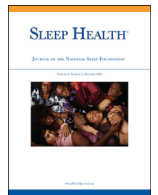




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The influence of sleep and movement on mental health and life satisfaction during the transition to parenthood



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ABSTRACT

Objectives: This study assessed whether sleep and physical activity impact mental health and life satisfaction across the transition to parenthood. This study assessed the impact of parenthood on mental health of new parents and parents expecting their second child, and whether change in mental health occurred dyadically across couples.

Design: Longitudinal 12-month study.

Participants: One hundred and fifty-seven couples (N = 314) between the ages of 25 and 40, who were not expecting to have a child (n = 102), expecting their first child (n = 136), or expecting their second child (n = 76) were recruited.

Measurements: Participants completed measures at baseline, 6 months, and 12 months. Sleep was assessed with how often participants met sleep guidelines (7–9 hours). Physical activity was measured objectively via accelerometers. *Mental health* was measured using 6 items from the short form-12 Quality of Life Survey. Life satisfaction was assessed with the Satisfaction with Life Scale (5 items).

Results: Mental health was not predicted by physical activity but was predicted by sleep. Sleep at 6 months was positively related to mental health at 6 months ($\beta = 0.156, p < .001$), and sleep at 12 months was positively related to mental health at 12 months ($\beta = 0.170, p < .001$). The change in mental health did not occur dyadically: mental health increased for women but not for men across groups. Mental health was positively related to life satisfaction at 6 months ($\beta = 0.338, p < .001$) and 12-months ($\beta = 0.277, p < .001$).

Conclusions: For new and established parents, getting sufficient sleep plays an important role in mental health and, in turn, life satisfaction

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Introduction

The transition to parenthood is often a celebrated event, with the expectation of diverse emotional rewards. These include the joy of becoming parents and personal growth, fulfillment, and happiness.¹ However, early parenthood also brings the challenge of combining new care responsibilities with other life obligations such as a career, other family commitments, and health maintenance.^{2,3} Other research shows that parenthood is associated with increased

psychological stress;⁴ increased risk for mood disorders, such as postpartum depression⁵ and reduced quality of life and life satisfaction.¹

Life satisfaction is an indicator of subjective well-being, which is a key dimension of mental health. Life satisfaction can be particularly reduced during the early stages after birth, when infant care requirements are intensive, especially among women.⁶ After birth of a second child, fathers' life satisfaction tends to increase, whereas mothers' life satisfaction tends to decrease.⁶ The transition to parenthood is critical for health, as new parents undergo significant changes across multiple domains, including neurobiological, psychosocial, and behavioral. In addition, for established parents, the birth of a second child may be associated with decreases in life satisfaction. Thus, new and established parents could benefit from strategies to improve mental health and life satisfaction.

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While the demands of early parenthood may reduce mental health and life satisfaction, little research has examined how health behaviors may contribute to these trajectories. Health behaviors such as physical activity are important contributors not only to physical health,⁷ but also to mental health, such as reduced risk of anxiety and depression⁸ and increased well-being.⁹ Physical activity positively predicts life satisfaction across the lifespan.¹⁰ Being physically active promotes well-being, quality of life, and mental health, reducing depression and anxiety.¹¹ Indeed, physically active adults report lower incidence of mental health problems.¹² Parents are less physically active than nonparents,¹³ which could impact their mental health. Changes in both personal and couple leisure time may be one explanation for the variability in how individuals adapt to parenthood. Parents adapt their leisure time to the demands of parenting; this may contribute to health behavior and lifestyle changes, such as reduced physical activity.¹³ Physical activity may be especially important during the transition to parenthood, as this time is characterized by significant change, marked by increased responsibility, new roles, and changes in life circumstances.

Another significant health behavior that changes during parenthood is sleep. Sleep is a critical health behavior that influences both mental and physical health, and sleep deprivation can contribute to the development of mental health problems.¹⁴ New parents are significantly more likely to report insufficient sleep than the general population,¹⁵ and sleep disturbance remains elevated during pregnancy and the postpartum period for a significant proportion of new mothers¹⁶ and new fathers.¹⁷ Disruptions in sleep are associated with severity of depression symptoms in both new mothers¹⁸ and new fathers.^{17,18} In addition, parental sleep problems in the first 6 months postpartum appear to exacerbate postpartum depression over the first year after birth and help explain the transmission of depression within couples.¹⁸ Even partial sleep deprivation influences mental health symptoms, subjective mental health, and positive affect.^{19,20} This impact is seen in as little as 2 days of partial sleep deprivation, which occurs with even just 2 hours less sleep per night.²⁰ Exhaustion from sleep deprivation may also compromise other health behaviors such as physical activity and exercise.⁴² The role of health behaviors in the relationship between parenthood and mental health is not well-understood.

According to family systems theory,²¹ anything that affects one member of the family will affect all other members of the

family; as such, changes in one partner's subjective mental health may influence changes in their partner's mental health. Research has demonstrated concordance between couples' physical and mental health.²² In parenthood, postpartum depression symptoms are positively correlated within couples,⁵ and paternal postpartum depression is strongly predicted by maternal postpartum depression.²³ However, the relationship between change in overall subjective mental health of fathers and mothers over the transition to parenthood is not well understood.

