Examination of physical activity, barriers, and wellbeing in mothers within one year of giving birth

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Abstract

Many new moms express a desire to be physically active but encounter a variety of barriers, such as lack of perceived social support. Different types of support might be needed for new mothers to be active (e.g., for exercise- or postpartum-related barriers). While social support (SS) has been shown to improve physical activity and well-being, there is a need to understand moderators of these relationships. Exercise-related cognitive errors (ECEs) bias how accurately individuals view their physical activity and might impact the support-activity relationship. It was hypothesized that ECEs and social support would interact to predict physical activity, barrier self-efficacy, and psychological well-being in the first year after giving birth. New moms (N= 268, M_{age}=29.96 years ± 6.12) completed a self-reported survey using the ECE questionnaire (ECE-Q), Social Support for Exercise scale (SSES; 2 subscales family and friends), a modified Postpartum Support questionnaire (PSSQ; 2 subscales: family and friends), Psychological Well-being scale (PWBS), barrier self-efficacy, and the short form International Physical Activity Questionnaire (IPAQ). SSES friends individually predicted physical activity bouts (B = .270, p < .001; R^2 =.06, p < .001) beyond covariates. SSES family (B = .219, p < .001) and the ECE-Q (B = .141, p = .025) predicted physical activity bouts (R^2 = .04, p < .001) beyond covariates. SSES from friends (B = .261, p <.001) and the ECE-Q (B = -.180, p = .002) predicted barrier-efficacy (R^2 = .03, p < .001) beyond covariates. SSES from family (B = .274, p < .001) and the ECE-Q (B = -.145, p = .014) predicted barrier-efficacy (R^2 = .02, p < .001) beyond covariates. SSES (B = -.288, p <.001) PSSQ (B = .490, p <.001) from friends and ECEs (B = -.121, p = .027) were predictors for PWBS (R^2 = .01, p < .001) beyond the covariates. PSSQ from family (B = .433, p < .001), and the ECE-Q (B = -.150, p = .007; predicted PWBS (R^2 = .02, p < .001) beyond covariates. None of the interactions were significant. While previous research has observed an interaction between SSES and ECEs in predicting physical activity bouts during pregnancy, the

current findings did not support this interaction after birth for new mothers. Findings underscore possible predictors of how new mothers view and overcome their physical activity barriers and of their wellbeing.

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SS	Social Support
ECE	Exercise- related Cognitive Errors
ECE-Q	Exercise- related Cognitive Error Questionnaire
SSES	Social Support for Exercise Scale
PSSQ	Postpartum Social Support Questionnaire
MVPA	Moderate to Vigorous Physical Activity
PWB	Psychological Well-Being

Introduction

Many new moms express that they want to engage in regular physical activity but encounter a variety of barriers that thwart their efforts. Examples of barriers include lack of perceived social support (Barkin et al., 2014), the inability or anxiety towards acquiring trustworthy and reliable childcare (Barkin et al., 2014; Evenson et al., 2009; Saligheh et al., 2016), fatigue (Bender, 2021; Evenson et al., 2009; Keller et al., 2006), lack of time and motivation (Bender, 2021; Carter-Edwards et al., 2009; Evenson et al., 2009; Saligheh et al., 2016) , overall costs of childcare (Barkin et al., 2014; Bender, 2021; Keller et al., 2006; Saligheh et al., 2016), transience (Barkin et al., 2014), environmental (Evenson et al., 2009; Bender, 2021), and organizational or policy (Everson et al., 2009; Vieten et al., 2018). These barriers add to the overall stress and anxiety towards the juggling act of taking care of one's own needs with the needs of caring for a newborn. Physical activity may provide an outlet for better managing these stress symptoms on top of providing a health positive role model for their children and limiting their risks of developing preventable diseases such as cardiovascular disease, type II diabetes, and obesity (Bellows-Riecken & Rhodes, 2008). During and after pregnancy, new parents see a decrease in activity levels that declines during pregnancy. For example, declines have been observed through the sixth month postpartum that on average halves their pre-pregnancy activity levels (Pereira et al., 2007). Given that physical activity tends to decline with new life transitions, like having children (Bellows-Riecken & Rhodes, 2008), the postpartum period may be a critical period to help mitigate physical activity reductions that might persist following pregnancy. The issue at hand involves comprehending and subsequently supporting mothers to overcome these perceived barriers to motivate physical activity and positive well-being. Physical activity guidelines for mothers are consistent with standard adult guidelines of 150 minutes a week of moderate or vigorous exercise (The Canadian Society for Exercise

Physiology, 2021). Most mothers see a decline in physical activity within pregnancy which can see a decrease with each sequential children (Bellows-Riecken & Rhodes, 2008; Nomaguchi and Bianchi, 2004). Most mothers do not meet physical activity guidelines and see a decline in physical activity within pregnancy which can see a decrease with each sequential children (Bellows-Riecken & Rhodes, 2008; Nomaguchi and Bianchi, 2004). The aim of this research was to understand social cognitive predictors (i.e., social support and cognitive biases) of barrier self-efficacy, physical activity, and positive well-being in the first year after giving birth.

Social Support

Social support is defined as the perceived availability of social resources such as comfort, care, assistance, and information a person may receive from others (Lox et al., 2019). In this way, social support can be thought of as a social network's provision of psychological and material resources intended to benefit an individual's ability to cope with stress (Cohen, 2004). Social support is thought to play a role in the risk for, progression of, and recovery from physical illnesses hypothesizing that those social relationships and the "norms" associated with their social groups influence health positive behaviors such as diet, exercise, smoking, alcohol intake, sleep, and adherence to medical regimes (Cohen, 1988). It is thought to affect mental and physical health through its influence on emotions, cognitions, and behaviors (Cohen, 1988). Positive perception of social support can act as a "stress buffer" allowing individuals to better cope with stress (Cohen, 2004). The stress buffering hypothesis suggests that social support is most predictive of behaviour when stress is high. When life is not very stressful and with few barriers, additional help or support may not be necessary for behavioural engagement. When life is not very stressful and with few barriers, additional help or support may not be necessary for behavioural engagement.. Within Cohen's (1985) model of social support, there are five different types of support that promote a buffer to stress and better management of the stressors within

their lives: instrumental, emotional, informational, companionship, and validation. In the context of postpartum mothers, high levels of instrumental and emotional social support have been linked in limiting the risk of postpartum depression and anxiety (Hopkins & Campbell, 2008). Instrumental support is defined as providing tangible and practical assistance that will help a person achieve certain goals such as driving someone to an appointment or by babysitting while someone achieves an important task. Emotional support is the provision of encouragement, caring, empathy, and concerning towards a person to help enhance their self-esteem, reduce anxiety, and provide acceptance and reassurance of self-worth. Informational support is the act of providing direction, advice, or feedback. This can be both formal sources of informational support (e.g. fitness trainers, health practitioners) or informal sources (family and friends providing their own experiences) (Cohen & Willis, 1985). Companionship support refers to the availability of people with whom you can engage in social activities with, within a physical activity setting, this could be someone who regularly accompanies group exercise sessions. Validation support is comparing one to others in order to validate one's thoughts, feelings, problems, and experiences are "normal". This validation provides a sense that the exerciser is not alone in the struggle to adhere to an exercise routine.

When a new mother does not have the necessary level of perceived support from family or friends, it may provoke increased levels of anxiety and depression as a response. Research has observed a negative relationship between perceived social support and reported rates of depression in mothers (Barkin et al., 2014; Hahn-Holbrook et al., 2013; Ritter et al., 2000; Hopkins & Campbell, 2008). Social support positively influences self-esteem and the decision to engage in health-positive behaviours (Chen et al., 2007). High anxiety and low social support might make it difficult to trust others to care for their children. In studies conducted by Barkin et al. (2014), Carter-Edwards et al. (2009), and Everson (2009), new mothers reported that they had

increased anxiety around finding trustworthy care to watch their children; some reported that they found it hard to even trust their husbands to be alone with their children.

Some of the most common barriers to physical activity seen in parents include lack of time, social support, fatigue, childcare, costs associated with both childcare and facility costs, environmental, and organizational or policy (Barkin et al., 2014; Bellows-Riecken & Rhodes, 2008; Bender, 2021; Everson et al., 2009; Keller et al., 2006; Saligheh et al., 2016; Vieten et al., 2018). When new mothers perceive they have enough social support, they perceive fewer barriers to health positive behaviours (Chen et al., 2007). Mothers have stated that they know the benefits to adopting a health positive lifestyle such as being more physically active, but feel they need to place the health of their child before themselves or else they feel guilty (Carter-Edwards et al., 2009).

Martos-Méndez (2015) examined social support in patients with chronic conditions; they found that social support and satisfaction with social support functioned as mediators of perceived self-efficacy regarding the patients managing their disease and adhering to treatment. Martos-Méndez also observed that those who perceive more support may feel more able to follow condition recommendations (diet and exercise) than those who perceive low support. Kaiser et al. (2016) found similar social support findings in women who had developed gestational diabetes mellitus throughout their pregnancy. Data collection was completed at end of pregnancy, 6 weeks postpartum and 6 months postpartum. They found that out of eight moderators tested, only two variables were determinants in low levels of health positive choices in the postpartum period: lower levels of social support and more perceived barriers to healthy lifestyle. This finding supports Cohen's stress buffering hypothesis that social support may be an important predictor to study, as it acts as a buffer to moderate the relationship between physical activity cognitions and behaviour. The stress buffering hypothesis suggests that social support

should be the most predictive and needed when stress is high, whereas social support may not be as predictive when stress is minimal (Cohen & Willis, 1985). That is, sufficient support can act as a buffer towards stressful events, decreasing the overall appearance of the stressor.

It may be important to examine social support based on who is providing the support. Yuksel et al. (2019) used a multidimensional measure of general social support from either their family, friends, and partners within pregnant women. It was found that high social support from their friends was most strongly related to their well-being (*r* of .36 from partner vs .32 from family vs .40 from friends). Abdollahpour and Keramat (2016) developed their own postpartum-related social support felt from family which was a direct predictor of new mother's well-being ($r = .20$). Da Costa and Ireland (2013) used the Social Support for Exercise Scale and reported at family support for exercise ($B = -.40$, $p = .009$). Unfortunately Abdollahpour and Keramat (2016) and Da Costa and Ireland (2013) did not report on other providers of social support (i.e., friends). A recent study by Locke et al. (under review) suggested that support from friends was a stronger predictor ($B = .265$, $p < .001$) than family ($B = .217$, $p < .001$) when it came to physical activity in a pregnant cohort. These findings suggest that both family and friends may be important sources of support for pregnant women and mothers worth examining as separate predictors.

