Belief-Level Markers of Physical Activity among Young Adult Couples: Comparisons across People without Children and New Parents

Ryan E Rhodes, Chris M Blanchard, Cecilia Benoit, Ryna Levy-Milne, Patti Jean Naylor, Danielle Symons Downs, & Darren E R Warburton

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ABSTRACT

The health benefits of regular moderate-vigorous intensity physical activity (PA) are well established, yet few people are active enough to reap these benefits. Young adults, particularly parents, often show declines in PA and may represent a critical population for PA intervention. Theory-based correlates used to guide future interventions, however, are scant in this population. The purpose of this study was to examine theory of planned behavior belief-level constructs as correlates of directly assessed PA across cohorts of young adult couples a) without children and b) with their first child over the initial 12 months. Participants were 238 adults (102 not expecting a child, 136 expecting first child) who completed baseline demographics, belief measures of the TPB, and seven-day accelerometry, followed by assessments at six- and 12-months. Results showed select medium-sized belief-PA correlations with sex and cohort interactions. Overall, women had larger affect-based behavioral belief associations with PA then men, and mothers showed larger associations with control over PA due to the demands of childcare than fathers. Mothers also had larger associations between control beliefs and PA compared to women without children. Extremely high ceiling effects on the behavioral beliefs show limited room for changes in intervention while control beliefs show ample room for change. Control over PA due to the demands of childcare was particularly low in mothers. The results underscore key belief markers that may require targeted intervention in young adults and highlight some critical correlates of PA during early parenthood.

Keywords: physical activity, theory of planned behavior, parenthood

An enormous evidence base has accumulated for the effect of moderate-vigorous intensity physical activity (PA) on the primary and secondary prevention of several chronic conditions, including cardiovascular disease, diabetes, cancer, hypertension, obesity, and osteoporosis (e.g., 2010; Warburton, Nicol, & Bredin, 2006). Despite this evidence, less than 20% of Canadian adults are meeting PA recommendations for public health. Understanding where and why physical activity declines across the lifespan may be helpful because PA promotion efforts can then target these groups. Declines have been noted in childhood/adolescence and older age (Kumanyika, Jeffrey, Morabian, Ritenbaugh, & Antipatis, 2002), but one of the steepest declines in PA is between the ages 25 to 35 (Jedwab, 2005; Statistics_Canada, 2005). Further, the decrease tends to level out or plateau between ages 35-45, and does not appear to resume thereafter (Jedwab, 2005; Statistics_Canada, 2005).

Several social changes in the lives of young adults may be responsible for PA declines such as co-habitation/marriage and early career demands, but one of the most reliable correlates of inactivity among this age-group is the onset of parenthood (Allender, Hutchinson, & Foster, 2008; Bellows-Riecken & Rhodes, 2008). A meta-analysis of 10 studies comparing parents and non-parents on moderate-vigorous PA showed an effect size $d = .48$, in favor of couples without children (Bellows-Riecken & Rhodes, 2008). While most of this evidence has focused on motherhood, there has been some recent evidence that fathers experience similar (Berge, Larson, Bauer, & Neumark-Szainer, 2011) or even greater (Hull, et al., 2010) declines in PA compared to mothers. Clearly, curbing the declining PA behavior of young adults, and new parents specifically, is an important task underpinned by a deeper knowledge of the correlates that contribute to it.

Theoretically-based PA correlates are important to ensure that the known mechanisms of PA behavior change are targeted in interventions (Rhodes & Nigg, 2011). While barrier-based correlates such as time and fatigue have been established among mothers in the PA literature for 20 years (e.g., Verhoef, Love, & Rose, 1992), there are limited theory-based studies encompassing the breadth of potential PA correlates in samples of parents. One theory that may have utility in this approach is Ajzen's (1991) theory of planned behaviour (TPB), due to its past predictive utility in the PA domain (McEachan, Conner, Taylor, & Lawton, 2011; Symons Downs & Hausenblas, 2005b). In this theory, it is proposed that intention is the proximal determinant of PA and attitude (i.e., overall evaluation of PA), subjective norm (i.e., perceived social pressure to perform PA) and perceived behavioural control (overall ease or difficulty of performing PA) are the primary determinants of intention. When planning interventions, however, Ajzen (2002) proposes that the focal constructs of interest should be belief-level markers of attitude (behavioural beliefs; e.g., PA will help me lose weight), subjective norm (normative beliefs; e.g., my spouse wants me to do PA) and perceived behavioural control (control beliefs; e.g., it would be easy to do PA even if I was tired). The relationship between PA and these belief-level markers serves as the focal point for intervention (Fishbein, 2000; Fishbein, Von Haeften, & Appleyard, 2001).