Little work has linked the potential moderating role of health behaviors such as sleep and physical activity between mental health and parenthood. The first aim of this study is to examine whether movement and lifestyle factors, such as physical activity, and sleep influence mental health, which, in turn, is associated with life satisfaction (See Fig. 1 for the proposed model). Based on previous research that indicates that partial sleep deprivation can impact mental health in as little as two days and that physical activity can lead to mood enhancement almost immediately after exercise, lifestyle variables have been placed proximally to mental health. Specifically, the model proposes that physical activity and sleep will influence mental health during the same time frame of measurement, as opposed to earlier measurements of physical activity and sleep impacting mental health six months later. Based on research demonstrating that physical activity and sufficient sleep have positive impact on mental health, we hypothesize that physical activity will be positively associated with mental health and that lack of sleep will be negatively related to mental health in new and second time parents, compared to couples without children.²⁰

The second aim of this study is to examine the degree and rate of change in mental health (ie, perceived mental health at baseline, 6 months and 12 months) in the transition to parenthood between couples without children, first time parents, and parents expecting their second child. The third aim of the study is to assess whether change in mental health is dyadic between partners. Based on past research, we hypothesize that new parents' mental health will worsen over the transition to parenthood and that this will occur similarly for both parents. There is a paucity of research investigating the impact of physical activity on mental health and life satisfaction in the transition to parenthood. Beyond sleep, potential moderators of the relationship between birth of a child, health behaviors, mental health, and life satisfaction are largely understudied.

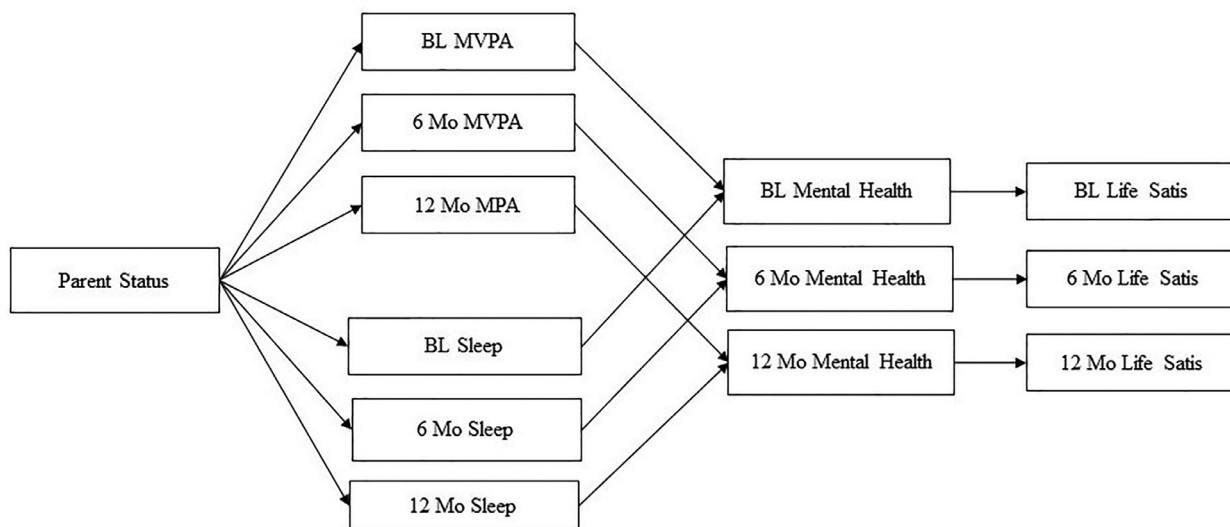


Figure 1. Proposed model of the relationships between parent status, sleep, physical activity, mental health, and life satisfaction. BL, baseline; MTH, month; MVPA, moderate to vigorous physical activity.

Participants and methods

The participants in this study are part of a larger study. Previous publications using this data set have examined motivation for healthy eating during parenthood,² physical activity and sedentary behavior,³ and the impact of housework on physical activity in new parents.²⁴ This current study includes physical activity as previously reported in Rhodes et al.³ and Divine et al.;²⁴ however, unique variables to this study include the amount of sleep and the main mental health outcomes.

One hundred and fifty-seven couples (N = 314) between the ages of 25 and 40 were recruited. Participants included those who were not expecting to have a child (n = 102), expecting their first child (n = 136), and established parents expecting their second child (n = 76). Participants were excluded if they were single parents and/or were mothers with health complications during pregnancy (eg, gestational diabetes, pre-eclampsia).

Procedures

Greater procedural details for this study have been extensively described in other papers.^{2,3,25} Briefly, participants were recruited from January, 2007 to December, 2011 through advertisements on public notice boards (eg, coffee shops, retail outlets, medical clinics) and online (eg, parenthood lists and craigslist.com). Physical activity, mental health, and amount of sleep were measured at 3 time points: during pregnancy (baseline), 6 months after birth (6 months) and 12 months after birth (12 months). The average gestational age at time of baseline assessment was 5.75 (1.96) months for women expecting their first child and 5.70 (2.08) months for women expecting their second child. Couples without children were assessed every 6 months (baseline, 6 months and 12 months). The study was approved by the Human Ethics Review Board at the University of Victoria, and all participants signed written informed consent.

