdraw from the study, you will both have to withdraw; children cannot participate without a caregiver and caregivers cannot participate without a child.

On-going Consent
To make sure that you continue to consent to participate in the evaluation component, we will re-confirm your consent when we do physical measures at the last session of the program and maintenance sessions and when we contact you for the focus group.

Anonymity
In terms of protecting your anonymity there will be no identifying names on any of your/your child's records. Your name/your child's name will be replaced by unique identification numbers. You will not be completely anonymous as the research team knows who is participating.

Confidentiality
Your confidentiality and the confidentiality of the data will be protected by having no participant names on any of the data. As well, hard copies of the data will be stored in a locked filing cabinet in a locked room at the University of Victoria. Electronic files will be stored using your unique identification numbers on a secure network drive at the University of Victoria which is accessible only to the principal investigator and research staff. During the fundamental

movement skills measure your child will be video recorded. Only the researchers will have access to the videos. During the telephone interview notes will be taken and the interview may be audio-taped and will be transcribed for further analysis. Only the researchers will have access to the tapes and transcripts.

Dissemination of Results
It is anticipated that the results of this evaluation study will be shared with others through presentations at conferences, a report to public health and community stakeholders and through academic publications.

Disposal of Data
This data (e.g. video, questionnaire, interview transcriptions) will be disposed of five years following publication. If the results are not published within 5 years of completing the study, the data will be destroyed. Hard copies will be shredded and any computer files with participant information will be deleted.

Individuals that may be contacted regarding this study include:

Dr. PJ Naylor	Dr. Karen Strange	Dr. Sam Liu
Principal investigator	HLP Project Director	Co-investigator
250-721-7844	250-216-7893	250-721-8392
pjnaylor@uvic.ca	kstrange@uvic.ca	samliu@uvic.ca

In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca) or the Research Subject Information Line in the University of British Columbia Office of Research Services by email at RSIL@ors.ubc.ca or by phone at 604-822-8598 (Toll Free Number 1-877-822-8598).

Your signature below indicates that you understand the above conditions of participation in this study, that you have had the opportunity to have your questions answered by the researchers, and that you consent to participate in this study.

_____	_____	_____
Name of Participant	*Signature*	*Date*

Children's Statement:

I have talked with my parents/guardians about the Healthy Living pilot program and evaluation study and I understand that all activities are a normal part of the Healthy Living Program. I understand that if I want to I can stop being in the pilot program evaluation study at any time. I have had the chance to ask questions and have received satisfactory answers to all of my questions.

_____ _____
Signature of Child One Date

_____
Printed name of child

Signature of Child Two Date

Printed name of child

Signature of Child Three Date

Printed name of child

A copy of this consent will be left with you, and a copy will be taken by the researcher.

Appendix D: Child Healthy Eating Questionnaire

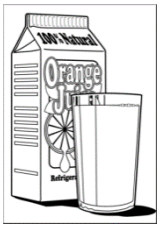
Child Nutrition Questionnaire

In THE LAST 7 DAYS…

1. Not counting juice**,** in the **last 7 days**, how many times did you eat **fruit**? Please remember to **include fresh, frozen, dried, or canned fruit.**

   a. None
   b. 1-3 times
   c. 4-6 times
   d. 1 time per day
   e. 2 times per day
   f. 3 times per day
   g. 4 or more times per day

2. In the **last 7 days**, how often did you drink **100% fruit juice** such as **apple or orange juice?** Do not count punch, Kool-Aid, sports drinks, fruit cocktails or fruit-flavoured drinks.



   a. None
   b. 1-3 times
   c. 4-6 times
   d. 1 time per day
   e. 2 times per day
   f. 3 times per day
   g. 4 or more times per day

3. In the **last 7 days**, how many times did you eat a **green leafy or lettuce salad**, with or without other vegetables?

   a. None
   b. 1-3 times
   c. 4-6 times
   d. 1 time per day
   e. 2 times per day
   f. 3 times per day
   g. 4 or more times per day

4. In the **last 7 days,** how many times did you drink a **regular soda or pop** that contains sugar? **DO NOT** count diet sodas or diet drinks.

   a. None
   b. 1-3 times
   c. 4-6 times
   d. 1 time per day
   e. 2 times per day
   f. 3 times per day
   g. 4 or more times per day

5. In the **last 7 days**, how many times did you eat **potatoes**? Do not count French fries, fried potatoes, or potato chips.

   a. None
   b. 1-3 times
   c. 4-6 times
   d. 1 time per day
   e. 2 times per day
   f. 3 times per day
   g. 4 or more times per day

6. In the **last 7 days,** how many times did you drink **fruit-flavoured drink** such as: Kool-Aid®, Sunny D®, sports or high-energy drinks (such as Gatorade®, Red Bull®, sweetened tea or coffee drinks (such as iced tea, Starbucks® latte or Frappuccino®)

   a. None
   b. 1-3 times
   c. 4-6 times
   d. 1 time per day
   e. 2 times per day
   f. 3 times per day
   g. 4 or more times per day

7. Excluding the vegetables you have already reported, in the **last 7 days**, how many times did you eat other **fresh, frozen, or canned vegetables?** Do not count fries or chips

   a. None
   b. 1-3 times
   c. 4-6 times
   d. 1 time per day
   e. 2 times per day
   f. 3 times per day
   g. 4 or more times per day

8. In the **last 7 days** how many times did you eat doughnuts, brownies, pies, or cakes?

   a. None
   b. 1-3 times
   c. 4-6 times
   d. 1 time per day
   e. 2 times per day
   f. 3 times per day
   g. 4 or more times per day

9. We want to know **what you think will happen** if you eat fruits and vegetables every day. There are no right or wrong answers, just your opinion. Please circle the answer that best describes how much you disagree or agree with each sentence below.

