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Physical activity and sedentary behavior across 12 months in cohort samples of couples without children, expecting their first child, and expecting their second child

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Abstract The onset of parenthood has been reported as a reason for steep declines in moderate–vigorous intensity physical activity (MVPA), but also increases in light activity rather than sedentary behavior. We examined the activity profiles of three cohorts of couples (couples without children, and first-time parents and second time parents) across 12 months. Participants were 314 adults (102 not expecting a child, 136 expecting first-child, 76 expecting second child) who completed baseline demographics and 7-day accelerometry, followed by assessments at 6 and 12 months. Hierarchical linear modeling showed that parents who were expecting their second child had lower MVPA; yet were less sedentary/had higher light intensity activity compared to other couples at baseline. First-time mothers' physical activity pattern changed to match the profiles of parents who were now parenting two children across the first 12 months of child-rearing. Findings support MVPA interventions targeting new mothers.

Keywords Parenthood · Physical activity · Sedentary behavior · Health

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Introduction

Regular moderate to vigorous intensity physical activity (MVPA) has been linked with reduced risks of acquiring over 25 chronic diseases or conditions (Warburton et al., 2010, 2006). Independent of MVPA, there is a growing body of research showing the deleterious health consequences of sustained sedentary behavior (i.e., activity below 1.5 METs) (Owen et al., 2010; Pate et al., 2008; Rhodes et al., 2012; Tremblay et al., 2011). Despite this evidence, most of the population in high-income countries is not active enough at the right intensity to reap health benefits and has a profile of sitting for many hours per day. For example, in Canada, a recent population study found that <20 % of adults were meeting MVPA guidelines (i.e., 150 min per week) for public health (Colley et al., 2011), while census data suggests that almost 4 hours per day is dedicated to leisure-time screen viewing (Statistics Canada, 2007).

Early adulthood appears to be a critical time where MVPA declines. Several epidemiological cohort studies suggest a prominent deflection point is between ages 25 and 35 (Baranowski et al., 1997; Caspersen et al., 2000; Statistics Canada, 2005). Life-transitions (i.e., changes to lifestyle), including co-habitation, early career demands, and the onset of parenthood have been examined to explain physical activity prevalence during this time (Allender et al., 2008). While all of these factors have evidence of their relationship with physical activity, the onset of parenthood appears to be especially important to declines in physical activity. For example, a meta-analysis of 10 studies comparing parents and non-parents on MVPA showed an effect size $d = .48$, with the prominent difference in favor of couples without children (Bellows-Riecken & Rhodes, 2008). Still, the credibility interval around this effect was extremely large, indicating considerable discrepancies in the available research at the time. Furthermore, the quality of the research had heterogeneity in terms of design, measurement and sampling. Higher quality research on the topic was recommended for the future.

Many of the studies that have evaluated parenthood and physical activity have been cross-sectional designs comparing parents to couples without children (Bellows-Riecken & Rhodes, 2008; Rhodes et al., 2008) or retrospective accounts of pre-parenthood physical activity (Albright et al., 2005; McIntyre & Rhodes, 2009). Longitudinal studies that evaluate within-person changes to parenthood are stronger designs to examine whether parenthood impacts physical activity because parents and couples without children could have different priorities and physical activity histories and retrospective assessment may be biased. The trajectories of physical activity and parenthood of multiple children can also be evaluated with longitudinal designs. At present longitudinal studies are mixed in their results on these topics. For example, Brown and Trost (2003) found new Australian mothers were 2.27 times more likely to be inactive compared to non-mothers in a 4-year longitudinal design. This same study also found mothers who had more than one child were twice as likely to be inactive as those with only one child (Brown & Trost, 2003). By contrast, a large 15 year longitudinal trial of U.S. adults found no evidence of parenting factors influencing physical activity behavior (Umberson et al., 2011). Other research has followed this pattern of mixed positive (Burke et al., 2004) or null results (Sjogren et al., 2011; Urizar et al., 2005). Clearly, sustained longitudinal research on the onset of parenthood would be helpful in order to better understand its impact on the physical activity of couples.