Measures

Participants self-reported their age, gender, parent status, the highest level of education, and annual household income at baseline.

Amount of *sleep* was assessed with one item for the Pittsburgh Sleep Quality Index,²⁷ asking participants to record the average number of hours of actual sleep they got at night over the last month. Participants were then categorized as meeting sleep guidelines of 7–9 hours⁴³ as yes or no.⁴³

Physical activity was measured objectively using the GT1M Activity monitor. Participants wore the activity monitor for 7 consecutive days at baseline, 6 months, and 12 months. Detailed procedures for activity monitor wear and data handling have been described previously with this sample.³ The GTMI activity monitor has been shown to provide reliable and valid measures of physical activity.²⁶

Life satisfaction was measured with the Satisfaction with Life Scale (SWLS),²⁸ which consists of 5 items and asks participants how they feel about their life right now (eg, “I am satisfied with my life”) on a 7-point Likert scale (“strongly disagree” to “strongly agree”). Scores range from 5 to 35, with higher scores indicating greater life satisfaction. The SWLS has strong psychometric properties,²⁸ with a Cronbach's $\alpha = 0.84, 0.83, 0.85$ for the three time points, respectively, in the current study.

Mental health was measured using the Short form-12 Part of the Health Survey,²⁹ which consists of 12 items measuring mental and physical health. For the purpose of this study, we used 6 items that relate to mental health, measuring energy (“I have a lot of energy”), social time (“Health interferes with social activities”), roles (“Accomplished less than you would like” and “Didn't do activities as carefully as usual” – scored as yes or no), and mental health (“Felt calm and peaceful” and “Felt downhearted and blue.”). Most items are scored on a

Likert scale from “none of the time” to “all of the time,” except those associated with roles, as noted above. Scores can range from 0 to 100, with higher scores indicating more positive mental health. The mental health scale was reliable: Cronbach's $\alpha = 0.81, 0.85, 0.83$ in the current study.

Life satisfaction was measured with the Satisfaction with Life Scale (SWLS),²⁸ which consists of 5 items and asks participants how they feel about their life right now (eg, “I am satisfied with my life”) on a 7-point Likert scale (“strongly disagree” to “strongly agree”). Scores range from 5 to 35, with higher scores indicating greater life satisfaction. The SWLS has strong psychometric properties,²⁸ with a Cronbach's $\alpha = 0.84, 0.83, 0.85$ for the three time points, respectively, in the current study.

Statistical analysis

We used a maximum likelihood approach to conduct multigroup (couples without children, new parents, and established parents) latent growth curve modeling in SPSS Amos (v. 26) with distinguishable dyads (ie, couples). We examined the initial level (intercept) and change (slope) in mental health over time between men and women. Linear change was assessed over the 3 time points. The variance around the slope and intercept was also modeled. To assess dyadic relationships, the covariance between men's and women's mental health scores at all 3 time points was modeled. Husband's and wife's growth parameters were estimated within the same analytical structural equation model.

To determine whether meeting guidelines for sleep and moderate to vigorous physical activity (MVPA) are associated with mental health, which, in turn, is associated with levels of life satisfaction, a longitudinal path analysis was conducted. Dummy variables were created to compare relationships across the 3 groups. Two models were conducted, one comparing new and established parents to couples without children (model 1) and a second comparing established parents to new parents (model 2). In model 1, two dummy variables were coded as 1, established parents = 0, and couples without children as 0. For the second dummy variable (D3) established parents were coded as 1, new parents as 0, and couples without children as 0. The comparative variable in this model was couples without children. By using 2 dummy coded variables in each model, we are able to isolate each examination of parent status. Specifically, in model 1, results for D2 allow us to compare the relationship between sleep and physical activity on mental health between new parents and couples without children. Findings for D3 allow us to compare relationships between established parents and couples without children. A negative *Beta* coefficient indicates that new parents (D2) or established parents (D3) are less likely to meet the sleep and/or physical activity guidelines than couples without children (comparative variable), whereas a positive *Beta* coefficient indicates that new parents or established parents are more likely to meet the sleep or physical activity guidelines than couples without children. In model 2, the first dummy variable (D1) in the model was coded as couples without children = 1, new parents = 0, established parents = 0. The second dummy variable in the model was D3. The comparative variable in this model was new parents. In this model, D3 allows us to compare relationships between established parents and new parents. A negative *Beta* coefficient indicates that established parents (D3) are less likely to meet the sleep and/or physical activity guidelines than new parents (comparative variable), whereas a positive *Beta* coefficient indicates that established parents are more likely to meet the sleep or physical activity guidelines than new parents. Findings from D2 compared to new parents would be the same as model 1 that compared new parents to couples without children. Magnitude of relationships was determined using Cohens *d* standards of > 0.2 small, > 0.5 medium, > 0.8 large effects. Maximum likelihood estimation was