However, there are additional issues new mothers face in being active that may not be captured in the social support for exercise scale alone. The Social Support for Exercise Scale (Sallis et al., 1987) typically only focuses on providing support to help an individual to exercise (i.e., they offered to exercise with me, or encouraged me to exercise). There may be additional barriers to exercise that new mothers may face that are not accounted for in the measure. The Postpartum Social Support Questionnaire (Hopkins & Campbell, 2008) focuses on typical day-to-day activities that may be affected with the addition of a new baby (i.e., watched the baby so

you can go out by yourself, helped out with grocery shopping). While it is not specific to physical activity, it might help to predict new mothers' physical activity beyond the exercise-specific social support measure.

Compared to other populations, new mothers may have a unique set of barriers that impact their ability to be physically active. Therefore, there is a need to observe both social support for exercise along with postpartum specific support. This issue has been unaddressed in previous research and postpartum social support may add additional utility beyond the contribution of exercise social support in predicting new mothers' physical activity.

Self-Efficacy

There are several different theories that act as a guide for how to understand and facilitate health behaviour change. Social learning theory was developed by observational psychologist Albert Bandura in the 1960s and 70s when children were exposed to and observed aggressive models both filmed and live, aggressive cartoons, or no models at all (Bandura et al., 1968). From this theory, Bandura proposed that from a social cognitive standpoint, human behaviour operates within a triadic framework, allowing reciprocal interactions to form between three different factors. Personal, social/environmental, and behavioural factors interact with each other to impact how individuals interpret the outcomes of their actions. From Bandura's standpoint, human agency does not occur in isolation; we learn and build our belief system from the people and the social environment around us (Bandura, 1997). One of the key factors within the agency component of social cognitive theory is self-efficacy. Perceived self-efficacy refers to belief and confidence towards one's own ability to complete certain skills and actions. People's motivation, affective states, and actions are based more on what they believe than on what is objectively true (Bandura, 1997).

Self-efficacy beliefs can influence a person's choice of activity, effort expenditure, and persistence in the face of adversity (Bandura, 1997). Bandura specifies two forms of self-efficacy: self-efficacy to perform discrete *tasks* and self-efficacy to *self-regulate* our thoughts, feelings, and behaviours. Task self-efficacy beliefs represent the beliefs in the capability to perform a skill successfully. Self-regulatory efficacy refers to self-management actions that facilitate program attendance and participation (e.g., scheduling exercise, overcoming barriers; Bandura, 2004). U8

For the purpose of this study, we will focus on a subtype of self-regulatory efficacy called barrier-efficacy, or the confidence to overcome barriers, as our main self-efficacy variable. Overcoming barriers to be physically active and the confidence to do so may be two of the most important self-regulatory skills that new mothers need to be active. In order to successfully commit to physical activity, new mothers must overcome and regulate a new set of barriers that come with having and caring for a newborn, such as childcare, time, fatigue, and motivation. A person may also feel more motivation if they perceive that their actions can be completed and that they have the abilities to complete their actions (Martos-Mendez, 2015). Barrier-efficacy is an important outcome to study for new mothers as it is one of the key factors that drive behavioral engagement.

Social Support and Self-Efficacy

Within Bandura's triadic determinism, it is acknowledged that our thoughts and behaviours are impacted by the social environment. Social support has commonly been associated with self-efficacy and physical activity in new mothers (Chen et al., 2007). Perceived social support has been acknowledged as an important predictor of new mothers' physical activity (Kaiser et al., 2016). The quality and quantity of social support have been linked to enhanced promotion of mental and physical health in a prenatal population (Antoniou et al.,

2021), suggesting that if one's support is perceived to be more helpful, one's mental and physical health may be improved. Essentially, if a new mom has a solid support circle to back her, she may be more confident to start and overcome her barriers. Six studies were identified that examined self-efficacy, social support, and exercise in a transitional phase in someone's life, with five testing specifically in the postpartum period. Of the six studies, four tested self-regulatory efficacy (Kaiser et al., 2013; Kohet al., 2010; Lewis et al., 2021; Martos-Méndez, 2015), and two examined barrier self-efficacy (Bender, 2021; Cramp & Bray, 2011). All six found that self-regulatory efficacy was the strongest predictor of physical activity.

Research has also suggested that certain factors are needed in a sequential order to adopt and adhere to health behaviour changes. These factors are self-efficacy, as the most important factor required to best make health positive changes, along with social support, perceived benefits, self-concept, perceived barriers, and health definition (Chen et al., 2007). In order to ensure new moms can make the changes needed to start and stick to their physical activity goals, it is imperative to find ways to improve their self-efficacy, perceived social support, and decrease the barriers.

As previously mentioned, there were six studies that examined perceived social support and self-efficacy for mothers (Bender, 2021; Chen et al., 2007; Kaiser et al., 2013; Koh et al., 2010; Lewis et al., 2021; Martos-Méndez, 2015). These six studies observed a positive relationship between perceived social support and amount of physical activity completed. Bender (2021) found that self-efficacy was the strongest predictor of physical activity; social support was weakly associated to physical activity. Social support was frequently reported as a key facilitator of activity in women's open-ended responses. Chen et al. (2007) focused on social support and mental health in new mothers. They found that social support predicted health promoting lifestyle practices (stress management, self-actualization, and health responsibility).

However, social support was not significantly related to exercise behaviour. Lewis et al. (2021) also found that the source of social support is important for interventions for new mothers trying to reduce their risk of depression. Koh et al. (2010) also found that women who reported higher social support and self-efficacy were more likely to be sufficiently active (social support *OR* = 1.05, 95% CI 1.02–1.08; self-efficacy *OR* = 1.07, 95% CI 1.04–1.10).

In the study by Bender (2021), it was found that higher barrier self-efficacy was associated with higher levels of MVPA and leisure time physical activity in the postpartum period (*Adj* r^2 = .48). Cramp and Bray (2011) examined the relationship between barrier and exercise self-efficacy and leisure time physical activity in postpartum women. Similarly, to Bender, they also found that both barrier and task self-efficacy were significantly correlated with physical activity ($p < .05$) over four different time points. Koh et al. (2010) examined women recently diagnosed with gestational diabetes mellitus (GDM) and found that women who reported higher self-regulatory efficacy (and social support) were more likely to be sufficiently active. However, the authors noted that associations between physical activity and self-efficacy were much lower than hypothesized (*OR* = 1.07, 95% CI 1.04–1.10). Martos-Méndez (2015) studied patients with varied chronic diseases and found that social support was positively associated with self-efficacy ($p < .01$) and negatively associated with nonadherence to physical exercise ($p < .01$).

On the flip side, two of the five studies that examined self-efficacy observed small but not statistically significant effects when examining the physical activity of those in the postpartum period (Koh et al., 2010; Kaiser et al., 2016). Kaiser et al. (2016) examined the relationship between the impact of social support and self-regulatory efficacy on physical activity after being diagnosed with gestational diabetes mellitus (GDM). Contrary to hypotheses, they found the self-efficacy was not a significant predictor to physical activity after being

diagnosed with GDM (p = .15), which counters the majority of studies. The authors suggest this could be due to the fact that the adapted efficacy survey that measured both physical activity and food intake was not sensitive enough. This study did find that social support, perceived barriers, and establishing health positive behaviours (e.g., physical activity) were correlated. Across studies, self-efficacy was a consistent psychological mechanism that may drive physical activity for new mothers.

Social support and self-efficacy have been often studied together, however, there has been a focus on social support for exercise (Koh et al., 2008; Smith et al., 2005; Da Costa & Ireland, 2013). Overcoming postpartum challenges and having the support to overcome those challenges may pose additional constraints on mothers' exercise engagement beyond exercise-specific factors. To our knowledge, there are no studies that have sought to examine the relative predictive utility of social support to overcome exercise-related challenges alongside a measure of social support for postpartum challenges. Such an examination will provide additional insight into what type of social support may involved in building the confidence to overcome barriers to being active.

Exercise related Cognitive Errors

The way in which individuals perceive the support available to them may impact their ability to overcome their barriers to be physically active. Exercise related cognitive errors (ECE) are defined as biased thought processes or a negative lens that causes individuals to focus on the negative aspects of their situations (Locke & Brawley, 2016). ECEs cause individuals to exaggerate the difficulty associated with their physical activity barriers and can lead to negative thoughts, feelings, and behaviours. ECEs can cause individuals to struggle in making the decision to exercise (Locke & Brawley, 2016). Research on ECEs is relatively new, with the development and validity of a questionnaire specific to exercise related decision making only

developed in 2016 (Locke & Brawley, 2016). Early research found that high ECEs were strongly and negatively associated with self-regulatory efficacy in chronic conditions and general populations (Locke & Brawley, 2018). They also found that modifying ECEs may help enhance self-regulatory efficacy which in turn can promote exercise (Locke et al., 2019). Those who displayed low levels of self-efficacy, displayed thoughts and feelings counter-productive to exercise decision making (Locke & Brawly, 2018), and had lower levels of exercise adherence (Locke & Brawley, 2016).

There's compelling evidence that people's perceptions of the situations they experience are not always accurate (e.g., Tversky & Kahneman., 1989). While ECEs function to exaggerate individuals' perceptions of their barriers to exercise, social support is a facilitating factor helping individuals to overcome their barriers. Inaccurate beliefs (e.g., cognitive errors) may inhibit individuals from fully capitalizing on the social support they possess. Biased perceptions, like a new mother thinking they have absolutely no support with their children when in fact they do, may impact their perceived ability to complete or adhere to physical activity. Inaccurate beliefs may be an important concept to study, however it has not been examined within the field of postpartum physical activity. Whether ECEs predict exercise engagement beyond the contribution of social support should be examined along with exploring potential interactions between these two psychological concepts which are focused on barrier-efficacy.

Psychological Well-being

Psychological well-being is a multidimensional concept that refers to being satisfied with a combination of mental and emotional dimensions (Ryff, 1989). Psychological well-being is not merely the absence of depression or anxiety. Rather, it is an important concept in positive psychology in and of itself that represents a combination of feeling good and functioning well, experiencing positive emotions, having some sense of control over one's life, having a sense of

purpose, and experiencing positive relationships (Ryff, 1989). Others have conceptualized it more concisely as the extent to which someone is flourishing (Diener et al., 2010).