Research is also lacking on physical activity measurement. Almost all studies in this domain have used self-report instrumentation (Bellows-Riecken & Rhodes, 2008). Employing self-report for understanding physical activity likely results in biases, possibly exaggerating estimates if parents consider their pre-parenthood physical activity profiles through rose-tinted glasses (Prince et al., 2008). One study has employed direct assessment via accelerometry for the assessment of MVPA (Candelaria et al., in press). This early evidence showed no difference in MVPA between parents and couples without children (Candelaria et al., in press). Also, limited direct assessments of light physical activity and sedentary behavior by parenthood status have been performed. The self-reported results have proved interesting, however, and suggest that parents may have less sedentary profiles than nonparents (Candelaria et al., in press; Grace et al., 2006; Pereira et al., 2007; Scharff et al., 1999; Sternfeld et al., 1999; Verhoef & Love, 1994). The importance placed on reducing sedentary behavior and increasing MVPA for improving public health suggests that sustained research, particularly involving direct assessment of both physical activity and inactivity is warranted.

Another important limitation of parenthood research raised by the Bellows-Riecken and Rhodes (2008) review was the overwhelming number of studies performed with mothers but not fathers. The evidence has generally showed that mothers report less MVPA than fathers, similar to the gender difference in MVPA across most high-income nations (Canadian Fitness and Lifestyle Research Institute, 2009). However, there were too few studies comparing fathers to men without children (or change to fatherhood over time) for commentary. There has been some recent preliminary evidence that fathers experience similar (Berge et al., 2011) or even greater (Hull et al., 2010) declines in MVPA compared to mothers when significant differences in parenthood status were identified. To our knowledge, the interaction between the parental dyad in physical activity has not been explored. It would seem reasonable that the interaction between parents in terms of brokering time for physical activity and the household norms for workload would be very important to investigate.

This paper takes up this challenge by examining the physical activity and sedentary behavior profiles of three cohorts of couples across 12 months using direct measurement and multi-level modeling of dyads. The cohorts were couples without children, first-time parents during the first year of their parenthood experience, and second time parents during the first year of this parenting experience between the ages of 25 and 40 years of age. It was hypothesized that parents would demonstrate lower sedentary behavior profiles than non-parents and that second-time parents would exhibit even lower sedentary behavior patterns than first-time parents due to the additional activities and workload that may come with multiple children. It was also hypothesized that non-parents would consistently show a higher MVPA trajectory across the year compared to new parents. Analyses by gender were considered exploratory. Finally, it was hypothesized that couples would show common patterns across time unique to individual effects of gender and parenthood cohort.

Methods

Participants

Participants were 314 adults (157 common law or married couples), aged 25–40, without children or with one child 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 (baseline), 76 participants had one child and were expecting their second child at the time of recruitment (baseline), and the remaining 102 participants were not expecting to have a child. Because this is a relatively understudied topic, we delimited to couples (rather than single parents), and the average age standard deviation that Canadians have their first child (Statistics Canada, 2001, 2004; Statistics_Canada, 2005) in order to help with the homogeneity of results. Similarly, exclusion criteria extended to females who experience health complications due to pregnancy or birth (e.g., gestational diabetes, pre-eclampsia, bed-rest, etc.).

Procedures

We advertized our study as a general couples health project (i.e., not physical activity specific) 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. Targeted recruitment of couples without children was also advertised at recreation and cultural centres, via newspaper advertisements, coffee shops and purchase lists. Rolling recruitment and subsequent data-collection were ongoing from January 2007 to December, 2011. Physical activity measurements continued for 12 months post-delivery at 6-month intervals for parents, and roughly every 6 months for couples without children. Overall, this included three measurement periods for parents (pregnancy, 6 months after child, one-year after child) and couples without children (baseline, 6, 12 months). Demographic data were assessed at baseline via self-report for all participants. Height and weight were self-reported at each time period. Participants completed these measures via paper-based questionnaire. For the physical activity and sedentary behavior assessment, participants were fitted with an accelerometer that was delivered to their home and subsequently picked-up after the assigned measurement time. Participants were compensated with $25 for their time each measurement period. The study was approved by the first author's institution review board and all participants completed initial and ongoing informed consent.

Measures

Basic demographic and health behavior measures were collected via self-report based on prior research from our team (Benoit et al., 2002-2005; Rhodes et al., 2007). *Physical activity and sedentary behavior* were measured objectively for 7 consecutive days using the GT1M Activity Monitor at each time period. This device is designed to ascertain normal human movement without impeding activity; it has been shown to provide valid and reliable estimates of physical activity (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 7 consecutive days (5 weekdays, and 2 weekend days) from when they get up in the morning to when they go to bed. The participants were instructed to remove the monitors at night and while swimming, bathing, or showering. They also complete a daily log/diary that identified when the accelerometer was removed, unusual circumstances and structured activities.