Our literature review uncovered two studies that have applied TPB beliefs in samples of parents. McIntyre and Rhodes (2009) evaluated belief-level correlates of mothers with children under five years of age in a cross-sectional design with self-reported physical activity. The study showed that behavioural beliefs had no association with PA but normative beliefs about friends and control beliefs about time, cost, fatigue, social support, and childcare had small-medium sized relationships with PA. More recently, Hamilton and White (2011) examined a sample of

mothers and fathers with children under five years of age using a one-week follow-up of self-reported PA. The results showed no noteworthy differences between mothers and fathers and similar findings to McIntyre and Rhodes. Specifically, behavioural beliefs were not associated with PA with the exception of improved parenting. By contrast, normative beliefs about friends, family, and spouse and control beliefs about time, convenience and fatigue all showed a relationship with PA

These studies provide promising initial evidence to guide future intervention efforts. Taken together, they suggest targeting attitude will have little utility yet interventions targeting norms and particular control barriers should curb PA decline in parents. Still, there are several limitations to these studies that warrant research of higher quality before designing interventions based on TPB. First, these studies may have found null results in the behavioural beliefs because their content was instrumental more than affective. Recent TPB research has shown that affective attitudes (i.e., enjoyment, pleasure) are far superior predictors of intention compared to instrumental attitudes (i.e., utility, benefit) (Rhodes, Fiala, & Conner, 2009) and belief level analyses have shown similar results (French, et al., 2005; Rhodes, Blanchard, Courneya, & Plotnikoff, 2009). Indeed, a retrospective sub-analysis of change in PA in the McIntyre and Rhodes (2009) study showed that the behavioural belief of stress relief explained those mothers who continued to exercise from mothers who gave up exercise after having a child. In the Hamilton and White (2011) study, it would also stand to reason that the belief about improvements to parenting is tied to PA through stress relief or break-time. It would seem prudent to balance the affective beliefs and instrumental beliefs in future research.

Second, prior research has not examined longitudinal PA prediction and beliefs related to the onset of parenthood. Beliefs related to time, access and fatigue are among the most common

barriers faced by all groups of people and not just parents (Canadian Fitness and Lifestyle Research Institute, 2009). Indeed, the beliefs used to explain PA are rarely different across population sub-groups (Rhodes & Blanchard, 2007; Rhodes, Blanchard, & Blacklock, 2008). A comparison cohort of people without children and of couples as they become parents would greatly improve our understanding of what barriers are unique and what barriers are relatively similar across time.

Finally, and common in almost all studies of parenthood and PA (Bellows-Riecken & Rhodes, 2008), past studies feature self-reported PA. Self-reported PA may suffer from common method variance with self-reported beliefs and the accuracy of PA recall in self-report is low (Prince, et al., 2008). This line of research would be greatly improved by direct assessment of PA.

With these aspects in mind, the purpose of this study was to examine TPB beliefs as correlates of directly assessed PA across cohorts of young adult couples over 12 months. The cohorts were couples between the ages of 25 and 40 who were: a) without children,and b) first-time parents during the first year of parenthood. In a prior paper (Rhodes, et al., in press), these data have shown new mothers significantly lowered their PA across the 12 months compared to couples without children. Thus our assessment in this paper seeks to evaluate whether TPB beliefs are associated with this behavior change. Our assessment of TPB beliefs was based on the approach suggested by Fishbein et al.(2001) where 1) belief correlations with PA were evaluated, followed by exploratory analyses that 2) reduce the number of beliefs to the potentially most meaningful targets and 3) inspect ceiling/floor effects. We hypothesized that affective beliefs and control beliefs would correlate with PA across all sample, yet control beliefs would have less ceiling effects and thus more room for improvement in interventions.

Moderation by parenthood cohort and gender was considered exploratory, but we expected few differences by sex or couple cohort to emerge based on the limited prior research available.

METHODS

Participants

Participants were 238 adults (119 common law or married couples), aged 25-40, without children at the time of recruitment from the Victoria Metropolitan Area in British Columbia, Canada. One hundred and thirty-six participants of this sample were expecting their first child at the time of recruitment, and the remaining 102 participants were not expecting to have a child. The sample was delimited to couples (rather than single parents), participants who passed the physical activity readiness questionnaire (PARQ (Canadian Society for Exercise Physiology, 2012) and the average age standard deviation that Canadians have their first child (Statistics Canada, 2001, 2004; Statistics_Canada, 2005). Similarly, couples that experienced health complications due to pregnancy or birth (e.g. gestational diabetes, pre-eclampsia, bed-rest, etc.) were excluded (n = 1). Our prior published study with these data (Rhodes, et al., in press) also included a smaller cohort of couples expecting their second child, but this was not included in the present paper due to the small sample (n = 35); we deemed this cohort underpowered four the belief analyses.