Psychological well-being can be influenced by a variety of factors such as social support, self- awareness, and types of coping strategies (Ryff, 1989; Kling et al., 1997). When people are placed in stressful situations, their ability to cope and overcome barriers may influence how they perceive their well-being and how content they are with their life (Chen et al., 2006; Corona et al., 2017). The first year after having a child provides many challenges and entails multiple physical and psychosocial changes for new mothers (Barkin, 2014). As mothers are typically the primary caregiver, they must add caring for the child on top of caring and maintaining their own health and wellness. These challenges can provide excess stress on these new mothers that may make managing their own health more difficult. During the first year, there is an increase in perceived workload for the mother (Connolly et al., 2014) which can place additional pressure. Because of this, evidence suggests that well-being can significantly decrease following pregnancy (Kling et al., 1997), suggesting that caring for a new child may be a critical time to understand and improve well-being.

Postpartum anxiety and depression occur together 20-60% of the time (Barkin et al., 2014; Hare et al., 2021) and are associated with many negative consequences for the mother including involving struggling to care for the newborn, poor parent infant bond, postpartum weight retention, and increased risk for future depression (Abdollapour & Keramat, 2016; Lewis et al., 2021). While depression and anxiety represent poor mental health states, mental health is related but distinct from well-being. Given mental health issues are prevalent in new mothers, improving well-being (a positive psychological factor) might also improve psychological functioning for new mothers.

Physical activity can improve the perceived well-being of new mothers and reduce instances of anxiety and depression (Chen et al., 2006; Connolly et al., 2014). However, if one's well-being is low, barriers to physical activity may be perceived as even more challenging. In a study conducted by Kull (2001) with women within a fertility age, they noted that physical activity was positively associated with perceived well-being.

It has been demonstrated that there is a strong correlation between social support and perceived well-being. Social support has accounted for a significant proportion of variability of depressive symptoms within young mothers (Antoniou et al., 2021). Previous research has demonstrated a strong support group significantly improved risks of depression and improved quality of life of those in the postpartum period (Shaw et al., 2006). Connolly et al. (2014) even suggested that high quality social support, specifically emotional support, may be critical in overcoming barriers to physical activity by improving a new mother's confidence and providing critical assurance. Psychological well-being is an important outcome to study when studying social support, ECEs, and physical activity for new mothers.

Study Purpose and Hypotheses

The broad purpose of this study was to examine the perceived factors that predict physical activity, barrier self-efficacy, and perceived well-being in women in the first year after giving birth. We examined the individual and interacting relationships between ECEs and level of perceived social support as predictors of these three outcomes with the following six hypotheses. It is predicted that social support will be positively related to all three outcomes, whereas ECEs would be negatively related. Regarding the interactions, its also predictive that when ECEs are high, the relationship between social support and outcomes would be stronger than when ECEs are low.

Hypothesis 1a: Social support for exercise and social support for postpartum challenges from friends will individually and positively predict the number of physical activity bouts engaged in a week for new mothers and will interact with ECEs to account for a significant proportion of variance.

Hypothesis 1b: Social support for exercise and social support for postpartum challenges from family will individually and positively predict the number of physical activity bouts engaged in a week for new mothers and will interact with ECEs to account for a significant proportion of variance.

Hypothesis 2a: Social support for exercise and social support for postpartum challenges from friends will individually and positively predict barrier-efficacy accounted by new mothers and will interact with ECEs to account for a significant proportion of variance.

Hypothesis 2b: Social support for exercise and social support for postpartum challenges from family will individually and positively predict barrier-efficacy accounted by new mothers and will interact with ECEs to account for a significant proportion of variance.

Hypothesis 3a: Social support for exercise and social support for postpartum challenges from friends will individually and positively predict self- reported psychological well-being and will interact with ECEs to account for a significant proportion of variance.

Hypothesis 3b: Social support for exercise and social support for postpartum challenges from family will individually and positively predict self- reported psychological well-being and will interact with ECEs to account for a significant proportion of variance.

Rationale: In line with the finding by Locke and Brawley (2017) showing ECEs are related to physical activity and self-regulatory efficacy in a general adult population, this study examined whether ECEs were related to physical activity and related outcomes in mothers within one year of giving birth. If one's ECE levels are high, social support may be perceived as being lower than it actually is. Viewing one's life through a negative lens like ECEs, may cause individuals to fail to use the social support available to them. It could be that the relationship between social support and physical activity is lessened when ECEs are high, but unaffected when ECEs are low. In line with Beck's (1976) model, cognitive errors are theorized to impact mental health outcomes. As such, it's hypothesized that ECEs would be negatively related to well-being. Finally, in line with the stress buffering hypothesis (Cohen & Wills, 1985), ECEs were hypothesized to interact with social support to predict our outcomes. Those with high ECEs may have more difficulty attempting to be physically active and as such, the relationship between our independent and dependent variables might differ depending for those with high and low ECEs.

In predicting mothers' physical activity, studies have primarily used social support measures specific to physical activity and have generally ignored support specific to challenges unique to the postpartum period. These two measures of social support are different but both potentially important for predicting physical activity engagement. For this study, we examined

social support for physical activity alongside social support for postpartum-related challenges. In line with the stress matching hypothesis, which states that the type and provider support comes from needs to match the support the receiver requires. There is a need to examine social support from family and friends separately to better understand social cognitive predictors of barrier-efficacy, physical activity, and positive well-being and how each aspect affects new mothers within this transitional phase.

Methods

Participants and procedure

Participants were recruited through virtual flyers posted on mom support and regional mother's Facebook and Instagram groups. Recruitment through Qualtrics panel was also used as the study progressed. Participants were directed to the landing page on Qualtrics and asked to complete the following screening questions for eligibility: age (≥18 years old), postpartum (10 weeks- 12 months) to accommodate caesarean births, as most will be cleared to start moderate physical activity at 10 weeks, and have been cleared to exercise (i.e., a healthcare provider has NOT said to avoid physical activity), and currently live in Canada or the USA. If eligible, they were directed to the letter of information and provided their implied consent by progressing to the survey after reviewing the letter.

Measures

Demographics: Current age, parity, ethnicity, annual income, highest level of education, gender, height, pre-pregnancy physical activity participation, pregnancy physical activity participation, current physical activity participation, pre-pregnancy weight, last weight prior to delivery, current weight, activity before pregnancy, number of babies in latest pregnancy, gestational age at delivery, number of total dependants, age of each dependant, relationship status, was this pregnancy: planned, unplanned, or prefer not to disclose, and number of weeks

postpartum. Pre-pregnancy weight and height were used to calculate pre-pregnancy body mass index. Pre-pregnancy weight was subtracted from current weight to calculate weight gain in pregnancy.

Physical Activity Participation: Participants completed the short form International Physical Activity Questionnaire (IPAQ). This scale uses 7 items that ask participants to self-report the number of bouts of movement activities performed in the past seven days throughout four different domains (vigorous activity, moderate activity, walking, and sitting (Craig et al., 2003). To calculate MVPA, we first had participants self-report how often they complete vigorous and moderate sessions of physical activity in the past seven days using the short form IPAQ (Craig et al., 2003). Total number of sessions were then added together to create a MVPA bouts score. We chose to use bouts as our physical activity variable as social cognitions may impact how often someone will be able to successfully complete an exercise session. Structured activity sessions may act as a barrier to those who posses certain cognitions, where as sporadic sessions may be easier to manage (Jerome et al., 2009). That is, the number of bouts one is able to complete may be more psychologically linked to social cognitions (e.g., social support and ECEs) than would the intensity or number of minutes they are active. Thus, we chose number of bouts as our dependant variable rather than total MVPA minutes or MET- total (MET score).

Barrier-Efficacy: Using Garcia and King's (1991) barrier-efficacy scale, fifteen items were used to measure individuals' confidence to be able to complete an exercise session when faced with a series of barriers within the next 6 months (when tired, during bad weather, while on vacation, etc). Items were assessed on a 100-point Likert scale ranging from 0% (*I cannot do it at all*) to 100% (*I'm certain that I can do that*). All items had a not applicable option. An example item reads "I could exercise when tired" (Garcia & King, 1991). In the current study, Cronbach's α was .93.

The Flourishing Scale: Psychological well-being was calculated using the Flourishing Scale (Diener et al., **The Flourishing Scale:** Psychological well-being was calculated using the Flourishing Scale, a subscale of Diener's psychological wellbeing scale (Diener et al., 2010). The scale assesses respondent's self-perceived success in areas such as relationships, self-esteem, purpose, and optimism. This scale has 8 items that describe aspects of human functioning, which are scored with a 7-point Likert scale between 1 (*strongly disagree*) and 7 (*strongly agree*). All items had a not applicable option. The flourishing scale has been validated within university aged students (Diener et al., 1987). An example item reads, "I lead a purposeful and meaningful life". In the current study, Cronbach's α was .89.

Social support for exercise scale: This scale is a validated 28-item measure of social support from either family or friends (Sallis et al., 1987). Participants rated the frequency that they received different types of support from family/friends over the past 3 month on a 1 (*none*) to 5 (*very often*) scale. All items had a not applicable option. An example question being "During the past three months, my family or friends helped plan activities around my exercise." The validity of the social support for exercise has been demonstrated in a general population (Sallis et al., 1987). In the current study, Cronbach's α for family was .88 and for friends was .89.

Postpartum Social Support Questionnaire (PSSQ): PSSQ was developed to provide a comprehensive, multidimensional self-report measure of social support during the postpartum period (Hopkins & Campbell., 2008). Participants completed a 27-item modified questionnaire that focused on support provided by "friends and other relatives" and by their "partner". The original scale was 51 items and was modified to include 2 of the 4 original subscales to reduce participant burden. The two subscales not used were support from "parents" and "parents-in-law". Partner support is often one of the important forms of social support (when present) and we opted to retain this as our primary scale for familiar support. All items had a not applicable

option. A further discussion of the benefits and limitations of this decision is expanded in the discussion section. Using a 7-point Likert scale, participants rated each item from 1 (*almost never*) to 7 (*very often).* The scale assessed two subscale scores including partner support (13 items) and friends support (14 items). An example question would be "How often do your friends help take care of the baby?" The validity for the PSSQ has been demonstrated (Hopkins & Campbell., 2008). In the current study, Cronbach's α for friends was .91 and for family was .83.