Both acceleration and step-count were obtained. Physical activity was measured for duration and frequency by assigning accelerometer cut points by sedentary bouts (0–100 average acceleration counts/min), light minutes (100–1,951 acceleration counts·min^{-1}), and bout (i.e., minimum of 10 min) minutes of MVPA ($\geq$1,952 average acceleration counts/min) intensity (Freedson et al., 1998; Trost et al., 2011). To calculate these variables the monitor was programmed to store data at 15 s intervals based on 60 s epochs on each day. The maximum allowable interruption period was 2 min. Research has shown accelerometers to be reliable and objective PA measurement devices, which provide robust quantitative data regarding physical activity behavior, and overcome many of the methodological issues associated with self-report PA data (Esliger et al., 2005; Strath et al., 2005; Welk, 2005).

Wear/Non-wear days were defined using the criteria previously defined by Eslinger et al. (2005, 2010), in that in order for data to be considered, a minimum of five full days (1 weekend and 4 week days) had to have met minimum wear time (600 min/day). If minimum wear time was not met, but detailed information was provided as to why the accelerometer was removed (e.g., swimming for 45 min), and with that time the 600 min/day minimum was met, the day was considered valid. Weekdays with missing data were modeled from the other 4 weekdays, and missing weekend days were modeled from existing weekend days (Esliger et al., 2005).

Analysis

Descriptive findings were generated for the demographic and clinical variables by couple status followed by the calculation of attrition rates. Next, it is recognized that two analytical approaches can be utilized in longitudinal couple studies within hierarchical linear modeling. First, a 3-level model can be created where repeated assessments (Level-1) are nested within the individual (Level-2) that are nested within the couple (Level-3) (Atkins, 2005). However, we utilized the more common approach, which is to nest the individual repeated assessments (Level-1) within the couple (Level-2) (Atkins, 2005; Raudenbush et al., 1995). This analysis can readily incorporate all participants who have provided at least one data point (e.g., a baseline assessment) under the missing at random assumption (Raudenbush et al., 1995). As there are three outcomes of interest, the analysis plan will describe the 3-step process for minutes of sedentary activity, which will be the same process for minutes of light intensity and MVPA in bouts. All analyses were conducted using HLM 6.0. For the first step, a Level-1 no intercept model was specified such that a main effect was entered for husband (0 = Wife; 1 = Husband), wife (0 = Husband; 1 = Wife), a husband linear trend (0 = baseline; 1 = 6 months, 2 = 12 months), and a wife linear trend with all coefficients set to random. In this model, the main effects for the husbands and wives' intercepts represent their respective baseline minutes of sedentary activity, whereas the linear trends represent the change in sedentary activity (or not) over each 6-month interval. At Level-2, cross-level interactions were added such that the mean age of the husbands and household income (0 = <\$75,000; 1 = >\$75,000) predicted the husbands' Level-1 intercept and the wives' mean age and household income predicted the wives' Level-1 intercept to control for potential confounds (see Table 2 for the regression equation). The husbands versus wives' coefficients were then statistically compared using the multivariate hypothesis testing procedure (e.g., to determine if the magnitude of change in the minutes of sedentary activity was the same for husbands and wives). In the second step, the correlations among the spouses' intercepts and slopes were examined to determine, for example, whether the wives' baseline minutes of sedentary activity were significantly associated with their own change in sedentary activity and/or their husbands' change in sedentary activity (and vice versa). The third step then examined whether parental cohort was significantly associated with the baseline and change in minutes of sedentary activity. Specifically, three dummy coded variables were created: non_parents (0 = no; 1 = yes), new_parents (0 = no; 1 = yes), and child_2nd (0 = no; 1 = yes). Then, cross-level interactions were created such that new_parents and child_2nd variables predicted the husbands and wives Level-1 intercepts (i.e., to determine if baseline minutes of sedentary activity were similar for non parents versus new parents and those with a 2nd child) and the husbands and wives slopes (i.e., to determine if the change in minutes of sedentary activity were similar for non parents versus new parents and those with a 2nd child) at Level-1. Follow-up analyses were then conducted excluding non-parents in order to make the new parents versus child_2nd comparisons. Finally, the parental coefficients were statistically compared using the multivariate hypothesis testing procedure to determine whether the magnitude of their potential associations with the Level-1 intercepts and slopes were similar for husbands and wives.