Table 1
Participant characteristics across parent status and gender

	Non-parent (n = 102)		New-parent (n = 136)		Established-parent (n = 76)	
	Women	Men	Women	Men	Women	Men
Age \pm SD	27.52 \pm 5.12	29.65 \pm 5.34	31.15 \pm 4.75	33.10 \pm 4.71	32.31 \pm 3.92	34.34 \pm 4.91
% Visible minority	6	6	5.6	6	8	8
% Income > 75,000	43	39	63	63	52	52
% Completed university	69	62.5	83	70.6	81	56
BMI \pm SD	22.65 \pm 2.89	25.48 \pm 3.66	24.90 \pm 3.14	26.18 \pm 3.51	24.49 \pm 4.26	26.18 \pm 3.51

BMI, body mass index.

used to estimate parameters. Model fit was determined when the comparative fit index (CFI) was > 0.90 and the root mean square error of approximation (RMSEA) < 0.08.³⁰

The study was powered for primary analysis in Rhodes et al.,³. The current study is secondary data analysis. For path analysis a widely accepted rule of thumb is 10 cases per indicator variable as a lower bound for an adequate sample size. The dyadic analysis has 6 observed variables, indicating that we require a minimum sample size of 60 for each group. The sample size for couples without children n = 102, new parents n = 136, and established parents n = 76. For the path analysis assessing associations between parent status, sleep, physical activity, and mental health, the model has 13 observed or measured variables, indicating that we would need a minimum of n = 130 cases for adequate sample size.

Results

Couples without children were younger and had lower incomes than new parents and established parents (Table 1). Descriptive statistics for sleep, physical activity, mental health, and life satisfaction for male and female participants across parent status is presented in Table 2. Attrition rate at 6-month and 12-month data collection was 8% and 10%, respectively. Details about attrition in this sample have been covered extensively in previous publications with this sample.^{2,3}

Path analysis of predictors of health behaviors and subsequent mental health

Both path analysis models (models 1 and 2) demonstrated acceptable model fit (model 1: CFI = 0.943, IFI = 0.93, RMSEA = .070, Fig. 2; model 2: CFI = 0.930, IFI = 0.932; RMSEA = 0.069, Fig. 3).

Comparing new parents and established parents to couples without children (model 1)

Meeting sleep and physical activity guidelines

There were small to medium effects of parent status on sleep and physical activity behaviors. New parents were significantly less likely to be meeting sleep guidelines at 6 ($\beta = -0.229, p < .001$) and 12 ($\beta = -0.226, p < .001$) months compared to couples without children. Established parents were also significantly less likely to meet sleep guidelines than couples without children at baseline ($\beta = -0.221, < .001$), 6 months ($\beta = -0.408, < .001$), and 12 months ($\beta = -0.320, < .001$); and new parents at baseline ($\beta = -0.236, p < .001$) and 6 months ($\beta = -0.171, p = .003$), but not 12 months ($\beta = -0.091, p = .120$) after birth.

Influence of sleep and physical activity on mental health and life satisfaction. For model 2 comparing new and established parents to couples without children. There were small but significant relationships between sleep and mental health. Specifically, sleep at 6 months was positively related to mental health at 6 months ($\beta = 0.156, p < .001$), and sleep at 12 months was positively related to mental health at 12 months ($\beta = 0.170, p < .001$). However, there was not a significant relationship between sleep and mental health at baseline ($\beta = 0.084, p = 0.132$). Mental health was positively related to life satisfaction at 6 months ($\beta = 0.338, p < .001$) and 12 months ($\beta = 0.277, p < .001$) but not at baseline ($\beta = 0.046, p = .246$). There were no significant relationships between physical activity and mental health.

Comparing established parents to new parents (model 2)

Meeting sleep and physical activity guidelines. There were small effects between new and established parents for physical activity and sleep. Established parents were significantly less likely to be meeting sleep guidelines baseline ($\beta = -0.236, p < .001$) at 6 ($\beta = -0.171, p <$

Table 2
Means and standard deviations for mental health, physical activity, sleep and life satisfaction across parent status and gender

	Non-parent (n = 102)		New-parent (n = 136)		Established parent (n = 76)	
	Women	Men	Women	Men	Women	Men
BL mental health	63.02 \pm 8.43	61.38 \pm 7.54	60.08 \pm 7.98	65.00 \pm 7.68	61.91 \pm 7.95	64.02 \pm 8.72
6 MTH mental health	67.96 \pm 11.60	68.64 \pm 13.97	65.63 \pm 14.35	68.42 \pm 13.91	62.90 \pm 12.66	64.92 \pm 15.73
12 MTH mental health	68.77 \pm 10.49	68.73 \pm 12.99	66.22 \pm 16.63	67.92 \pm 12.62	66.79 \pm 13.44	67.73 \pm 13.54
BL life satisfaction	27.59 \pm 4.63	25.30 \pm 5.68	27.67 \pm 5.06	27.13 \pm 5.23	27.44 \pm 5.05	26.08 \pm 5.58
6 MTH life satisfaction	27.47 \pm 4.41	26.35 \pm 4.63	27.86 \pm 4.87	26.69 \pm 5.32	27.35 \pm 5.00	26.69 \pm 5.32
12 MTH life satisfaction	27.67 \pm 4.28	26.24 \pm 4.85	27.96 \pm 4.56	26.59 \pm 4.61	27.10 \pm 5.11	26.49 \pm 4.92
BL sleep %	94	92	91	88	68	74
6 MTH sleep %	90	94	65	73	42	61
12 MTH sleep %	90	92	66	70	61	58
BL MVPA	146.60 \pm 97.98	144.36 \pm 151.76	116.62 \pm 112.23	121.24 \pm 107.04	113.61 \pm 90.29	114.54 \pm 112.81
6 MTH MVPA	174.46 \pm 98.95	140.71 \pm 128.08	135.35 \pm 92.37	125.15 \pm 91.20	86.9 \pm 92.78	69.28 \pm 83.94
12 MTH MVPA	145.75 \pm 105.47	119.65 \pm 121.61	106.89 \pm 78.70	124.58 \pm 101.88	64.61 \pm 48.33	47.97 \pm 49.95