Fruits and Vegetables (If I eat)	**Please choose your answer**				
If I eat fruits and vegetables every day…	**I disagree very much**	**I disagree a little**	**I am not sure**	**I agree a little**	**I agree very much**
a. I will become stronger	A	B	C	D	E
b. My friends will start eating them too	A	B	C	D	E
c. I will have stronger eyes	A	B	C	D	E
d. I will have a nicer smile	A	B	C	D	E
e. I will be healthier	A	B	C	D	E
f. I will think better in class	A	B	C	D	E
g. I will have more energy	A	B	C	D	E
h. My family will be proud of me	A	B	C	D	E

10. There are many things that can get in the way of eating fruits and vegetables. Please rate **HOW SURE** you are that you can do the following in each situation. Please answer **ALL** questions.

	Please choose your answer.				
How sure are you that you could…	**I'm sure I can't**	**I probably can't**	**Neutral**	**I probably can**	**I'm sure I can**
a. Eat 5 servings of fruits and vegetables everyday.	A	B	C	D	E

b. Ask someone in your in your family to buy your favorite fruit or vegetable?	A	B	C	D	E
c. Ask for fruits and vegetables with your lunch?	A	B	C	D	E
d. Drink 100% fruit juice instead of fruit punch or soda?	A	B	C	D	E
e. Eat fruits and vegetables as a snack instead of chips or candy?	A	B	C	D	E
f. Ask someone in your family to include fruits or vegetables with dinner?	A	B	C	D	E
g. Eat fruits and vegetables when eating out at a restaurant?	A	B	C	D	E

11. There are many reasons **<u>why people eat fruits and vegetables every day</u>**. Please circle the answer that best describes how much you disagree or agree with each sentence below.

Fruits and Vegetables	**Please choose your answer.**				
Why do you eat fruits and vegetables…	**I disagree very much**	**I disagree a little**	**I am not sure**	**I agree a little**	**I agree very much**
a. I simple enjoy eating a variety of fruits and vegetables	A	B	C	D	E
b. I would feel bad about myself if I didn't eat enough fruits and vegetables	A	B	C	D	E
c. Others would be upset with me if I didn't eat enough fruits and vegetables	A	B	C	D	E
d. It is personally important to me to eat enough fruits and vegetables	A	B	C	D	E

12. There are many reasons **<u>why people limit how many sweet/salty snack foods and sugary drinks</u>** they have. Please circle the answer that best describes how much you disagree or agree with each sentence below.

Snack Foods & Sugary Drinks	**Please choose your answer.**				
Why do you limit your sweet/salty snack foods and sugary drinks…	**I disagree very much**	**I disagree a little**	**I am not sure**	**I agree a little**	**I agree very much**
e. I don't like the taste of many sweet/salty snack foods or sugary drinks	A	B	C	D	E
f. I feel good about myself if I limit sweet/salty snack foods and sugary drinks	A	B	C	D	E
g. Others would be happy with me if I limit sweet/salty snack foods and sugary drinks	A	B	C	D	E
h. It is personally important to me to limit sweet/salty snack foods and sugary drinks	A	B	C	D	E

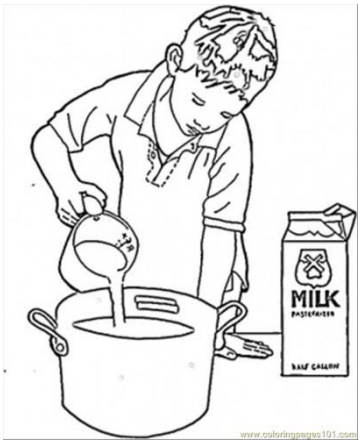
13. The following statements are about fruits and vegetables. Please circle the best answer for each statement below that describes **why you eat fruits and vegetables.**

Why do YOU eat fruits and vegetables?	**Please choose your answer.**				
	I disagree very much	**I disagree a little**	**I am not sure**	**I agree a little**	**I agree very much**
a. Eating vegetables makes me feel healthy	A	B	C	D	E
b. In my home vegetables are served at dinner most nights	A	B	C	D	E
c. I like tasting new vegetables I haven't tried before	A	B	C	D	E
d. It is easy to prepare vegetables to eat (e.g. salad)	A	B	C	D	E
e. Eating fruit makes me feel healthy	A	B	C	D	E
f. Fruit is an easy snack	A	B	C	D	E
g. I like tasting new fruits that I haven't tried before	A	B	C	D	E

h. In my home fruit is available to eat at any time	A	B	C	D	E
i. I like to drink water	A	B	C	D	E
j. I ask my parents to buy foods and drinks that I have seen advertised on T.V.	A	B	C	D	E
k. My parents encourage me to eat fruits and vegetables	A	B	C	D	E
l. Most of my teachers encourage the students to eat fruits and vegetables	A	B	C	D	E

14. We want to know about **<u>your ability to prepare and cook food</u>**. The following statements include a variety of important cooking and food preparation skills. Please select the best answer to describe your abilities.

Cooking Skills (I can)	**Please choose your answer.**				
	YES!	**Yes**	**No**	**NO!**	**Not sure**
a. I can make a snack with fruit.	YES!	Yes	No	NO!	Not Sure
b. I can make a snack with vegetables.	YES!	Yes	No	NO!	Not Sure
c. I can help my family make a meal.	YES!	Yes	No	NO!	Not Sure
d. I can make a salad	YES!	Yes	No	NO!	Not Sure
e. I can cut up food.	YES!	Yes	No	NO!	Not Sure



You are finished! Thank you for your cooperation!