Results

Baseline descriptive statistics are presented in Table 1. Couples without children were younger, had lower household income, lower BMI, and were more likely to be unemployed than couples expecting their first or second child. There were no differences across groups on educational achievement, self-reported visible minority status or health condition profiles. Expectant mothers were often in their second trimester of pregnancy during the time of recruitment.

Fifteen couples did not return for our second wave of data-collection across the couples without children (n = 8), couples who had their first child (n = 5) and couples expecting their second child (n = 2) representing a 10 % attrition rate. The reasons for this drop-out were because the couples moved away (n = 2), reported they were too busy (n = 3), relationship dissolved (n = 2), had a health complication (n = 1) or undisclosed (n = 7). An additional 12 couples did not return for our third wave of data-collection across the couples without children (n = 5), couples who had their first child (n = 5) and couples expecting their second child (n = 2); this represented an 8 % attrition rate. The reasons for this drop-out were because the couples moved away (n = 2), reported they were too busy (n = 1), relationship dissolved (n = 4), had a health complication (n = 1) or undisclosed (n = 4). Differential attrition rates across the cohorts were not significantly different in either wave of data collection.

Sedentary minutes

The unstandardized and standardized beta coefficients are presented in Table 2 along with the multivariate hypothesis tests (i.e., spousal comparisons). As can be seen, husbands and wives had similar baseline levels, however, the decrease in sedentary minutes was significantly larger for the wives compared to the husbands (multivariate hypothesis test: $\chi^2(1) = 9.23$). Further, husbands and wives baseline sedentary minutes (i.e., intercepts) were positively correlated (r = .59) in addition to their change over time (i.e., their slopes; r = .78) indicating that a change for one spouse was significantly associated with a change in the other spouse. With respect to the parental comparisons, results in Table 3 showed that couples

Table 1 Demographic and health profile at baseline

Characteristic	Without children (N = 102)	Onset of first child (N = 136)	Onset of second child (N = 76)
Demographic profile			
% Female	50.0	50.0	50.0
Mean age (SD)	28.46[a] (5.28)	32.11 (4.83)	33.32 (4.52)
% Visible minority	9.0	8.4	9.1
% Completed university	65.7	76.9	68.9
% >$75,000 Household income	38.2[a]	62.1	52.0
% Currently employed	62.9[a]	89.2	80.4
Health profile			
Mean months pregnant (SD)	NA	5.75 (1.96)	5.70 (2.08)
Mean BMI (SD)	24.11 (3.59)[a]	25.55 (3.38)	26.51 (3.87)
% Smoker	7.2	1.5	4.0
% With heart disease	0.0	0.0	0.0
% With diabetes	1.0	2.2	4.0
% With cancer	1.0	1.5	0.0
% With high blood pressure	2.5	4.3	2.7
% With high cholesterol	2.1	2.9	1.3
Physical activity profile			
Mean weekly min sedentary (SD)	2,364.3 (552.3)	2,387.5 (637.0)	2,302.2 (500.2)
Mean weekly min light PA (SD)	914.1 (476.2)	949.3 (377.2)	975.3 (486.3)
Mean weekly MVPA min (SD)	154.3 (138.1)	121.7 (100.6)	55.9 (63.4)
% Meeting PA guidelines	53.9	45.7	34.2

[a] Nonparent significantly different than first-time parent and second time parent

Table 2 Unstandardized and standardized coefficients for growth curve parameters for husbands and wives in addition to multivariate hypothesis test spousal comparisons

Parameter	Sedentary minutes		Light intensity minutes		MVPA—Minutes in bouts	
	Beta	β	Beta	β	Beta	β
Initial level						
Husbands (β_{10})	2,181.16**		1,156.03**		35.33**	
Wives (β_{20})	2,202.13**		972.90**		39.15**	
Rate of change						
Husbands (β_{30})	−164.28**	−.19**	88.15*	.13*	−6.19	−.07
Wives (β_{40})	−285.06**	−.33**	198.86**	.29**	−4.33	−.05
Multivariate hypothesis tests (spousal comparisons)						
β_{10} versus β_{20}	$\chi^2(1) = .08$		$\chi^2(1) = 7.34$**		$\chi^2(1) = .24$	
β_{30} versus β_{40}	$\chi^2(1) = 9.23$**		$\chi^2(1) = 8.56$**		$\chi^2(1) = .16$	