Procedures

We advertised our study at ultrasound clinics, coffee shops, newspapers, online parenthood lists and purchase lists (e.g., craigslistvictoria.com), physician and midwife offices, and outreach parent programs such as Best Babies, as well as prenatal classes and baby retail outlets. A stratified recruitment strategy of advertisement at all regional sections of the Victoria

metropolitan area (Victoria, Oak Bay, Saanich, Esquimalt, View Royal, Colwood, Langford, and the Highlands) was conducted in order to maximize representation of the region. Rolling recruitment and subsequent data-collection were ongoing from January 2007 to December, 2011. There were three measurement periods for parents (pregnancy, six months after child, one-year after child) and non-parents (baseline, six, 12 months) across the study. Short-term assessment of PA is often criticized for failing to convey patterns of the behavior, (Rhodes & Nigg, 2011) and prediction tends to remain relatively invariant within a six-month frame (Rhodes & Plotnikoff, 2005; Symons Downs & Hausenblas, 2005b). Thus, assessment of physical activity every six months seems a reasonable time-lag. From the perspective of parenthood, assessment six-months after the birth of the child allows for recovery from the physical experience of giving birth with mothers and the early establishment of behavioral patterns in the family. All participants signed ongoing informed consent for the study, and the study was approved by the University of Victoria ethics board. Seven couples agreed to participate in the study by signing informed consent, but they subsequently dropped out of the study before completing baseline measures.

Measures

Basic demographic and health behavior measures were collected via self-report based on prior published protocols (Benoit, Jansson, Leadbeater, & McCarthy, 2002-2005; Rhodes, Courneya, Blanchard, & Plotnikoff, 2007). These questions ask participants their self-reported height/weight, date of birth, sex, education, family income, and minority status, along with brief checkbox items about smoking status (yes/no), and whether a physician/health professional has ever told them they have heart disease, diabetes, cancer, high blood pressure or high cholesterol.

PA was measured objectively for 7 consecutive days at baseline and at six- and 12-months using the GT1M Activity Monitor. The GT1M device is designed to ascertain normal human movement without impeding activity; it has been shown to provide valid and reliable estimates of PA (Abel, et al., 2008; Janz, 1994). The activity monitor is attached to an elastic belt and worn at the waist above the left hip. Participants wore the monitors for five weekdays, and two weekend days from when they got up in the morning to when they went to bed. The participants were instructed to remove the monitors at night and while swimming, bathing, or showering. They also complete a daily PA log/diary that identified when the accelerometer was removed, unusual circumstances and structured activities. Participant accelerometry data was included if there was a minimum of five full days (one weekend day and four week days) meeting the minimum wear time (600 minutes/day) as proposed by Eslinger and colleagues (Esliger, Copeland, Barnes, & Tremblay, 2005; Esliger, et al., 2010). If minimum wear time was not met, but detailed information showed that the unit was removed for physical activity (e.g. swimming for 45 minutes) and, if included, the day met the wear time requirement, the day was considered valid. Weekdays with missing data were modeled from the composite of the other four weekdays, and missing weekend days were modeled from the available existing weekend days (Esliger, et al., 2005; Esliger, et al., 2010).

Duration (minutes) and frequency (# of bouts) of moderate vigorous PA was calculated using established accelerometer cut points (≥1952 average acceleration counts/min) from (Freedson, Melanson, & Sirard, 1998; Trost, Loprinzi, Moore, & Pfeiffer, 2011). To calculate these variables the monitor was programmed to store data at 15 second intervals and converted to average counts per minute.

Theory of Planned Behaviour (TPB) constructs were phrased in accordance to the Public Health Agency of Canada's recommended weekly activity guidelines at the time of data collection (Health Canada, 2002). Specifically, participants were asked to consider regular PA as activities of at least moderate intensity, performed at least four times per week, 30 minutes or more per time across the next six months when answering the items.

TBP belief items were created from prior published pilot work in British Columbia (Rhodes, Blanchard, et al., 2009; Rhodes, Blanchard, & Matheson, 2007) and augmented by the specific benefits and barriers elicited from samples of mothers (Cody & Lee, 1999; McIntyre & Rhodes, 2009). Five-point likert scaling was used because it has shown has shown the same reliability and predictive utility as semantic differential styles of assessment or seven-point scaling with these constructs (Rhodes, Matheson, & Mark, 2010). All beliefs were phrased in terms of "over the next six months" to correspond with the six-month assessment time-frame. The expectancy only component of the beliefs, and not the value of beliefs, was measured due to prior evidence that the value or expectancy x value formulation provides little explained variance in behavior over expectancies (Gagne & Godin, 2000; Rhodes, Blanchard, et al., 2009)

Behavioural Beliefs, which assessed the subjective probability that physical activity behaviour will produce a given outcome was measured using the following items: (1) "increase my energy", (2) "make me feel better", (3) "reduce my chances of disease", (4) "improve my self-esteem", (5) "improve my social life", and (6) "help relieve my stress", (7) "gets me out of the house", (8) "control my weight", (9) "improve my fitness". The response format was from 1 (extremely unlikely) to 5 (extremely likely).

Normative beliefs were measured with four items. Participants were asked to rate the following phrases about whether the following people think they should be regularly active : “my extended family (i.e., parents, siblings)”, “my friends”, “healthcare professionals” and “my spouse”. The items were answered using a 5-point scale from 1 (completely untrue) to 5 (completely true).