Exercise-related cognitive errors**:** The exercise-related cognitive error questionnaire (ECE-Q) is a 16-item measure assessing cognitive errors that are specific to exercise situations (Locke & Brawley, 2016). Participants were asked to rate how accurate the items were to how they would think. Items were rated on a nine-point Likert scale ranging from 1 (*not at all like I would think*) to 9 (*exactly like I would think*). All items had a not applicable option. An example item reads, "You consider starting an exercise routine, but think to yourself, 'I'm not good at sticking with anything. I'll probably quit after a month so why start". The validity of the ECE-Q has been demonstrated in general populations (Locke & Brawley, 2016). In the current study, Cronbach's α was .92.

Analytic plan

IBM SPSS Statistics (28.0.1.1 (14)) was used to run correlations between variables. First, statistical assumptions were tested and reported from a 4-step multiple regression. Independent variables were standardized for the regression analysis. After standardization, social support and exercise-related cognitive error interaction terms were created by multiplying the two standardized scores together resulting in four interaction terms (e.g., social support for exercise from friends * ECEs). In Step 1 three covariates were analyzed: number of dependants, education level, income level, and number of weeks postpartum against each of the dependant

variables; MVPA bouts, barrier-efficacy, and psychological well-being. Covariates were determined as an increase in dependants may influence all dependant variables negatively, more dependants may see a decrease in physical activity levels (Verhoef & Love,1992), barrier-efficacy (Brown et al., 2001), and psychological well-being (Mclanahan & Adams, 1987). Education level, income, and number of weeks postpartum may also see an influence in dependant variables. Thus, controlling for these prior to running our social cognitive predictors allows us to control for their relationship with our outcomes in the regression. In step 2, both social support measures for either family or friends were added to the model. In step 3, exercise-related cognitive errors were added into the regression. Lastly, in step 4, an interaction variable for both standardized social support measurements * ECEs were added to observe any interactions between the two. This was completed a total of six times with one 4-step multiple regression for social support family and one step multiple regression for social support from friends for each of the three dependant variables (see Tables 2-13 for complete results).

Results

There were 953 individuals who accessed the survey (815 from Qualtrics participant panel, 138 from other online recruitment efforts). A total of 370 participants were deemed eligible (18 years or old, 10 weeks-12 months postpartum, cleared to return to exercise, and a resident of Canada or the USA). Of the 370 participants that were deemed eligible, a total of N = 268 participants completed the survey (M_{age}= 29.96 years, SD= 6.34; $M^{weeks\ postpartum}$= 22.74, SD=13.80). Table 1 outlines full demographic and sociodemographic information. The most frequent responders were White (67.5%), those who held a Bachelors degree (29.5%), had a household income of $70,000-99,999 annually (25%), were responsible for 1-2 dependants (41%; 36.6%), and had a single baby in their last pregnancy (90.7%). 64.6% stated that their last pregnancy was planned.

Physical Activity: Friends

Statistical assumptions for hypothesis 1a were run for multiple regression and were assessed in line with Field (2018) and Tabachnick and Fidell (2007). Regarding the assumption of influential multivariate outliers, there were 29 participants' whose Mahalanobis distance were greater than the Chi square critical value (15.51, df= 8) suggesting the possible presence of multivariate outliers. However, none of these participants' data were influential outliers as indicated by their scores not exceeding the critical DIFFIT value of 2 (observed maximum= .62) or Cook's distance of 1 (observed maximum of .05). Regression is robust to the presence of outliers as long as they're not influential and therefore we did not remove any cases. The assumption of multicollinearity was met as indicated by our VIF statistics not exceeding the critical value of 10 (maximum VIF= 1.62) and our tolerance values exceeding .01 (minimum tolerance = .62). The assumption of independence of errors was met as evidence of the Durbin-Watson statistic of 1.57 (which was near the critical value of 2, suggesting uncorrelated

residuals). Our analysis met all statistical assumption for multiple regression, and we proceeded to the analysis.

Table 3 displays the findings from the regression predicting new mother's number of MVPA bouts. In step 2, social support for exercise from friends significantly and positively predicted (B = .270, p < .001) number of MVPA bouts beyond the covariates (R^2 *Change*= .058). Social support for postpartum challenges from friends was not a significant predictor. In step 3, the addition of the ECE-Q did not significantly improve the model. Step 4 saw no interaction between social support for exercise and ECE-Q or postpartum social support and ECE-Q both within friends. Overall, social support for exercise from friends was the only significant predictor and accounted for 6.5% of the variance in MVPA.

Physical Activity: Family

Statistical assumptions for hypothesis 1b were checked and not violated (See in Table 4). In step 2, social support for exercise from family significantly and positively predicted (B = .219, p = .004) number of MVPA bouts beyond the covariates (R^2 *Change*= .043) (see table 5). In step 3, the addition of the ECE-Q was found to be predictive in the positive direction (B = .141, p = .025; R^2 *Change*= .019). Postpartum support from their partner was not a significant predictor. Again, there was no interaction was observed in step 4 of this model. Overall, social support for exercise from family and ECEs predicted and accounted for 6.1% of the variance in MVPA.

Barrier-Efficacy: Friends

Statistical assumptions of outliers and multicollinearity were checked and not violated for hypothesis 2a (See table 6 for results). In step 2, social support for exercise from friends significantly and positively predicted (B = .261, p < .001) number of perceived barriers beyond the covariates (R^2 *Change*= .101) (see table 7). Social support for postpartum challenges from friends was also found to be a significant predictor beyond the covariates (B = .128, p = .050).

Step 3 the addition of ECEs did statistically improve the model (B = -.180, p = .002; R^2 change= .030). Step 4 saw an no interaction between both social support for exercise and ECE-Q and postpartum social support and ECE-Q both within friends. Overall, social support for exercise from friends, postpartum social support from friends, and ECEs predicted and accounted for 16.1% of the variance in barrier-efficacy.

Barrier-Efficacy: Family

Statistical assumptions of outliers and multicollinearity were checked and not violated for hypothesis 2b (see table 8). Multiple regression for hypothesis 2b (see table 9) saw in Step 2 social support for exercise from family to be significant and positively predicted the level of perceived barriers beyond the covariates (B= .274, p < .001; R^2 *Change*= .105). Postpartum support from their partner was not a significant predictor. Step 3 the addition of ECEs did statistically improve the model (B= -.145, p = .014; R^2 change= .020). Step 4 saw no interaction between the independent variables. Overall, social support for exercise from friends and ECEs predicted and accounted for 15.1% of the variance in barrier-efficacy.

Psychological well-being: Friends

Statistical assumptions of outliers and multicollinearity were checked and were also found not violated for hypothesis 3a (see table 10) In step 2, social support for exercise from Friends significant and negatively predicted (B = -.288, p < .001) level of perceived well-being beyond the covariates (R^2 *Change*= .188) (see table 11). Social support for postpartum challenges from friends was also found to be a significant and positive predictor beyond the covariates (B= .490, p < .001). Step 3 the addition of ECEs statistically improve the model (B = -.121, p < .027; R^2 *Change*= .014). Step 4 saw no interaction between the independent variables. Overall, social support for exercise from friends, postpartum social support from friends, and ECEs predicted psychological well-being and accounted for 25.8% of the variance.

Psychological well-being: Family

Hypothesis 3b also found that statistical assumptions of outliers and multicollinearity were not violated (see table 12). In step 2 (see table 13), Social support for exercise from family was not found to be a significant predictor, however, social support for postpartum challenges from their partner was found to be a significant predictor beyond the covariates (*B*= .433, *p* <.001; R^2 change= .154). Step 3 the addition of ECEs did statistically improve the model (*B*= -.150, *p* = .007; R^2 change= .021). There were no observed interactions in Step 4. Overall, postpartum social support from their partner and ECEs predicted psychological well-being and accounted for 22.9% of the variance. Correlations between all study variables can be found in table 14.

Discussion

Individuals can struggle to manage their health behaviors during new or transitional periods in their lives. While it may be intuitive that the majority of the struggle that new mothers have in being physically active comes from taking care of their new child, barriers related to physical activity also pose a challenge. Commonly reported barriers to exercise for new mothers are fatigue, lack of time (Bender, 2021; Carter-Edwards et al., 2009; Everson et al., 2009; Keller et al., 2006), environmental (Evenson et al., 2009; Bender, 2021), organizational (Everson et al., 2009; Vieten et al., 2018), and lack of social support (Barkin et al., 2014; Everson et al., 2009; Keller et al., 2006). To our knowledge, research has yet to examine whether measures of social support for postpartum challenges or social support for exercise is more predictive of mothers' physical activity engagement. In seeking to understand new mothers' physical activity, we examined the relative predictive utility that both social support for exercise and social support for postpartum specific barriers had in predicting physical activity, barrier-efficacy, and psychological well-being. We further examined whether these predictions differed when the social support was from family or friends. Finally, we examined whether ECEs accounted for additional variance in these outcomes. A summary of the findings relative to whether the hypothesized relationships were supported can be found in Table 15.

This study is the first, to our knowledge, to examine two different forms of social support (for exercise or specific to postpartum challenges) in predicting important wellness outcomes for new mothers. It was also the first study to examine ECEs for new mothers. Social support for exercise was the most consistent predictor across all dependant variables from both family and friends. The postpartum social support questionnaire was not correlated with physical activity, however, it was with both barrier-efficacy and psychological well-being. Below each key finding is discussed.

Physical activity bouts

In line with our hypothesis, the number of MVPA bouts was positively and significantly predicted by social support for exercise from both friends and family. This falls in line with past literature that observed a positive and medium effect sized relationship between perceived social support and amount of physical activity (Chen et al., 2007; Martos-Méndez, 2015). MVPA is an important behavior for reducing chronic disease risk and women are at increased risk of developing certain chronic conditions following pregnancy (e.g., diabetes; Kaiser et al., 2013; Koh et al., 2010). Understanding factors that predict physical activity can help to illuminate possible targets for intervention strategies.