MVPA, moderate to vigorous physical activity; β, standardized beta; χ^2, Chi square

* $p < .05$; ** $p < .01$

Regression model tested for each outcome

Level-1 model

Outcome = π_1 (husband) + π_2 (wife) + π_3 (husband linear trend) + π_4 (wife linear trend) + e

Level-2 Model

$\pi_1 = \beta_{10} + \beta_{11}$ (husband age) + β_{12} (household income) + r_1

$\pi_2 = \beta_{20} + \beta_{21}$ (wife age) + β_{22} (household income) + r_2

$\pi_3 = \beta_{30} + r_3$

$\pi_4 = \beta_{40} + r_4$

Table 3 Coefficients for growth curve parameters and the potential moderating effect of parental status for husbands and wives

Parameter	Sedentary minutes		Light minutes		MVPA Minutes in bouts	
	Beta	β	Beta	β	Beta	β
Initial level						
Husbands	2,355.72		1,006.11		49.17	
1. NonP versus NewP	−123.40	−.98	164.35	.15	−12.33	−.09
2. NonP versus child_2nd	−537.31***	−.36***	384.49**	.31**	−34.37**	−.23**
3. Child_2nd versus NewP	413.91**	.30**	−220.15	−.18	22.04	.14
Wives	2,258.77		923.82		50.44	
4. NonP versus NewP	83.94	.06	−65.98	−.06	−10.15	−.08
5. NonP versus child_2nd	−380.15**	−.25***	293.06**	.24**	−30.38*	−.20*
6. Child_2nd versus NewP	464.09***	.34***	−359.04***	−.32***	20.22	.13
Rate of change						
Husbands	−199.52**	−.23**	52.09	.07	−13.45**	−.16**
7. NonP versus NewP	−36.45	−.03	54.36	.05	12.67	.09
8. NonP versus child_2nd	193.22**	.13**	34.32	.03	5.48	.03
9. Child_2nd versus NewP	−229.67**	−.17**	20.04	.02	7.19	.05
Wives	−130.32*	−.15*	68.47	.10	8.91	.10
10. NonP versus NewP	−282.15***	−.22***	223.02**	.21**	−21.78*	−.17*
11. NonP versus child_2nd	−115.49	−.08	121.08	.09	−13.97	−.09
12. Child_2nd versus NewP	−166.65**	−.13**	101.94	.09	−7.81	−.05
Multivariate hypothesis tests (spousal comparisons)						
1 versus 4	$\chi^2(1) = 1.93$		$\chi^2(1) = 3.54$		$\chi^2(1) = .01$	
2 versus 5	$\chi^2(1) = .99$		$\chi^2(1) = .48$		$\chi^2(1) = .05$	
3 versus 6	$\chi^2(1) = .11$		$\chi^2(1) = 1.59$		$\chi^2(1) = .01$	
7 versus 10	$\chi^2(1) = 5.65$**		$\chi^2(1) = 3.10$		$\chi^2(1) = 10.23$**	
8 versus 11	$\chi^2(1) = .8.93$**		$\chi^2(1) = .81$		$\chi^2(1) = 3.05$	
9 versus 12	$\chi^2(1) = .61$		$\chi^2(1) = 1.45$		$\chi^2(1) = 1.97$	

MVPA, moderate to vigorous physical activity; β, standardized beta; NonP, non-parent; NewP, new parent; child_2nd, parent with a 2nd child

* $p < .05$; ** $p < .01$; *** $p < .001$

without children engaged in significantly more sedentary minutes at baseline compared to couples expecting a 2nd child (husband β = −.36; wife β = −.25), and parents expecting their first child engaged in significantly more sedentary minutes than couples expecting a 2nd child (husband β = .30; wife β = .34). In terms of change, results showed that first-time mothers decreased their sedentary minutes significantly more than women without children (wife β = −.22; see Fig. 1a), however, this was not the case for husbands (husband β = −.03) and the multivariate hypothesis test confirmed this relationship was significantly stronger for the wives $\chi^2(1) = 5.65$. Further, Fig. 1c shows that husbands without children decreased their sedentary minutes significantly more than husbands with a 2nd child (husband β = .13), whereas there was no difference for wives (β = −.08). The multivariate hypothesis test confirmed this relationship was significantly stronger for the husbands $\chi^2(1) = 8.93$. Finally, husbands and wives with their first baby decreased their sedentary minutes significantly more than their 2nd child counterparts (husband β = −.17; wife β = −.13; see Fig. 1b, d).