BL, baseline; MTH, month; MVPA, moderate to vigorous physical activity.

Sleep % refers to percentage of participants meeting sleep recommendations of 7-9 hours per night.

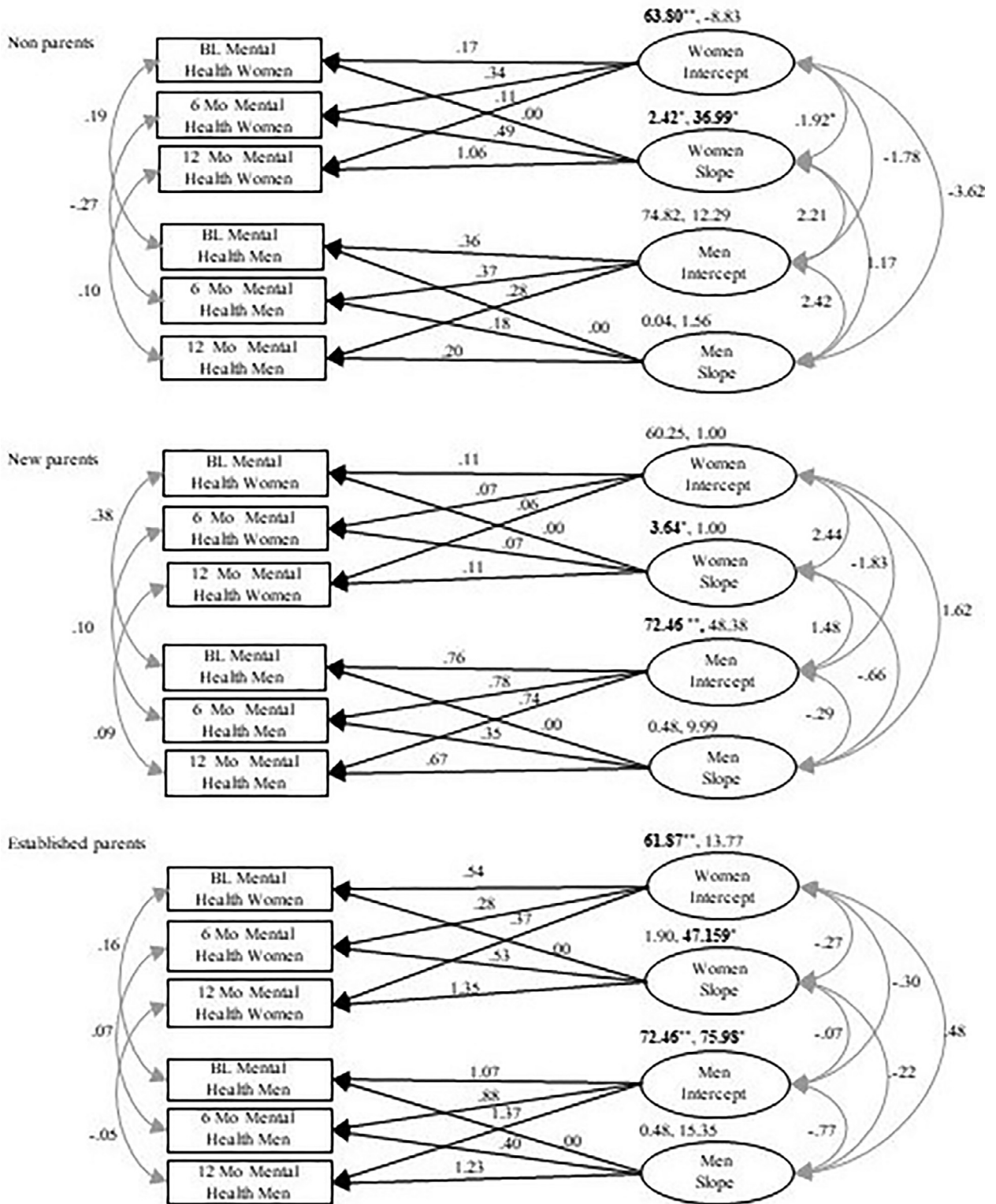


Figure 2. Results of the dyadic growth curve model for couples without children, new parents and established parents. For slope and intercept, the unstandardized values and variances are presented. Significant values are in bold and level of significance is denoted with ** for $p < .001$, and * for $p < .05$. BL, Baseline; MTH, month; MVPA, moderate to vigorous physical activity; Standardized β , standard error presented.