Control Beliefs were measured using items: (1) “house (domestic) related work”, (2) “job (occupational) related work”, (3) “limited free time”, (4) “feeling too tired”, (5) “access to physical activity facilities”, (6) “no one to be active with”, (8) “financial concerns/limited money”, (9) “health concerns/sickness”, and (10) “bad weather”. In addition, cohorts expecting children completed a control belief about “childcare”. Preceding the control belief adjectives was the statement “If you really wanted to, how confident are you in engaging in physical activity despite…”. Items were measured using a 5-point scale from 1 (extremely unconfident) to 5 (extremely confident.

Analysis Plan

Preliminary Analyses: Descriptive findings were generated for the demographic and clinical variables by cohort followed by the calculation of attrition rates. Next, the TPB variables were checked for normality, after which analyses were conducted in SPSS version 21 to examine the pattern of missing data across the TPB and accelerometer data and identify the appropriate data imputation procedure.

Main Analyses: The analysis of theory of planned behavior beliefs has no established method. Thus, several recommendations were considered (Ajzen, 2002; Blanchard, et al., 2008; Fishbein, et al., 2001; Rhodes, Plotnikoff, & Spence, 2004; Sutton, 2002). From this literature,

some key themes emerged that helped guide our analysis strategy. First, beliefs are considered multidimensional with a poorly understood causal structure, so a univariate profile analysis approach over a multivariate analysis is desirable. Therefore, our analyses followed a univariate assessment of each belief.

Second, analyses that focus on belief-intention associations are sometimes suggested (Fishbein, et al., 2001), but other researchers have argued that the belief-behavior relationship is considered fundamental to provide at least baseline evidence that targeting a belief for a behavioral intervention may have merit (Blanchard, et al., 2008; Rhodes & Blanchard, 2007; Sutton, 2002; Weinstein, 2007). Given that intention can be only modestly linked to PA in experimental (Rhodes & Dickau, 2012) and observational (Rhodes & de Bruijn, 2013) research we considered PA the dependent variable for this paper. Correlations between beliefs and PA were evaluated in terms of their absolute magnitude and through comparisons in Fisher Z tests between sex within their cohort (i.e., husbands vs. wives) and between the same sex of the other cohort (e.g., mothers vs. women without children) when at least one correlation was statistically significant.

Third, while a profile approach is helpful to provide the most belief-level markers for intervention, some researchers have suggested that exploratory data-reduction analyses are helpful to identify the primary belief markers to be considered in an intervention (Blanchard, et al., 2008; Fishbein, et al., 2001). Following the suggestions of these researchers, we used step-wise regression to identify the independent predictors of PA that lead to the highest explained variance. The stepwise approach is needed to account for the obvious multi-collinearity among beliefs.

Finally, from a pragmatic perspective, beliefs that have a relationship with behavior still need to have enough variance for interventions to change them in a substantive way (i.e., the absence of a ceiling effect in its relationship with behaviour) (Ajzen, 2002; Fishbein, et al., 2001). To evaluate this issue in our exploratory analyses we included descriptive data of the beliefs in terms of the percentage of participants who were below advocacy on the scale (i.e., below 4 or 5 on the 5-point scale). This is similar to work conducted by Blanchard and colleagues (2008) in a prior belief analysis which yielded helpful insight.

Results

Preliminary Analyses

Baseline descriptive statistics are presented in Table 1. Couples without children were younger, had lower household income, and were more likely to be unemployed than couples expecting their first child. Body mass index was lower for women without children compared to expectant mothers. There were no differences across groups on educational achievement, visible minority status or health condition profiles with the exception of smoking behaviour. Women without children were more likely to be smokers than expectant mothers.

Thirteen couples did not return for our second wave of data-collection representing a 11% attrition rate. This included eight couples without children, and five couples with their first child. The reasons for this drop-out were couples; a) moved away (n = 2), b) were too busy (n = 3), or c) dissolved their relationship (n = 2). Six couples did not disclose a reason. An additional 10 couples did not return for our third wave of data-collection and this was equally distributed across the couples without children (n = 5) and couples who had their first child (n = 5) with a 9% attrition rate. The reasons for this drop-out were because the couples: moved away (n = 1),

dissolved their relationship (n = 4) or had a health complication (n = 1). Four reasons were undisclosed.

In terms of normality, modest positive skewness and kurtosis values were present for the six and 12-month accelerometer data; therefore, the distributions were transformed using their square root (Tabachnick & Fidell, 1996). In terms of the missing data analyses, results showed that missingness at six and 12 months was significantly related to education and the data were considered missing at random (MAR: i.e., the probability of missing a particular data point such as a moderate-vigorous PA score at six months is not related to its particular value, but can be dependent upon other variables in the model; (Allison, 2002). Unfortunately, using listwise deletion when one has data MAR may lead to biased estimates. Therefore, missing values were imputed in SPSS version 21 using the expectation maximization algorithm (Allison, 2002).