Light intensity minutes

Table 2 shows that husbands engaged in significantly more light intensity minutes compared to their wives at baseline (multivariate hypothesis test: $\chi^2(1) = 7.34$), however, the increase in light intensity minutes was significantly larger for the wives (multivariate hypothesis test: $\chi^2(1) = 8.56$. Similar to sedentary minutes, the husbands and wives baseline minutes of light intensity were significantly and positively correlated to each other (r = .70) as were their slopes (r = .61) indicating that their own increase in light intensity activity was significantly associated with their partners' increase. With respect to the parental comparisons, results showed that couples expecting a 2nd child engaged in significantly more light activity compared to couples without children (husband β = .31; wife β = .24),

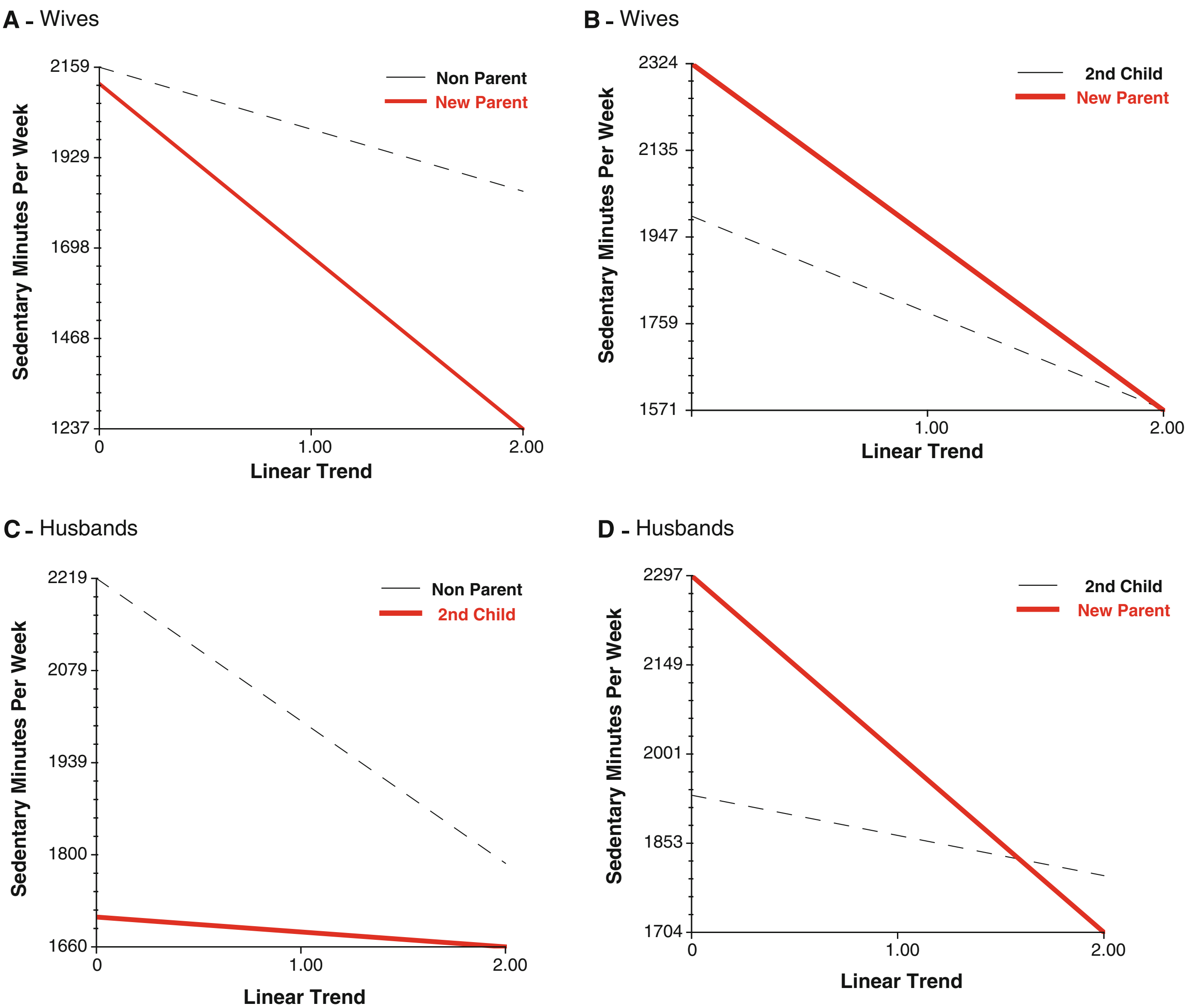

Fig. 1 Wives and husbands rate of change for sedentary behavior by parental status

however, only wives expecting a 2nd child engaged in significantly more light activity compared to wives expecting their first baby (wife $\beta = -.32$). Finally, first-time mothers increased their light minutes of activity significantly more than wives without children (wife $\beta = .21$).

MVPA minutes

Table 2 shows that husbands and wives had similar baseline levels of MVPA minutes that were significantly correlated to each other (r = .47), however, neither showed a significant change in MVPA minutes over time. In terms of parental comparisons, Table 3 shows that couples without children engaged in significantly more minutes of MVPA at baseline compared to parents with a 2nd child (husband $\beta = -.23$; wife $\beta = -.20$). Finally, first-time mothers showed a significantly larger decrease in minutes of MVPA compared to women without children (wife $\beta = -.17$), which was not present for husbands (husband $\beta = .09$). The multivariate hypothesis test confirmed this relationship was significantly stronger for the wives $\chi^2(1) = 10.23$.

Discussion

One of the most important declines for physical activity behaviors may be during early adulthood. The lifestyle changes created from the onset of parenthood have been suggested as a likely cause (Allender et al., 2008). The purpose of our study was to examine the physical activity and sedentary behavior profiles of three cohorts of couples (couples without children, first-time parents during the first year of their parenthood experience, and second time parents) across the first 12 months of the onset of new parenthood. To our knowledge, this is the first longitudinal study to objectively assess physical activity and sedentary behavior in the transition to parenthood, and the first study to examine the role of the couple as a dyad in physical activity change across time.