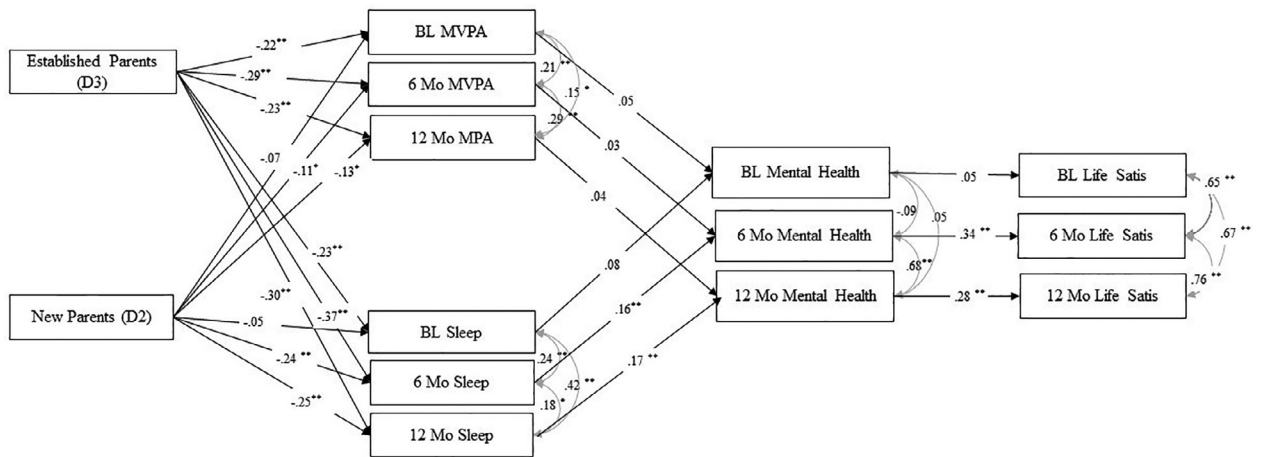


Figure 3. Results of the path analysis model (model 1) assessing movement factors predicting mental health comparing new parents and established parents to couples without children. Note: Model 1. D2 = dummy variable where new parents = 1, established parents = 0, couples without children = 0; D3 = dummy variable where established parents = 1, new parents = 0, couples without children = 0, comparative variable = couples without children. Standardized Beta value presented. Significance is denoted with a * $p < .05$, and ** $p < .001$. BL, Baseline; MTH, month; MVPA, moderate to vigorous physical activity; satis, satisfaction.

.001) but not at 12 ($\beta = -0.091, p = .120$) months compared to new parents. Established parents were also significantly less likely to meet physical activity guidelines that new parents at baseline ($\beta = -0.161, p = .007$), 6 ($\beta = -0.203, <.001$) and 12 months ($\beta = -0.122, p = .041$).

Influence of sleep and physical activity on mental health and life satisfaction. There were small significant relationships between sleep and mental health. Specifically, sleep at 6 months was positively related to mental health at 6 months ($\beta = 0.164, p < .001$), and sleep at 12 months was positively related to mental health at 12 months ($\beta = 0.177, p < .001$). However, there was not a significant relationship between sleep and mental health at baseline ($\beta = 0.052, p = .132$). Mental health was positively related to life satisfaction at 6 months ($\beta = 0.338, p < .001$) and 12 months ($\beta = 0.277, p < .001$) but not at baseline ($\beta = 0.046, p = .246$). There was no significant relationship between physical activity and mental health.

Dyadic growth curve The model demonstrated adequate fit (CFI = 0.86, IFI = 0.90, and RMSEA = 0.08, Fig. 4). For women without children there was a significant improvement in mental health (intercept = 63.8, $p < .001$; slope 2.43, $p = .010$), but not for men

without children (intercept = 74.82, $p < .001$; slope 0.37, $p = .974$). This means that for women without children, mental health is expected to improve 2.43 points on the scale at each time point starting from 63.8 (intercept) at the initial time point. The same pattern was seen in new parents, with an improvement in mental health among new mothers (intercept = 60.26, $p < .001$; slope 3.64, $p = .001$) but not new fathers (intercept = 72.46, $p < .001$; slope 0.78, $p = .717$). New mothers' mental health increased by a 3.64 points at each time point, from a starting score of 60.26 (intercept). Among established parents there was a small improvement in mental health over time for women (intercept = 61.87, $p < .001$; slope 1.90, $p = .051$) but not men (intercept = 70.19, $p < .001$; slope 0.32, $p = .648$). Established mothers had an improvement in mental health by 1.90 points at each time point, from a starting score of 61.87. There was no change in mental health over time among men. Additionally, across all groups the covariance between the slope for mental health between men and women was not significant (without children, $r = -3.46, p = .053$; new parents, $r = -2.0, p = .851$; established parents $r = -10.35, p = .198$).