Correlations of Beliefs and PA

Bivariate correlations for the samples can be found in Tables 2-4 for the behavioural, normative and control beliefs respectively. Consistency was found across the patterns of several beliefs. The behavioral belief that PA would increase energy was significantly associated with PA for mothers in both the baseline-6 months and the 6 months to 12 months prediction times, as well as for women without children in the 6 months to 12 months prediction time. Similarly, the belief that PA would relieve stress was associated with PA for both women cohorts during baseline to 6 months and women with children at 6 months to 12 months. In terms of normative beliefs, there was consistency with both male cohorts with significant correlations between extended family and healthcare workers and PA. In both cases, however, the relationship was negative, suggesting that higher PA was associated with lower norms. Finally, there was consistency in control beliefs for control over PA without facility access in cohort without

children during the baseline to 6 month prediction period and this continued for men during the 6-12 month period. Men in both cohorts (men with their first child baseline to 6 months; men without a child 6 months to 12 months) showed a significant association between PA and the belief they have control over PA despite no one to do the activity with, while women in both cohorts (women without a child in baseline to six months and women with a child in 6 months to 12 months) showed an association between PA and control over PA with health problems. Of particular interest, women with their first child had significant associations between PA and control over PA despite childcare and domestic duties (i.e., housework).

Comparisons between Men and Women

Several significant differences in the belief-PA correlations were present between men and women of the same cohort. In particular, women had larger associations between the belief that PA relieved stress and PA than men (both prediction time periods for women with a child and baseline-6 months for women without children). Women with their first child also had larger associations between the belief that PA improved energy (both time points) and that PA would make them feel better (baseline -6 months) and PA than men with their first child.

Comparisons between Cohorts

A few significant differences emerged between the sexes by cohort. Specifically, men without a child had a stronger PA association with the belief that PA would improve their social lives compared to men with a child during the 6-12 month prediction period. Women with children also has larger PA associations with control beliefs about domestic work, health, and bad weather compared to women without children.

Exploratory Belief Reduction and Ceiling Inspection

The exploratory stepwise regressions can be found in Tables 5-6 for the baseline-6 month and 6-12 month prediction time period respectively. During the baseline-6 month period, both cohorts of women showed that the belief that PA could relieve stress had the largest independent association with PA. Women without children also showed an independent contribution of control over PA despite health problems. The largest belief associated with PA for men without children was control over PA despite facility access limits and the largest association for men with a child was control over PA despite having no one to do the activity with. Collectively, explained variance in PA ranged from 6% to 20%. Interestingly, the inspection of belief ceiling effects showed that the belief about stress relief had extremely high advocacy (94-98%) and thus limited range for change while the control beliefs had far more variance in the distribution across the scale.

For the 6 month to 12 month prediction period, the belief that PA would make you feel better had the largest independent association with PA among women without children, while the belief that PA would relieve stress had an independent association with PA among mothers. The largest association with PA among mothers, however, was the control belief about childcare. Men without children again showed that control over PA despite facility access limitations was the largest correlate with PA, but extended family norms had an independent association with PA for this group as well. Men with children also showed this relationship between PA and extended family; indeed, it was the only variable to explain PA in that cohort. Like the bivariate correlations, this association was negative, suggesting that higher normative pressure from the extended family was associated with less PA. Similar to the baseline-6 month regressions, the behavioral beliefs had extremely high ceiling effects. Over 95% of respondents advocated agreement with the benefits of PA. The normative and control beliefs showed considerable

variability across the scale, suggesting room for intervention. The largest discrepancy was control over childcare, where 76% of mothers did not feel they had control over PA.

Discussion

The purpose of this study was to examine theory of planned behavior belief-level constructs as correlates of directly assessed PA across cohorts of young adult couples a) without children and b) with their first child over the initial 12 months. According to the theory of planned behavior (Ajzen, 2002), belief-level constructs are critical to defining the markers for theory-based intervention. Furthermore, the precision in belief-level assessment of PA correlates allows for a more specific understanding of why people may or may not participate in PA over general constructs such as attitude and perceived control. Our study advances the state of knowledge in beliefs about physical activity among parents by using accelerometry over prior studies that used self-reported PA (Hamilton & White, 2011; McIntyre & Rhodes, 2009), applying two 6-month prediction time-periods in comparison to prior research that was retrospective or featured a short prospective design, and by including a comparison cohort of couples without children in order to identify beliefs common to young adult couples and beliefs unique to parents. Our assessment of control beliefs also included an important motivational qualifier (i.e., “if I really wanted to”) in order to help instruct participants to answer whether barriers affect volition rather than motivation (Rhodes & Courneya, 2003). The approach helps lower the chance that barriers are being used as mere excuses for inactivity. Overall, the results demonstrated some support for the theory of planned behavior approach to understanding PA correlates for future intervention with several belief-PA effect sizes in the medium range.

First, we hypothesized that affective beliefs and control beliefs would generally emerge as correlates in the cohorts in comparison to instrumental or normative beliefs. This hypothesis

had mixed support. Across all samples, instrumental beliefs such as reducing chronic disease and improving physical fitness showed no significant relationship with PA, and controlling weight emerged as significant for only one of eight tests. There was more evidence for the hypothesized affective beliefs about the benefits of PA such as improving energy (3/8 tests) and stress relief (3/8 tests) yet improved self-esteem (0/8 tests), social life (1/8 tests), and feeling good (1/8 tests) had limited support similar to the instrumental beliefs. The findings complement prior behavioral belief analyses using self-reported data with similar samples that show limited links with PA (Hamilton & White, 2011; McIntyre & Rhodes, 2009), but our study now replicates these findings with accelerometry and advances the literature with the addition of affective beliefs. Overall, the evidence also lends some support to meta-analyses/reviews showing that proximal affective reasons for PA are generally stronger than distal instrumental reasons (Rhodes, Fiala, et al., 2009; Teixeira, Carraça, Markland, Silva, & Ryan, 2012).