It was hypothesized that parents would demonstrate lower sedentary behavior profiles than non-parents, and that second-time parents may exhibit even lower sedentary behavior patterns than first-time parents due to the additional activities and workload that may come with multiple children. These differences were expected to manifest in higher light activity and lower sedentary behavior for parents. Our findings showed some support for these hypotheses. At baseline, parents with children in the home were less sedentary than couples without children or couples expecting their first child, independent of gender. These parents also showed more light intensity activity than the couples without children. Both effects were in the medium effect size range (Cohen, 1992) suggesting that the differences would be quite easy to observe at a clinical level of importance and support prior research on this topic (Candelaria et al., in press; Grace et al., 2006; Pereira et al., 2007; Rhodes et al., 2012; Scharff et al., 1999; Sternfeld et al., 1999; Verhoef & Love, 1994).

A strength of this study was using a longitudinal design to examine change in couples across time. In terms of sedentary behavior change, males showed an overall decrease with non-parents having the largest decrease. No changes in light activity were identified. This was contrary to our hypotheses. Women, however, showed changes in the hypothesized direction. First-time mothers showed a marked decrease in sedentary behavior across the 12 months in comparison to the other two groups. The finding paralleled an increase in light activity across time for first-time mothers in comparison to the other two groups of females. The results are interesting because they highlight the shift from sedentary behavior to light activity by first-time mothers, presumably as they attend to the daily workload of infant care. In our sample, 85 % of mothers were on 12 month maternity leave or equivalent. It may be that new fathers did not change because their basic routines did not shift. An examination of these behaviors over the subsequent years would be helpful as mothers re-enter the workforce after their 12 month maternity leave. The baseline results of parents already with children suggested limited gendered difference, so it may be that both parents negotiate comparable childrearing or household chores following this year of leave. Further, the extent to which an increase in light activity would be observed among mothers in other countries where women return to work during the first year is unclear.