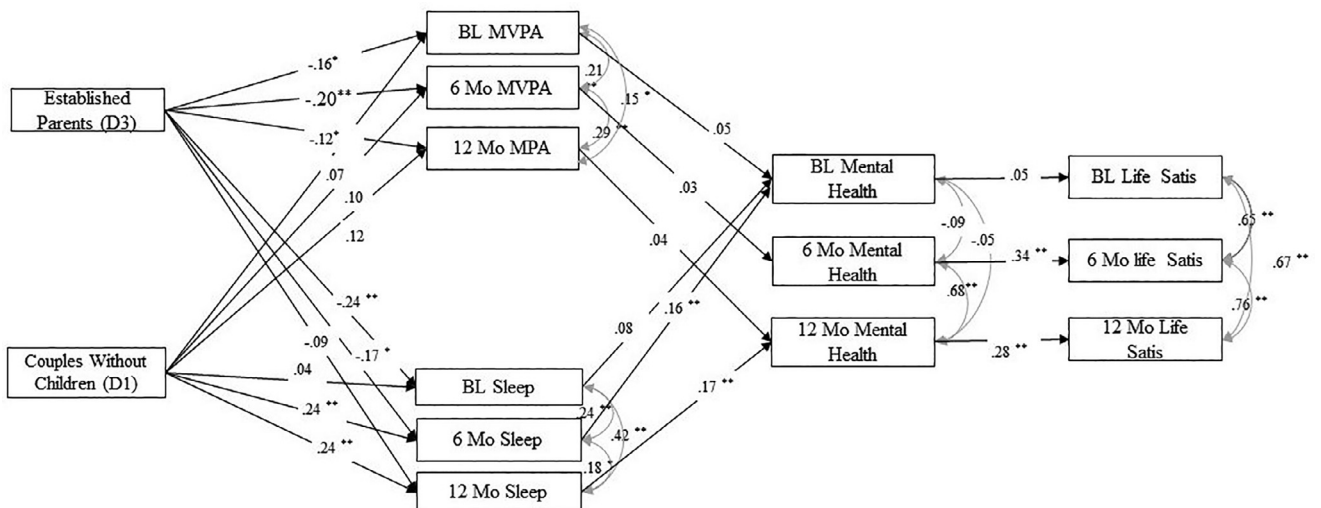


Figure 4. Results of the path analysis model (model 2) assessing movement factors predicting mental health compared to new parents. Note: Model 2. D1 = dummy variable was couples without children = 1, new parents = 0, established parents = 0; D3 = dummy variable where established parents = 1, new parents = 0, couples without children = 0, comparative variable = new parents. Standardized Beta value presented. Significance is denoted with a * $p < .05$, and ** $p < .001$. BL, Baseline; MTH, month; MVPA, moderate to vigorous physical activity; satis, satisfaction.

Discussion

Results of this study indicate that, for new and established parents, getting sufficient sleep results in better mental health. Earlier research showed that the transition to parenthood is not a discrete event, and emergent stressors tend to remain after the birth of a child; this can impact mental health of new parents over time.³¹ The first aim of the study was to assess the impact of sleep and physical activity on mental health and life satisfaction between couples with-out children, new parents, and parents expecting their second child. We also hypothesized that meeting physical activity and sleep guidelines would be associated with a positive impact on mental health. The hypothesis was not supported in terms of physical activity levels but was for sleep. Specifically, getting sufficient sleep was associated with positive mental health. The number of new and established parents meeting sleep guidelines decreased substantially between baseline and six months postpartum. This is consistent with previous research that has found significant sleep deprivation during parenthood.¹⁵ Importantly, we see this trend in reduced sleep not only for first time parents, but even more so for parents expecting their second child who were less likely than new parents to meet sleep guidelines after the birth of the child. This is consistent with previous studies, that found reduced sleep from six weeks to seven months post-partum (Bhati & Richards, 2015)⁴⁴ Not surprisingly, couples without children are more likely to meet sleep guidelines than new parents at six and 12 months and established parents during pregnancy, and six and 12-months post-partum. Although the number of parents meeting sleep guidelines decreased, the range of number of hours per night was from 2.50–10 hours, with a mean of 6.3 hours per night at baseline. This is just below the recommended number of hours of sleep, but we still found an impact on mental health. The findings suggest that even small decreases in the amount of sleep impact parents' mental health in the first year after birth. Although we did not assess mediating effects of parent status on the link between sleep and health, due to sample size limitations, especially for established parents, the findings suggest that new and established parents who are able to get the recommended amount of sleep for good health may experience positive impacts on their mental health. While findings suggest that sleep should be a priority for new parents, this is easier said than done while taking care of a newborn, who may wake parents up multiple times per night for feedings, and diaper changes. Thus, interventions may be useful to help address sleep problems early in the postpartum phase and to help prevent sleep problems from worsening. Given that parents' sleep is dependent on their baby's sleep patterns, potential strategies could involve improving the baby's sleep (e.g., cluster feeding at night) and developing good sleep habits (e.g., avoiding caffeine after a certain time).⁴⁵

With respect to physical activity, we hypothesized that physical activity will be positively associated with mental health in new and second time parents, compared to couples without children. Contrary to our hypothesis, meeting physical activity guidelines for MVPA did not significantly predict mental health in this study. As previously established in this sample,³ and in line with other research,¹³ couples without children were more active than new and established parents, with established parents being the least active group.³ Perhaps as physical activity decreases substantially with the transition to parenthood, parents are not getting enough moderate intensity activity to achieve mental health benefits. Thus, new parents may benefit from targeted physical activity promotion or programs to achieve established health benefits. Although sleep has important implications for mental health, the amount of sleep a parent gets is sometimes out of their control. Thus, physical activity may be an important target to improve mental health in parents.