It was observed that social support for exercise was the predictor of new mother's physical activity levels. While it may make sense that social support to overcome barriers to a specific behavior was the strongest predictor of that behavior, we also expected support for postpartum-specific barriers to be predictive. However contrary to that hypothesis, support for postpartum-specific barriers, did not account for variance in physical activity. This may be due to the fact that social support for exercise touches on specific situations that involve overcoming barriers to be active. The support for postpartum-specific measure was more general and involved situations directed towards parental and household duties of the mother that may support wellbeing. For example, the PSSQ contains items asking questions like, "how often do they watch the baby so you can go out by yourself"? (Hopkins & Campbell, 2008). It could be that the postpartum measure was too general and thus, not predictive of physical activity.

There are challenges that new mothers face that may get in the way of exercise that are accounted for by the social support for barriers during the postpartum period, but not for the exercise specific support questionnaire. We might expect that a measure containing items focusing on childcare might predict physical activity since these types of barriers have been

linked to lower physical activity engagement in past research (Barkin et al., 2014; Everson et al., 2009). However, this wasn't the case. In predicting physical activity, there could be enough overlapping variance between the two social support measures that only social support for exercise was significant.

The number of dependants (a covariate) was related to physical activity engagement, suggesting those with more dependants engaged in more activity and approximately 2/3 of the sample had two or more dependants. One possible reason why postpartum social support did not predict physical activity may have been because some mothers already had experience managing postpartum related barriers from a previous pregnancy, which may have attenuated the association. By their second pregnancy, mothers may have developed routines in taking care of kids (Leahy-Warren et al., 2010). An additional reason why postpartum social support did not predict physical activity could be that some mothers may consider taking care of their mobile children as a form of physical activity, meaning social support for postpartum challenges may be a weaker predictor.

Studies that have used social support to predict physical activity have solely used the social support for exercise scale (ie. Da Costa & Ireland., 2013; Koh, 2010; Keller et al., 2006; Lewis et al., 2021; Smith et al., 2005). This is the first study to our knowledge to also include the postpartum social support questionnaire in addition to the exercise social support measure. There is a gap in the literature as postpartum specific social support may account for variance that may not be accounted for within exercise specific support measurements when it comes to caring for a newborn on top of caring for your own needs.

ECEs predicted physical activity along side social support from family but not friends. One likely explanation is that social support from family accounted for less variance in physical activity than social support from friends (B = .22 vs B = .26), which likely freed up variance.

According to the model (Beck, 1976), cognitive errors generally result in negative thoughts that reduce the likelihood that a behavior is performed. However, ECEs were found to positively predict MVPA which is contrary to past findings (Locke & Brawley, 2016; 2017). As such, new mothers with higher ECEs exercised more than those with lower ECEs. Although uncommon, Drapeau (2014) suggest that cognitive errors can have a positive valence that increases the likelihood that a behavior is performed in some individuals, as was the case with our findings. Individuals may have positive distortions, biasing them towards something positive, strong, or successful (Drapeau, 2014). An example for this population could be, "*If I don't exercise now then I won't be able to for the rest of the day*". This is an example of all-or-nothing thinking and it could very well be that if a mother does not do their exercise during their child's morning nap, then there would not be time during for the rest of the day to fit it in. This all-or-nothing thinking may provide a surge of motivation in the moment to follow through with planned exercise. Those who feel that they are busy as the day progresses, may feel that they cannot procrastinate, causing them to implement their intentions with the little time frame they are given (Robinson et al., 2019). Exaggerated thinking is consistent with the cognitive error model (Beck, 1976) and could be adaptive in certain situations for busy new mothers. To this point, past research into ECEs has solely focused on the negative effects of cognitive errors instead of the potential positive ones. This begs the question of why we observed a positive relationship in mothers and not other populations, like the general population and pre-diabetic population. Perhaps to some extent all-or-nothing thinking is adaptive when the window to exercise is narrow.

Barrier-Efficacy

The results partially supported hypotheses 2a and 2b as social support for exercise from both family and friends significantly predicted mothers' confidence to overcome barriers. This

aligns with past research that has shown that social support is positively associated with self-regulatory efficacy (Bender, 2021; Kaiser et al., 2013; Koh et al., 2010). In Kaiser et al. (2013), they observed two key factors affected establishing healthy behaviours within the first 6 months postpartum: social support and barrier-efficacy. New mothers have expressed that they encounter a host of new barriers within the postpartum period. These barriers can cause doubts and lower new mothers' confidence in their ability to balance their competing demands to successfully complete an exercise regime. The confidence to overcome physical activity barriers is an important psychological outcome necessary for sustained physical activity engagement (Schwarzer, 2002). The results suggest that when mothers perceive that they have social support for exercise, they are more confident to overcome their physical activity barriers.

While we intuitively predicted support to overcome postpartum challenges would predict new mothers' confidence to be active, this was not the case. This result may be understood when understood through self-efficacy theory. Tenets of self-efficacy theory suggest that is domain specific (Bandura, 1997). As such, it makes sense that social support to help overcome exercise-related barriers was the strongest predictor of confidence to overcome exercise-related barriers.

Contrary to our hypotheses, there were no observed interactions between social support and ECEs, suggesting that the relationship between social support and barrier-efficacy did not differ based on ECE level. However, one novel finding was that ECEs predicted the confidence to overcome physical activity barriers for new mothers. Those with higher ECEs may lack the confidence to overcome their barriers, while those with lower ECEs may possess the confidence to overcome these barriers. Barriers hinder mothers' perceived likelihood of successfully completing physical activity. People need the confidence to overcome their barriers and it appears the both social support and ECEs predict barrier-efficacy. When a new mother perceives they have enough social support, they might perceive fewer barriers to health positive behaviours

and our prediction is supported by this notion. Having sufficient perceived levels of social support can also buffer against stressful situations which can allow for better coping and thus improved barrier-efficacy (Cohen, 2004).

ECEs represent a psychological process that results in exaggerated perceptions of barriers that individuals encounter. Like Locke and Brawley (2017), we might expect those with high cognitive errors will have lower self-efficacy to manage their exercise. When the challenge associated with one's barriers is increased, we would expect individuals' confidence to overcome their barriers to decrease. ECEs are a biased thought process that is theorized to exaggerate and increase the perceived level of challenge (Beck, 1976; Locke & Brawley, 2016). These findings support the theorized negative impact of cognitive errors on self-efficacy. Mothers who make ECEs may have increased difficulty in overcoming their physical activity barriers when they magnify the challenge associated with their barriers.

According to Bandura (1997), confidence is one of the strongest predictors of behaviour. New mothers with high ECEs may be less likely to possess the confidence or experience to overcome their barriers to exercise. The addition of a newborn is a life transition (Bellows-Riecken & Rhodes, 2008). Whether it's a mother's first or second child (or more), the newborn represents an added load that the mother must learn to manage. As Bandura (1997) says, "Building personal efficacy through mastery experiences involve acquiring the cognitive, behavioural, and self regulatory tools for creating and executing effective courses of action to manage ever-changing life circumstances" (pg. 80). In other words, there may be a period of transition where a new mother is still building the self-efficacy to overcome her barriers. ECEs might magnify the perceived challenge and thwart new mothers' barrier efficacy. Given barrier-efficacy is an important psychological resource needed to regulate regular physical activity engagement, continued study of the relationship between ECEs and barrier-efficacy is warranted.

Psychological Well-being

Physical activity and positive mental health have a longstanding positive association (Taylor et al., 1985) that suggests wellbeing is an important outcome to examine alongside physical activity for new mothers. In support of hypotheses 3a and 3b, postpartum social support for both family and friends positively predicted psychological well-being as assessed by Diener et al.'s (2010) flourishing subscale, while ECEs negatively predicted it. As such, when postpartum social support was greater, so was psychological well-being and when ECEs were lower psychological well-being was higher. Mothers' well-being and mental health often get poorer with the birth of a new child (Nomaguchi & Milkie, 2020) and it is important to study their predictors.

Perceived psychological well-being is typically strongly linked to positive mental health and mental welfare (Abdollahpour, 2016). Our findings are consistent with past research demonstrating social support predicts mothers' anxiety and depression (Barkin et al.,2014; Chen et al., 2007; Everson et al., 2009; Lewis et al., 2021; Saligheh et al., 2016). Within past literature, those with higher perceived social support were less likely to experience postpartum related anxiety and depression. The observed medium-sized relationship in the present research has similar magnitude to past research. Chen et al. (2007) also found that overall social support increased a mother's self-confidence and assurance in her role as a mother; for first time mothers, this may be especially important for managing their stress. The items contained in the postpartum support questionnaire focus on life stresses related to being a mother and might have a greater impact on well-being than to be active. Well-being is multifaceted. When new mothers generally feel secure and supported, they are more likely to be less stressed and therefore report higher well-being.

However, contrary to hypotheses, exercise social support was negatively associated with psychological well-being. One explanation could be that not all support is helpful or wanted, even if well-intended. A qualitative study by Gallant (2003) similarly found that higher support was associated with lower well-being in individuals with chronic illnesses. It was reported that their spouses were generally regarded as supportive, but their support sometimes made the respondents feel overly restricted and lacking autonomy. It was also reported that concern from friends, although appreciated, made some participants feel singled out. These findings support the notion that not all support is necessarily wanted and that the quality of support received may be more influential than the quantity of support received. Indeed, previous research has shown that social support quality was a stronger predictor of well-being than social support quantity (Turner, 1994). Our studies separated who provided the support (family or friends) but we did not assess the quality or type of support. While we did demonstrate the quantity of social support for exercise predicted well-being, there could be some utility in assessing the quality of social support (e.g., Fong, 2016) – for either exercise or postpartum challenges.

While there was no interaction between ECEs and social support, ECEs individually predicted well-being. When ECEs were high, then one's psychological well-being was observed to be lower. The same biased perceptions that may affect the decision to exercise might also be related to how one views their own mental health status (Locke & Brawley, 2015). The concept of cognitive errors originated from Beck's (1976) model of depression. Therefore, it's no surprise that ECEs are related to related variables, such as well-being. ECEs are a state-like measure of cognitive errors as they were shown to be moderately related to but distinct from general cognitive errors of depression (Locke & Brawley, 2016). It could be that those who make cognitive errors about physical activity are more likely to have cognitive errors about other life domains. Our findings might suggest that mothers who make ECEs might exaggerate other

situations in life that lead to lower well-being. In order to mediate these exaggerations, postpartum mothers may benefit from cognitive reframing in order to bypass these exaggerated perceptions and possibly increase their overall well-being. Future research within the field of postpartum mothers could investigate the benefit of reframing of those who possess higher ECEs and lower well-being.