Like the mixed findings from the behavioral beliefs, control and normative beliefs showed only partial support for our hypothesis. Normative beliefs about friends had no significant relationship with PA, but norms about health care providers, extended family, and one's spouse all had two of eight tests that showed some relationship. By contrast, control beliefs about occupational demands and time and fatigue barriers had no significant relationship with PA. This proved different to prior evidence with control beliefs and norms (Hamilton & White, 2011; McIntyre & Rhodes, 2009). It is particularly interesting that time and fatigue did not emerge in these analyses. The findings may have been from the difference between accelerometry and self-report or from the more stringent assessment of volitional control beliefs in these analyses. Lack of time and fatigue are common excuses for low motivation in engaging in PA (Brawley, Martin, & Gyurcsik, 1998) and our analysis that tried to control for motivational

confounds may have reduced these correlations to null. Still, particular control beliefs did show some continuity across prediction time-frames or across cohorts. Access to PA facilities (3/8 tests), domestic work duties (2/8 tests), social support (2/8 tests), health concerns (2/8 tests), and child care (2/8 tests) all showed some support as control beliefs. Overall, the results support our hypothesis that many control beliefs would be associated with PA.

Our analyses by sex and cohort (couples without children/couples with first child) proved interesting. When comparing the sexes, it was clear that affective beliefs were associated with PA more for women than men, particularly in the case of parents. Specifically, women had larger stress relief and PA correlations than men in three of the four possible tests, while mothers also showed larger PA correlations than fathers in beliefs about PA improving energy and feeling better. Stress relief was also a consistent predictor of PA among women in our exploratory regression analyses. The stress relief from regular exercise among mothers and women generally has been reported in the past (Long & Haney, 1988; Urizar, et al., 2005), yet to our knowledge, this is the first study to compare it to men and use directly assessed physical activity.

The other consistent finding when comparing the sexes was between the parent cohort and control beliefs over PA due to childcare demands. In these data, mothers reported significantly larger correlations with PA than fathers; indeed, fathers did not have a relationship between control over PA and childcare demands. This finding is interesting because we have little comparators in the published literature on the PA belief-systems of mothers and fathers. In our sample, 85% of mothers were on 12 month maternity leave (or equivalent) and home with the baby. It is likely, as our evidence suggests, that overcoming childcare concerns would fall primarily on mothers because they are the primary caregiver during this time. It will be

interesting for future studies to evaluate whether any changes occur as many women re-enter the workforce after their leave and adjustments to family roles need to be made.

The comparison by sex also showed that a theory of planned behavior perspective did not seem to explain the PA of men in comparison to women. For example, men showed only one significant correlation with PA of 36 possible tests in the behavioral beliefs. Normative beliefs among men had some significant correlations but these were in a negative direction with PA, which is opposite to theory of planned behavior assumptions (Ajzen, 1991). The finding may have occurred from people who are the least active reporting the most pressure to be active in the future (e.g., family, spouses, trying to get them active) but this is mere speculation. Overall, the results suggest we have very little understanding of why men were active in this sample. The generally null results may come from our belief elicitation studies that were conducted with mixed but majority female samples and samples of mothers but not fathers. More focus groups with male-only samples seem warranted. Still, the beliefs used in our study mimic prior analyses (Hamilton & White, 2011) and general beliefs used in the TPB (Symons Downs & Hausenblas, 2005a) so it is not easy to interpret. Fortunately, the assessment of control beliefs yielded some explanation for the PA patterns of men. Males without children reported control over access to facilities as a consistent correlate of PA while fathers showed control over social support (baseline-6 months) and control over bad weather (6 months to 12 months) as correlates of PA. Taken together the results suggest that we know little of why men were active in this sample, but control over access, social support, and bad weather may facilitate their activity.

Our second comparison analysis was based on beliefs by cohort. Interestingly, there were very few differences in behavioral or normative beliefs. For example, only the behavioral belief about PA improving ones social life was different in a comparison by cohort in the behavioral or

normative beliefs. In this case, men without children had a larger correlation with PA than men with a child. The obvious interpretation might be that men with children do not have the time to have social-based PA (e.g., sport teams, group exercise) in the first year of parenthood compared to men without children; however, we believe the general lack of differences is more of interest than one significant finding. Overall, the null findings make sense. Having a child would seem to have less to do with your reasons for being active than on the control (of barriers) over PA. We found particular support for this premise with women by the 6 month to 12 month time-period. There were several differences in control constructs between women with children and women without children which included control over PA despite domestic duties, health, bad weather, and indirectly via an association with control over PA despite childcare demands (i.e., the women without children did not have this measure to complete for obvious reasons). All of these significant differences showed the importance of mothers having control over these beliefs and their association with PA compared to women without children. Thus, control over PA appears crucial for mothers and this stands to reason given their role as primary caregiver to a new baby and the additional workload this entails.