The present study also examined the dyadic relationship between new mothers and fathers with respect to changes in their mental

health over the transition to parenthood. First, we hypothesized that new parents would experience worsening mental health over time and that mothers' and fathers' mental health trajectories would be related to each other. However, findings did not support this hypothesis. Rather, we saw that mental health improved from birth to 12 months postpartum for mothers but not for fathers. These findings align with some previous research findings that new mothers, on average, can benefit from parenthood compared to new fathers,³² yet contrast with findings reporting negative effects on mental health.^{4,5} Specifically, research has found that depressive symptoms occur for new mothers early in the postpartum period, whereas new fathers' depressive symptoms are often delayed and tend to follow new mothers' depressive symptoms.³³ Another explanation for the different findings between this study and previous research with mothers^{4,5} may be a result of measurement. The current study used a measure of subjective mental health, as opposed to mental health defined by depressive or anxiety symptoms used in much of the previous research;^{4,5} however, both approaches are measuring the same core constructs.

In contrast to our findings about parenthood and mental health among new mothers, our findings for men during the transition to parenthood echoes previous research that has shown no change.⁶ Thus, the current findings do not indicate that the change in mental health is occurring dyadically, in contrast to the assumptions of family systems approach.²¹ The differences in mental health change among men and women may relate to their roles and responsibilities in caring for their baby. Research on life events shows that people adapt to life events within 12 months.³⁴ Adjustment to the new roles and responsibilities of parenthood is associated with both positive and negative effects. This seems to be the case for women in this study, who experienced an improvement in perceived mental health at 6 months and 12 months postpartum. Perhaps for new mothers, the positive effects of parenthood outweigh the negative effects, resulting in positive changes in mental health. With respect to men in this study, these positive and negative effects might balance each other out, resulting in little or no change in perceived mental health. More focused qualitative research may help us to better understand the effects of parenthood on mental health.

Additionally, prior to becoming a parent, factors may have been present that could influence risk of poor mental health during the transition to parenthood. The current sample of new parents had lower weight, had completed more education,³⁵ and were more physically active³⁶ than the average Canadian population. Indeed, higher levels of education and physical activity³⁷ are associated with reduced mental health risk. Thus, it is possible that our sample had a bias towards health and less active populations may see a greater drop in physical activity over the transition to parenthood, which may affect their mental health largely.

The current findings indicate that perceptions of mental health at 6 and 12 months positively predicted life satisfaction at the same time points. Life satisfaction is a subjective, cognitive evaluation of an individual's life as a whole. Generally, parental status positively impacts women's life satisfaction.³⁸ Similarly, parenthood is associated with more happiness and life satisfaction for women but not men across European developed countries.³⁹ However, when defined as subjective well-being, cross-sectional and longitudinal research indicates that subjective well-being declines in a sustained way in response to parenthood.⁴⁰ The current findings highlight the importance of mental health in perceptions of well-being and life satisfaction.

This study includes several strengths that add to the literature. First, this study included new and established fathers, who are often excluded from parenting and health research. Relatedly, this study assesses the dyadic patterns of mental health change within couples, testing family systems assumptions that one partner's mental health

can influence the other partner's mental health. Third, this study uses a longitudinal assessment from before birth to 12 months postpartum. Past research has relied heavily on cross-sectional designs. Several limitations must also be considered. Previous research has indicated that parental sleep decreases during later pregnancy.⁴¹ Our assessments of baseline physical activity, sleep, and mental health for expectant parents were during later pregnancy, and prenatal sleep declines may have influenced our baseline assessment. Although changes in health behaviors such as reduced physical activity or disrupted sleep may have already been occurring during later stages of pregnancy, our findings still reflect patterns in sleep experiences during the transition to parenthood. This study also examined these relationships only in two parent heterosexual families; perhaps differences in dyadic changes in mental health would be found in same-sex couples. In addition, we used a convenience sample, and the sample was different on physical activity and related variables (eg, education, weight, income) than the average Canadian and may not be representative of the general population and may confound the associations in the analysis.

Conclusions

In conclusion, our findings indicate the importance of meeting sleep guidelines for the mental health and, in turn, life satisfaction of new and established parents. Practitioners should be aware of the relationship between sleep and mental health for new parents and discuss realistic sleep strategies. Mental health change was positive across time among women, especially for new mothers, with no change among fathers regardless of parental status. Physical activity was not related to mental health across parental status, yet the transition to parenthood is associated with substantial decreases in MVPA, and thus suggests an avenue for intervention among new parents to help improve physical health.

Declaration of competing interest

The authors have no conflicts of interest to declare

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:[10.1016/j.sleh.2022.06.013](https://doi.org/10.1016/j.sleh.2022.06.013).

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