Exercise-related Cognitive Errors

The study of ECEs in new mothers represents a novel contribution to the literature. We have discussed the implications of ECEs in relation to each of the three dependent variables above. Here we summarize the novel contributions this study adds. This was the first study to examine ECEs in a population of new mothers who face unique challenges. We demonstrated relationships between ECE and physical activity. In support of our hypotheses, ECEs negatively predicted barriers-efficacy and psychological well-being. Contrary to our hypotheses, ECEs were positively related to physical activity alongside social support from family; and was not significantly related to physical activity alongside social support from friends.

ECEs were expected to be related negatively to our dependant variables as those who have lower cognitive errors, may possess less biased and fewer negative thoughts about exercise. If one has higher cognitive errors, the same barriers may be perceived as harder to overcome than someone who has lower cognitive errors. Our findings built on those by Locke and Brawley (2017) in the general population, suggesting ECEs and self-regulatory efficacy are negatively associated. Another novel finding was the relationship between psychological well-being and ECEs. Given the concept of cognitive errors originates from a model of depression, it is unsurprising they are related. The biased thoughts associated with ECEs might hinder efforts to promote positive psychological well-being for new mothers. While continued study is warranted,

interventions may want to consider the potential impact of cognitive errors on the development of well-being.

It was observed that higher ECEs predicted a higher amount of activity. This may be due to all-or-nothing thinking that may be adaptive when the exercise window is narrow within a busy population. Exaggerated thinking is consistent with the cognitive errors model as outlined by Beck (1976); those who possess a higher level of cognitive errors may view situations in an exaggerated manner or with a biased (typically) negative lens, without taking into account what the absolute or factual situation is. It can be possible that this level of exaggeration may in fact swing in the opposite direction and be biased towards a positive direction (Drapeau, 2014). In contrast to previous research with a pregnant population (Locke et al., Under review), ECEs did not interact with social support to predict any of our outcomes.

ECEs are worth continuing to further investigate whether cognitive errors might play an adaptive role for physical activity engagement for new mothers. Biased perceptions are theorized to negatively impact mental health and the engagement of behaviours. Locke et al. (2019) demonstrated that ECEs could be attenuated to promote physical activity through cognitive error reframing counseling. While additional research is needed, cognitive error reframing could be one way to help mothers increase their physical activity and well-being.

Predictive Differences Between Family and Friends' Social Support

The decision was made to use two of the four subscales of the postpartum social support questionnaire largely to reduce participant burden. The "friends and other family" subscale was retained; however, it did not as directly align with the social support for exercise with friends subscale as originally envisioned. Similarly, we retained the partner subscale which may not align as directly with the social support for exercise family subscale. As a result, there may be interpretational challenges in making direct comparisons between social support for exercise and

for postpartum challenges in this study. Measuring social support and comparing measures can be challenging because authors have operationalized social support measures in contrasting ways with different types of subscales (e.g., subscales based on the type of support, who provided the support, or the quantity vs quality of support). Nonetheless, the entirety of our findings allow us to draw some general observations.

In general, social support for friends was more of a consistent predictor than family/partner support. Our findings broadly supported similar findings by Turner (1994) who found that women tend to rely on social support from a broader bubble (i.e., friends) whereas men tend to rely on support from their spouse (Turner, 1994). Women may be more likely to exercise with their friends because of the usefulness of companionship in routine (Larsen et al., 2014). In order to overcome barriers, social support that people receive needs to be correctly matched to their barriers. This not only includes the type of social support (e.g., emotional, informational) but who is providing the social support (e.g., friend vs family/partner; Cohen & Wills, 1985; Cutrona, 1990). Support from friends may in fact be more motivating within a physical activity setting since friends may be more willing to provide practical assistance and complete an activity with you, making it a social experience, which can make the activity more enjoyable. Whereas family or partners may provide support that has the potential to be construed as lecturing. Based on all our support findings taken together, interventions should consider promoting activity with friends who might provide the right type of social support to help new mothers be active and be more confident to overcome their physical activity barriers.

Strengths

Assessing social support using two different measures that measure different challenges that new mothers experience extended previous research that has tended to exclude postpartum factors when predicting new mothers' physical activity (Koh et al., 2010; Smith et al., 2005; Da

Costa & Ireland., 2013). Relatively speaking, our sample was diverse across our demographic variables, however there are some underrepresented groups (e.g., South Asian with only 0.7% of respondents) and findings might not generalize to these groups. Another strength of this study was controlling for our covariates like income level and number of dependents which are factors previously shown to impact physical activity levels (Giles-Corti & Donovan, 2002; Nomaguchi & Bianchi, 2004).

Limitations

The following limitations may affect the transferability of findings such as self-selection and obtaining an internet sample. Those who self-select might be more motivated to participate in research about physical activity and therefore their responses might not generalize to the broader population. An additional limitation was the use of a self-report measure of physical activity which may lead to biased and over-reported physical activity levels compared to device-measured activity (Haskell, 2012). A third limitation was the adjustment made to the PSSQ item wording to allow for alignment with the family and friends subscales from the SSES. While there was acceptable internal reliability, this adjustment has not been validated. A fourth limitation of this study was the use of online sampling which can result in poor quality data (Pozzar et al., 2020). We also recruited via two different measures (Qualtrics and social media) from both Canada and the United States. An additional limitation was for not controlling for potential differences between the two recruitment methods between the two populations. It is possible that differences in maternity leave between Canada and the United States impacts the variables of study. An additional limitation is that there may be possible incongruence between physical activity measures and social cognitive measures. The IPAQ is a commonly used measure that captures more detail than other self-report measures (e.g., the Godin Leisure-time Questionnaire, Craig et al., 2003; Godin & Shephard, 1997). While our intended outcome sought to

operationalize bouts of purposeful exercise, the IPAQ may have captured incidental non-exercise physical activity like household duties, which is an example the questionnaire provides. Lastly, a caveat to this research is that the data are cross-sectional and should not be interpreted as causal. While our independent variables significantly predicted scores on our dependent variables, we cannot determine the directionality of these relationships at this time (whether one causes the other).

Future Directions

Given the unexpected positive relationship between ECEs and physical activity, future research should examine the impacts of ECEs with a positive valence on mothers' behavioural engagement. Future research should also seek to test this more broadly and examine whether ECEs might be positively related to physical activity in populations that may feel they are very busy and lack the time to dedicate to structured exercise or physical activity. Due to a lack of time, it may be possible that individuals feel they only have a single opportunity to complete their exercise. Is this the case for all those that feel they are too busy? Given there is heterogeneity in the relationship between social support and physical activity, future studies should seek to continue to examine moderators and mediators across time. Lastly, rather than assessing self-reported physical activity, the use of device measurement (i.e., smart watches) may limit potential biased reporting should be considered.

Conclusion

The purpose of this study was to understand how the social cognitive predictors of social support and cognitive biases predict physical activity, barrier-efficacy, and positive well-being within new mothers. Other studies have looked at the predictive value of the postpartum social support scale or the social support for exercise scale, but none have examined them together. Results from this study suggest that social support for exercise and ECEs are primary factors

driving new mothers' ability to overcome barriers to motivate physical activity and positive well-being. Social support and ECEs are two factors that impact how one perceives their barriers to physical activity and their ability to overcome those barriers. Interventions aiming to help new mothers overcome their barriers may want to consider the facilitating impacts of social support and the hindering impacts of ECEs.

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Results tables and figures:

Table 1: *Demographic Table*

	Mean (SD)
N = 268	
Age (years)	29.96 (6.12 +/-)
Weeks Postpartum	22.74 (13.80+/-)
	Frequencies (%)
Ethnicity	
White	181 (67.5)
Black	33 (12.3)
Hispanic and Latino American	27 (10.1)
Indigenous	7 (2.6)
East Asian	6 (2.2)
Middle Eastern	3 (1.1)
Southeast Asian	4 (1.5)
South Asian	2 (0.7)
Other	5 (1.9)
Highest level of Education	
Elementary/Middle school	7 (2.6)
High school	65 (24.3)
College Diploma	43 (16.0)
Bachelors	79 (29.5)
Masters Degree	33 (12.3)
Doctoral Degree	14 (5.2)
Trades/ Technical/ Vocational Training	14 (5.2)

Other	10 (3.7)
Prefer not to disclose	3 (1.1)
Annual household income	
0-$29,999	47 (17.5)
$30,000- 49,999	29 (10.8)
$50,000-69,999	47 (17.5)
$70,000-99,999	67 (25.0)
$100,000-149,999	42 (15.7)
$150,000 or more	27 (10.1)
I don't know	3 (1.1)
Prefer not to disclose	6 (2.2)
Total number of dependants	
1	110 (41.0)
2	98 (36.6)
3	26 (9.7)
4	14 (5.2)
5	8 (3.0)
6	5 (1.9)
7	5 (1.9)
8 or more	2 (0.7)
Planned vs unplanned pregnancy	
Planned	173 (64.6)
Unplanned	85 (31.7)
Prefer not to disclose	10 (3.7)
Total number of babies	
Singleton	243 (90.7)
Twins	14 (5.2)
Triplets	10 (3.7)
Quintuplets	1 (0.4)
Relationship status	
Married/ Domestic Partnership	198 (73.9)

Single	40 (14.9)
Divorced	10 (3.7)
Separated	4 (1.5)
Widowed	1 (0.4)
Other	15 (5.6)

Table 2: *Assumption of Influential Multivariate Outliers Physical Activity and Social Support Friends*

Statistic	Value
Mahalanobis	34.651
Critical DFFIT value	.62452
Cook's distance	.048
VIF statistics	1.620
Tolerance values	.617
Durbin- Watson statistic	1.568

Note: Mahalanobis statistic assesses absence of outliers for predictors; DFFIT statistics assesses influential outliers for both the x and y axes; Cooks distance assesses directional influential outliers for both the x and y axes; VIF assesses the amount of multicollinearity in a regression analysis; Statistical tolerance assesses whether or not two independent variables are highly correlated; Durbin-Watson assesses independence of errors.