One of the main benefits to conducting belief analyses according to the theory of planned behavior is to reduce correlates to key targets for intervention. As part of our exploratory analyses and in-line with the recommendations by Fishbein et al. (2001), we used regression analyses in an attempt to define the primary belief targets for intervention and to examine their ceiling effects. We hypothesized that control beliefs would have less ceiling effects than behavioral beliefs, which often have high degrees of advocacy (Hamilton & White, 2011) and thus more room for improvement in interventions. Our results showed strong support for this hypothesis. For example, though women had affective beliefs such as stress relief and feeling

good as their key behavioral beliefs to target in interventions, the degree of advocacy was >95%. This suggests extremely limited room for change in intervention campaigns. By contrast, the control beliefs had a large range for potential intervention. Of particular interest was the control belief about childcare among new mothers in the 6-month to 12-month prediction period. Seventy-six percent of mothers reported that they did not believe they had control over PA due to childcare duties. This suggests an enormous group of people who could benefit from interventions aimed at improving control. The finding complements prior intervention trials that have tried to help mothers with self-regulation and solving childcare barriers (Cramp & Brawley, 2006; Fahrenwald, Atwood, Noble-Walker, Johnson, & Berg, 2004), but it also seems likely that mothers will need intervention beyond individual-level strategies. Social-, environmental- and policy-level change to help reduce the load of infant care is likely required for sustained maternal health behaviors like PA (McIntyre & Rhodes, 2009).

Although this study had several methodological strengths, including direct assessment of PA and assessment of two cohorts across time, there are study limitations that warrant consideration. First, our sample was clearly more educated, less overweight (Statistics Canada, 2007), and more physically active (Colley, et al., 2011) than average for the Canadian population, suggesting there may have been selection bias. Our non-random sample appeared to possess high initial motivation for health. We are also unable to provide estimates of the reach of recruitment due to our passive (flyers, advertisements) recruitment strategy. Finally, the longitudinal nature of the study is a strength, but a longer time frame may show even larger heterogeneity in PA and TPB variables as time elapses. The extant literature on parenthood and PA suggests that the first five years represents the largest decline in activity (Rhodes, Symons Downs, & Bellows Riecken, 2008) so a longitudinal study over five years may be ideal.

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Table 1
Demographic and Health Profile of Couples at Baseline

Characteristic	without Children (N = 102)		onset of first child (N = 136)	
	Women	Men	Women	Men
Demographic Profile				
Mean Age	27.52A	29.35A	31.14	33.10
(SD)	(5.12)	(5.33)	(4.78)	(4.71)
% Visible Minority	6.0	12.0	9.8	9.0
% Completed University	68.7	62.5	83.1	70.6
% > $75,000 Household Income	45.2A	45.5A	66.7	65.2
% Currently Employed	54.2A	71.5A	88.7	89.7
Health Profile				
Mean Months Pregnant	NA		5.75	
(SD)			(1.96)	
Mean BMI	22.65A	25.48	24.90	26.18
(SD)	(2.89)	(3.68)	(3.14)	(3.51)
%Smoker	5.9A	8.2	0.0	2.9
% with Heart Disease	0.0	0.0	0.0	0.0
% with Diabetes	2.1	0.0	4.2	0.0
% with Cancer	2.1	0.0	1.4	1.5
% with High Blood Pressure	0.0	10.2	1.4	7.5
% with High Cholesterol	0.0	3.9	1.4	4.0

A = significantly ($p < .05$) different than the other cohorts by sex

Table 2.

Behavioral Belief Comparison of Couples without Children and Couples who had their First Child over 12 Months

	Baseline predicting 6 months			6 months predicting 12 months		
	r			r		
Belief	Women	Men	*Z*	Women	Men	Z
Couples without Children						
Energy	.09	.03		.25*	.22	0.10
Feel Better	.07	-.03		.12	.04	
Reduce Disease Risk	.18	.12		.22	.09	
Self-Esteem	-.04	-.07		-.10	.03	
Social Life	.18	-.02		.11	.23*[A]	-0.61
Stress Relief	.36**	.03	1.70*	.07	.06	
Get out of the house	-.03	-.13		.09	.02	
Control weight	.17	-.19		.24*	.12	0.61
Improve Fitness	.11	-.12		-.09	.13	
Couples with Children						
Energy	.30**	-.04	1.71*	.24*	-.10	2.00**
Feel Better	.36**	.07	1.78*	.13	-.10	
Reduce Cancer Risk	.16	-.11		.01	.01	
Self-Esteem	.22	.14		-.01	-.05	
Social Life	.09	-.03		-.01	-.17[A]	
Stress Relief	.42**	.14	1.78*	.28**	-.05	1.95*
Get out of the house	.07	-.11		.14	-.10	
Control weight	.12	-.15		.04	-.22	
Improve Fitness	.16	.06		-.03	-.15	

Note: A indicates a significant ($p < .05$) difference between the couples without children and couples with children for the same sex for the same prediction period using a Fisher Z test (score not shown). * = $p < .05$, ** = $p < .01$ for the Fisher Z test between men and women.