Taken together, the results show basic support for the premise that parenthood necessitates shifts in lifestyle that result in lower sedentary behavior and higher daily light activity. The results did not appear to be sensitive to the onset of multiple children, but rather the presence of young children in the home. The findings suggest that interventions that address sedentary behaviors may not need to target parents of young children at the same level of importance of couples without young children (Rhodes et al., 2012).

It was also hypothesized that couples without children would show higher MVPA compared to parents. Our baseline results supported this hypothesis, with both fathers and mothers (i.e., couples expecting their second child) showing lower bouts of MVPA per week than couples without children. The effect size was in the medium range, which is commensurate with meta-analytic results of parents compared to non-parents and MVPA (Bellows-Riecken & Rhodes, 2008). Indeed, 54 % of couples without children and 46 % of expectant couples were meeting Canadian guidelines (Canadian Society for Exercise Physiology, 2011) of 150 MVPA minutes, yet only 34 % of parents were meeting guidelines at baseline. To our knowledge, however, this is the first accelerometry assessment of MVPA that has found support for the relationship with parenthood. It is also interesting to note that the relationship was similar for both males and females, suggesting that fathers were less active compared to males without children. While the relationship between motherhood and low MVPA has seen considerable attention, this research adds to recent evidence that shows fathers are inactive when compared to males without children (Berge et al., 2011; Hull et al., 2010).

The longitudinal change analysis of MVPA, however, showed less variation than the baseline comparisons across groups. In terms of MVPA and emergent motherhood, first-time mothers showed declines in total bouts across time in comparison to women without children and mothers with their second child. No significant additional decreases were present with mothers of second children, although the trends were for decreases in comparison to women without children. The MVPA results, overall, suggest some potential declines for first-time mothers but most of these data show limited change across 12 months. The results add to a pattern of mixed significant (Burke et al., 2004) or null (Sjogren et al., 2011; Umberson et al., 2011; Urizar et al., 2005) findings for lower MVPA following the onset of parenthood.

Analyses by gender and parental status proved important during this longitudinal assessment, because it showed that first-time mothers begin to resemble the activity patterns of parents who had children at baseline. Still, another novel component of these analyses was the consideration of the couple as a dyad. The medium to large (Cohen, 1992) correlations across sedentary behavior, light activity, and MVPA clearly demonstrate that couple behavior is generally in tangent. Thus, while the specific results by parental status and gender point to targeted interventions toward first-time mothers for MVPA, and couples without children for sedentary behavior, the couple may be the best overall target for these interventions.

Although this study had several methodological strengths, including direct assessment of physical activity and homogenous assessment of three 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 the averages for the Canadian population, suggesting there may have been selection bias during the recruitment of participants. Given this data limitation, it is likely that changes in physical activity across time may be even larger for a population with lower baseline physical activity status because our non-random sample presumably possessed high initial motivation for health. Additionally, less active populations will likely find it even more difficult to escape their inactivity with the onset of pregnancy. Second, the longitudinal nature of the study is a strength, but a longer time frame may show even larger heterogeneity in physical activity and sedentary behavior as time elapses. The extant literature on parenthood and physical activity suggests that the first 5 years is among the largest decline in activity (Rhodes et al., 2008) so a longitudinal study over 5 years may show even larger differences. Finally, the baseline assessment of accelerometry for female expectant parents was during pregnancy and this may impact real baseline scores of physical activity. Still, first- and second-time mothers did not differ on their months of pregnancy and yet the baseline activity profiles of first-time expectant mothers matched women without children more than the group of second-time expectant mothers. This suggests that the assessments during pregnancy may not have had a particularly noteworthy biasing of these data.

In summary, our findings showed that parents who were expecting their second child were less sedentary, had higher light intensity activity yet lower MVPA, compared to couples without children and couples expecting their first child at baseline. Mothers of their first child changed their physical activity patterns to match the profiles of parents who were now parenting two children across the first 12 months of child-rearing. Still, the physical activity profiles and subsequent changes across 12 months were very dependent on the couple, with couples tending to change their physical activity profiles in tangent. These results provide some support for MVPA interventions targeting new mothers in early parenthood, and parents compared to non-parents overall. The results also suggest that parents may not need to be the target of interventions to reduce -sedentary time. Overall, physical activity interventions focused at the level of the couple may be more efficacious than at the individual parent regardless of type of parenting profile.

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