Table 3: *Hypothesis 1a Physical Activity Bouts and Social Support Friends Multiple Regression*

Dependent Variable	***F***	***df***	***Adjusted R^2***	**B**	***R^2 Change***
Hypothesis 1a (DV: MVPA Bouts)					
Step 1	1.787	252	.012		.028
Number of Dependants				.155*	
Education Level				-.023	
Income Level				.026	
Weeks postpartum				.063	
Step 2	3.885	250	.063***		.058***
Number of Dependants				.081	
Education Level				-.009	
Income Level				-.018	
Weeks postpartum				.050	
PSSQ Friend				-.038	
SSES Friend				.270***	
Step 3	3.738	249	.070***		.010

Number of Dependants				.075	
Education Level				-.015	
Income Level				.004	
Weeks postpartum				.054	
PSSQ Friend				-.024	
SSES Friend				.256***	
ECE-Q				.102	
Step 4	3.113	247	.069***		.007
Number of Dependants				.059	
Education Level				-.019	
Income Level				-.001	
Weeks postpartum				.054	
PSSQ Friend				-.017	
SSES Friend				.258***	
ECE-Q				.108	
ECE-Q * PSSQ Friend				-.040	
ECE-Q * SSES Friend				.102	

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

Table 4: *Assumption of Influential Multivariate Outliers Physical Activity and Social Support Family*

Statistic	Value
Mahalanobis	47.250
Critical DFFIT value	.58056
Cook's distance	.048
107VIF statistics	1.598
Tolerance values	.626
Durbin- Watson statistic	1.594

Note: Mahalanobis statistic assesses absence of outliers for predictors; DFFIT statistics assesses influential outliers for both the x and y axes; Cooks distance assesses directional influential outliers for both the x and y axes; VIF assesses the amount of multicollinearity in a regression analysis; Statistical tolerance assesses whether or not two independent variables are highly correlated; Durbin-Watson assesses independence of errors.

Table 5: *Hypothesis 1b Physical Activity Bouts and Social Support Family Multiple Regression*

Dependent Variable	***F***	***df***	***Adjusted R^2***	**B**	***R^2 Change***
Hypothesis 1b (DV: MVPA Bouts)					
Step 1	1.787	252	.012		.028
Number of Dependants				.155*	

Education Level				-.023	
Income Level				.026	
Weeks postpartum				.063	
Step 2	3.148	250	.048***		.043***
Number of Dependants				.102	
Education Level				-.035	
Income Level				-.010	
Weeks postpartum				.071	
PSSQ Partner				.000	
SSES Family				.219**	
Step 3	3.474	249	.063***		.019*
Number of Dependants				.086	
Education Level				-.040	
Income Level				.017	
Weeks postpartum				.078	
PSSQ Partner				.004	
SSES Family				.228***	
ECE-Q				.141*	
Step 4	2.692	247	.056***		.000
Number of Dependants				.085	
Education Level				-.041	
Income Level				.016	
Weeks postpartum				.075	
PSSQ Partner				.007	
SSES Family				.229**	
ECE-Q				.143*	
ECE-Q * PSSQ Partner				.015	
ECE-Q * SSES Family				.006	

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

Table 6: *Assumption of Influential Multivariate Outliers Barrier-Efficacy and Social Support Friends*

Statistic	Value
Mahalanobis	37.572
Critical DFFIT value	2.30242
Cook's distance	.090
VIF statistics	1.491
Tolerance values	.671
Durbin- Watson statistic	1.584

Note: Mahalanobis statistic assesses absence of outliers for predictors; DFFIT statistics assesses influential outliers for both the x and y axes; Cooks distance assesses directional influential outliers for both the x and y axes; VIF assesses the amount of multicollinearity in a regression analysis; Statistical tolerance assesses whether or not two independent variables are highly correlated; Durbin-Watson assesses independence of errors.

Table 7: *Hypothesis 2a Barrier-Efficacy and Social Support Friends Multiple Regression*

Dependent Variable	***F***	***df***	***Adjusted R^2***	**B**	***R^2 Change***
Hypothesis 2a (DV: Barriers)					
Step 1	3.579	257	.038**		.053**
Number of Dependants				.082	
Education Level				-.070	
Income Level				.206***	
Weeks postpartum				.099	
Step 2	7.707	255	.134***		.101***
Number of Dependants				.008	
Education Level				-.083	
Income Level				.141*	
Weeks postpartum				.066	
PSSQ Friend				.128*	
SSES Friend				.261***	
Step 3	8.159	254	.161***		.030**
Number of Dependants				.018	
Education Level				-.082	
Income Level				.105	
Weeks postpartum				.056	
PSSQ Friend				.099	
SSES Friend				.284***	
ECE-Q				-.180**	
Step 4	6.481	252	.159***		.004
Number of Dependants				.018	
Education Level				-.083	
Income Level				.099	
Weeks postpartum				.066	
PSSQ Friend				.088	
SSES Friend				.284***	
ECE-Q				-.181**	
ECE-Q * PSSQ Friend				-.082	
ECE-Q * SSES Friend				.047	

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

Table 8: *Assumption of Influential Multivariate Outliers Barrier-Efficacy and Social Support Family*

Statistic	Value
Mahalanobis	30.774
critical DFFIT value	2.59590
Cook's distance	.087
VIF statistics	1.063
tolerance values	.644
Durbin- Watson statistic	1.582

Note: Mahalanobis statistic assesses absence of outliers for predictors; DFFIT statistics assesses influential outliers for both the x and y axes; Cooks distance assesses directional influential outliers for both the x and y axes; VIF assesses the amount of multicollinearity in a regression analysis; Statistical tolerance assesses whether or not two independent variables are highly correlated; Durbin-Watson assesses independence of errors.

Table 9: *Hypothesis 2b Barrier-Efficacy and Social Support Family Multiple Regression*

Dependent Variable	***F***	***df***	***Adjusted R^2***	**B**	***R^2 Change***
Hypothesis 2b (DV: Barriers)					
Step 1	3.579	257	.038**		.053**
Number of Dependants				.082	
Education Level				-.070	
Income Level				.206**	
Weeks postpartum				.099	
Step 2	7.945	255	.138***		.105***
Number of Dependants				.016	
Education Level				-.107	
Income Level				.138*	
Weeks postpartum				.091	
PSSQ Partner				.113	
SSES Family				.274***	
Step 3	7.826	254	.155***		.020*
Number of Dependants				.031	
Education Level				-.108	
Income Level				.113	
Weeks postpartum				.083	
PSSQ Partner				.101	
SSES Family				.268***	
ECE-Q				-.145**	
Step 4	6.460	252	.158***		.010
Number of Dependants				.031	
Education Level				-.104	
Income Level				.106	
Weeks postpartum				.098	

PSSQ Partner	.076
SSES Family	.276***
ECE-Q	-.150**
ECE-Q * PSSQ Partner	-.124
ECE-Q * SSES Family	.050

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

Table 10: *Assumption of Influential Multivariate Outliers Psychological Well-Being and Social Support Friends*

Statistic	Value
Mahalanobis	33.157
critical DFFIT value	2.74047
Cook's distance	.242
VIF statistics	1553
tolerance values	.644
Durbin- Watson statistic	1.902

Note: Mahalanobis statistic assesses absence of outliers for predictors; DFFIT statistics assesses influential outliers for both the x and y axes; Cooks distance assesses directional influential outliers for both the x and y axes; VIF assesses the amount of multicollinearity in a regression analysis; Statistical tolerance assesses whether or not two independent variables are highly correlated; Durbin-Watson assesses independence of errors.

Table 11: *Hypothesis 3a Psychological Well-Being and Social Support Friends Multiple Regression*

Dependent Variable	***F***	***df***	***Adjusted R^2***	**B**	***R^2 Change***
Hypothesis 3a (DV: Psychological well-being)					
Step 1	5.345	265	.061***		.075***
Number of Dependants				-.183**	
Education Level				.117	
Income Level				.159**	
Weeks postpartum				-.016	
Step 2	15.639	263	.246***		.188***
Number of Dependants				-.110*	
Education Level				.040	
Income Level				.150**	
Weeks postpartum				-.039	
PSSQ Friend				.490***	
SSES Friend				-.288***	
Step 3	14.311	262	.257***		.014*
Number of Dependants				-.103	
Education Level				.044	
Income Level				.124*	
Weeks postpartum				-.044	

	PSSQ Friend				.470***	
	SSES Friend				-.272***	
	ECE-Q				-.121*	
Step 4		11.529	260	.260***		.009
	Number of Dependants				-.088	
	Education Level				.044	
	Income Level				.131*	
	Weeks postpartum				-.047	
	PSSQ Friend				.470***	
	SSES Friend				-.277***	
	ECE-Q				-.127*	
	ECE-Q * PSSQ Friend				.057	
	ECE-Q * SSES Friend				-.115	

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

Table 12: *Assumption of Influential Multivariate Outliers Psychological Well-Being and Social Support Family*

Statistic	Value
Mahalanobis	44.183
Critical DFFIT value	3.64163
Cook's distance	.167
VIF statistics	1.542
Tolerance values	.648
Durbin- Watson statistic	2.021

Note: Mahalanobis statistic assesses absence of outliers for predictors; DFFIT statistics assesses influential outliers for both the x and y axes; Cooks distance assesses directional influential outliers for both the x and y axes; VIF assesses the amount of multicollinearity in a regression analysis; Statistical tolerance assesses whether or not two independent variables are highly correlated; Durbin-Watson assesses independence of errors.