Table 3.

Normative Belief Comparison of Couples without Children and Couples who had their First Child over 12 Months

	Baseline predicting 6 months			6 months predicting 12 months		
	r			r		
Belief	Women	Men	*Z*	Women	Men	Z
Couples without Children						
Extended family	.08	-.20		.05	-.24*	1.40
Friends	-.08	-.12		.06	-.17	
Healthcare workers	-.20	-.01		-.14	-.23*	0.46
Spouse	.24*	-.03	1.35	-.10	.08	
Couples with Children						
Extended family	-.13	.16		.01	-.26*	1.60
Friends	-.02	.22		.11	-.07	
Healthcare workers	.00	-.07		.03	-.24*	1.59
Spouse	.14	.22		.05	-.21*	1.52

Note: A indicates a significant ($p < .05$) difference between the couples without children and couples with children for the same sex for the same prediction period using a Fisher Z test (score not shown). * = $p < .05$, ** = $p < .01$ for the Fisher Z test between men and women.

Table 4.

Control Belief Comparison of Couples without Children and Couples who had their First Child over 12 Months

	Baseline predicting 6 months			6 months predicting 12 months		
	r			r		
Belief	Women	Men	*Z*	Women	Men	Z
Couples without Children						
Domestic Work	.16	.22		-.05[A]	.17	
Occupational Work	.04	.15		-.23	.13	
Time	.09	.18		.10	.07	
Fatigue	-.07	-.05		.02	-.02	
Access	.24*	.24*	0.00	-.07	.26*	-1.65*
Social Support	.05	.13		-.14	.24*	-1.89*
Finances	.18	.17		-.09	.13	
Health	.28*	.10	0.92	-.11[A]	.02	
Bad Weather	-.01	.08		-.20[A]	.15	
Couples with Children						
Domestic Work	.21*	.04	1.00	.25*[A]	-.05	1.77*
Occupational Work	-.02	.16		.20	-.17	
Time	.02	.06		.18	-.01	
Fatigue	.01	.16		.18	.09	
Access	-.01	.14		-.02	-.09	
Social Support	.08	.26*	-1.08	.12	.01	
Finances	.21*	.17	0.24	.05	.02	
Health	-.02	.16		.24*[A]	-.08	1.88*
Bad Weather	.03	.18		.24*[A]	.21	0.18
Childcare	.28*	-.04	1.90*	.34**	-.21	3.28**

Note: A indicates a significant ($p < .05$) difference between the couples without children and couples with children for the same sex for the same prediction period using a Fisher Z test (score not shown). * = $p < .05$, ** = $p < .01$ for the Fisher Z test between men and women.

Table 5

Stepwise Regression Analysis of Beliefs predicting Physical Activity Baseline to 6 Months

Variable	F_{change}	df	R^2 change	β^1	β^2	%<4
Women without Children						
(Block #1)	7.43**	1, 49	.13			
Stress Relief				.36**	.35**	2.0
(Block #2)	4.12*	1, 48	.07			
Control over Health					.26*	76.5
Men without Children						
(Block #1)	2.97*	1, 49	.06			
Control over Facility Access				.24*		39.2
Women with First Child						
(Block #1)	16.01**	1, 66	.17			
Stress Relief				.42**		5.6
Men with First Child						
(Block #1)	4.80*	1, 66	.07			
Control over Social Support				.26*		32.4

Note: * $p < .05$** $p < .01$; df = degrees of freedom; β^{1-2} = standardized regression coefficients for equations 1-2. %<4 = the percentage of the sample below 4 on the 5-point scale.

Table 6

Stepwise Regression Analysis of 6 Month Beliefs predicting Physical Activity at 12Months

Variable	F_{change}	df	R^2 change	β^1	β^2	%<4
<u>Women without Children</u>						
(Block #1)	3.13**	1, 49	.08			
Energy				.25**		3.9
<u>Men without Children</u>						
(Block #1)	3.53*	1, 49	.07			
Control over Facility Access				.26*	.31*	60.8
(Block #2)	4.48*	1, 48	.08		-.27*	58.8
Extended Family Norms						
<u>Women with First Child</u>						
(Block #1)	7.43*	1, 66	.12			
Control over Child Care				.34**	.28*	76.3
(Block #2)	4.40	1,65	.06			
Stress Relief					.26*	4.2
<u>Men with First Child</u>						
(Block #1)	4.85*	1, 66	.07			
Extended Family Norms				-.26*		50.0

Note: * $p < .05$** $p < .01$; df = degrees of freedom; $\beta^{1\text{-}2}$ = standardized regression coefficients for equations 1-2. %<4 = the percentage of the sample below 4 on the 5-point scale.