Table 13: *Hypothesis 3b Psychological Well-Being and Social Support Family Multiple Regression*

Dependent Variable	***F***	***df***	***Adjusted R^2***	**B**	***R^2 Change***
Hypothesis 3b (DV: Psychological well-being)					
Step 1	5.345	265	.061***		.075***
Number of Dependants				-.183**	
Education Level				.117	
Income Level				.159**	
Weeks postpartum				-.016	
Step 2	12.990	263	.211***		.154***
Number of Dependants				-.161**	
Education Level				.058	

	Income Level				.094	
	Weeks postpartum				-.055	
	PSSQ Partner				.433***	
	SSES Family				-.065	
Step 3		12.459	262	.230***		.021**
	Number of Dependants				-.146*	
	Education Level				.061	
	Income Level				.065	
	Weeks postpartum				-.061	
	PSSQ Partner				.421***	
	SSES Family				-.071	
	ECE-Q				-.150**	
Step 4		10.025	260	.232***		.008
	Number of Dependants				-.133*	
	Education Level				.061	
	Income Level				.068	
	Weeks postpartum				-.062	
	PSSQ Partner				.429***	
	SSES Family				-.089	
	ECE-Q				-.147**	
	ECE-Q * PSSQ Partner				.052	
	ECE-Q * SSES Family				-.109	

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

Table 14: *Correlations between study dependent and independent variables.*

	MVPA	Barrier-efficacy	Psychological well-being	PSSQ partner	PSSQ friends	SSES family	SSES friends	ECE-Q
MVPA	-							
Barrier-efficacy	.323**	-						
Psychological well-being	-.033	.053	-					
PSSQ partner	.120	.253**	.434**	-				
PSSQ friends	.104	.243**	.398**	.880**	-			
SSES family	.247**	.320**	.069	.448**	.463**	-		
SSES friends	.281**	.314**	-.103	.365**	.404**	.812**	-	
ECE-Q	.125*	-.199**	-.227**	-.137*	-.132*	-.044	.073	-

Note: * $p = .05$; ** $p < .001$

Table 15: *Summary Table*

Hypothesis/DV	Independent variables	Direction of Relationship (only stated if significant)	Hypothesis supported? (Y/N)
1a. Physical activity	SSES Friend	Positive	Y
	PSSQ Friend	-	N

	ECE	-	N
	Interactions	-	N
1b. Physical activity	SSES Family	Positive	Y
	PSSQ Partner	-	N
	ECE	Positive	N
	Interactions	-	N
2a. Barrier-efficacy	SSES Friend	Positive	Y
	PSSQ Friend	-	N
	ECE	Negative	Y
	Interactions	-	N
2b. Barrier-efficacy	SSES Family	Positive	Y
	PSSQ Partner	-	N
	ECE	Negative	Y
	Interactions	-	N
3a. Psychological well-being	SSES Friend	Negative	N
	PSSQ Friend	Positive	Y
	ECE	Negative	Y
	Interactions	-	N
3b. Psychological well-being	SSES Family	-	N
	PSSQ Partner	Positive	Y
	ECE	Negative	Y
	Interactions	-	N

Appendix

Certificate of Ethics Clearance for Human Participant Research

Brock University
Office of Research Ethics
Tel: 905-688-5550 ext. 3035
Email: reb@brocku.ca

Health Science Research Ethics Board

Certificate of Ethics Clearance for Human Participant Research

DATE: 12/14/2022

PRINCIPAL INVESTIGATOR: LOCKE, Sean - Kinesiology

FILE: 22-079 - LOCKE

TYPE: Masters Thesis/Project STUDENT: Jenna Osborne
SUPERVISOR: Sean Locke

TITLE: Examination of activity, barriers, and wellbeing in individuals within one year of giving birth

ETHICS CLEARANCE GRANTED

Type of Clearance: NEW Expiry Date: 12/1/2023

The Brock University Health Science Research Ethics Board has reviewed the above named research proposal and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri-Council Policy Statement. Clearance granted from **12/14/2022** to **12/1/2023**.

The Tri-Council Policy Statement requires that ongoing research be monitored by, at a minimum, an annual report. Should your project extend beyond the expiry date, you are required to submit a Renewal form before 12/1/2023. Continued clearance is contingent on timely submission of reports.

To comply with the Tri-Council Policy Statement, you must also submit a final report upon completion of your project. All report forms can be found on the Office of Research Ethics web page at https://brocku.ca/research-at-brock/office-of-research-services/research-ethics-office/#application-forms

In addition, throughout your research, you must report promptly to the REB:

a) Changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) All adverse and/or unanticipated experiences or events that may have real or potential unfavourable implications for participants;
c) New information that may adversely affect the safety of the participants or the conduct of the study;
d) Any changes in your source of funding or new funding to a previously unfunded project.

We wish you success with your research.

Approved:

Stephen Cheung, Chair
Health Science Research Ethics Board

Note: Brock University is accountable for the research carried out in its own jurisdiction or under its auspices and may refuse certain research even though the REB has found it ethically acceptable.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and clearance of those facilities or institutions are obtained and filed with the REB prior to the initiation of research at that site.

Measures

Eligibility questions:

What is your current age?

- ○ Over the age of 18
- ○ Under the age of 18

Are you currently residing within Canada or the US?

- ○ Yes
- ○ No

Are you currently within 10 weeks- 12 months of your postpartum period?

- ○ Yes, I am 10 weeks to 12 months postpartum
- ○ No, I am not 10 weeks to 12 months postpartum

Have you currently been cleared to exercise (I.e., a healthcare provider has NOT said to avoid physical activity)

- ○ Yes, I have been cleared to exercise
- ○ No, I have not been cleared to exercise

Have you been instructed by your doctor to avoid exercise?

- ○ No, I haven't been told to avoid exercise
- ○ Yes, I was told to avoid exercise

Demographic questions:

What gender do you currently identify as?

- ○ Women
- ○ Man
- ○ Non-binary
- ○ Transgender
- ○ Two-Spirit
- ○ Other
- ○ Prefer not to disclose

What is your current relationship status?

- ○ Married/ domestic partnership
- ○ Single
- ○ Divorced
- ○ Separated
- ○ Widowed
- ○ Other
- ○ Prefer not to disclose

If you chose other, please specify

_____

Demographics What is your current age?

18 21 24 28 31 34 37 41 44 47 50 54 57 60

Use the slider to choose your current age ()	

What is your current height? (feet and inches)

Feet _____

Inches _____

Which race category best describes you?

- ○ Hispanic & Latino Americans
- ○ White
- ○ Black (African, Afro- Caribbean, African- American, African- Canadian Decent)
- ○ Indigenous
- ○ East Asian (Chinese, Korean, Japanese, Taiwanese decent)
- ○ Middle Eastern (Arab, Persian, West Asian decent e.g. Afghan, Egyptian, Iranian)
- ○ Southeast Asian (Filipino, Vietnamese, Cambodian, Thai, other Southeast Asian decent)
- ○ South Asian (East Indian, Pakistani, Sri Lankan, Indo- Caribbean)
- ○ Other (Please write in response down below)
- ○ Prefer not to disclose

Other race category

_____

What is your total household annual income before taxes?

- ○ 0- $29,999
- ○ $30,000-49,999
- ○ $50,000- 69,999
- ○ $70,000- 99,999
- ○ $100,000- 149,999
- ○ $150,000 or more
- ○ I don't know
- ○ Prefer not to disclose

What is the highest level of education you have currently completed?

- ○ Elementary/ Middle School
- ○ High School
- ○ College Diploma
- ○ Bachelors
- ○ Masters Degree
- ○ Doctoral Degree
- ○ Trades/ Technical/ vocational training
- ○ Other
- ○ Prefer not to disclose

If other, please specify

_____

The next series of questions does ask about your weight, if comfortable, please respond to them to the best of your abilities

What was your pre- pregnancy weight (lbs) 3 months prior to pregnancy

_____

What was your ***last known weight*** prior to delivery (lbs)

_____

What is your current weight (lbs)

_____

These questions are to ask you how physically active you have been and currently are. Physical activity can be any sort of planned and unplanned exercise. This also includes, biking, walking, or anything that causes your heart rate to raise!

On average how physically active were you **in the 3 months prior to pregnancy?**

- ○ Multiple times a day
- ○ Once a day (6-7 times a week)
- ○ A couple times a week (3-5 times a week)
- ○ Few times a week (1-2 times a week)
- ○ A few times a month (less than once a week on average)
- ○ Not at all

On average how physically active were you **during your latest pregnancy?**

- ○ Multiple times a day
- ○ Once a day (6-7 times a week)
- ○ A couple times a week (3-5 times a week)
- ○ Few times a week (1-2 times a week)
- ○ A few times a month (less than once a week on average)
- ○ Not at all

On average how physically active are you **currently?**

- ○ Multiple times a day
- ○ Once a day (6-7 times a week)
- ○ A couple times a week (3-5 times a week)
- ○ Few times a week (1-2 times a week)
- ○ A few times a month (less than once a week on average)
- ○ Not at all

These questions are based on your history of pregnancy and postpartum. If you've have more than one baby (dependant, surrogacy, rainbow babies), please include them in the next few responses.

How many times have you carried a fetus to 24 weeks or more?

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10 or more times

What are the total number of dependants under your care currently?

- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6
- ○ 7
- ○ 8
- ○ 9
- ○ 10
- ○ 10 or more

What are the ages of your dependants? (Please separate ages with a semicolon)

_____

These next series of questions pertain to your latest pregnancy

Was this pregnancy

- ○ Planned
- ○ Unplanned
- ○ Prefer not to disclose

How many babies did you give birth to in this latest pregnancy?

- ○ Singleton
- ○ Twins
- ○ Triplets
- ○ Quadruplets
- ○ Quintuplets

What was your current baby's gestational age at delivery?

_____

How many weeks postpartum are you currently?

_____

Flourishing scale (Psychological Well-being)
Below are eight statements with which you may agree or disagree. Using the 1-7 scale below, indicate your agreement with each item by indicating that response for each statement.

1. I lead a purposeful and meaningful life

    7. Strongly agree

    6. Agree

    5. Slightly agree

    4. Mixed or neither agree nor disagree 3. Slightly disagree

    2. Disagree

    1. Strongly disagree

2. My social relationships are supportive and rewarding

    7. Strongly agree

    6. Agree

    5. Slightly agree

    4. Mixed or neither agree nor disagree 3. Slightly disagree

    2. Disagree

    1. Strongly disagree

3. I am engaged and interested in my daily activities

    7. Strongly agree

    6. Agree

    5. Slightly agree

    4. Mixed or neither agree nor disagree 3. Slightly disagree

    2. Disagree

    1. Strongly disagree

4. I actively contribute to the happiness and well-being of others

    7. Strongly agree

    6. Agree

    5. Slightly agree

    4. Mixed or neither agree nor disagree 3. Slightly disagree

    2. Disagree

    1. Strongly disagree

5. I am competent and capable in the activities that are important to me

    7. Strongly agree

    6. Agree

    5. Slightly agree

    4. Mixed or neither agree nor disagree 3. Slightly disagree

    2. Disagree

    1. Strongly disagree

6. I am a good person and live a good life

    7. Strongly agree

    6. Agree

    5. Slightly agree

    4. Mixed or neither agree nor disagree 3. Slightly disagree

    2. Disagree

    1. Strongly disagree

7. I am optimistic about my future

    7. Strongly agree

    6. Agree

5. Slightly agree

4. Mixed or neither agree nor disagree 3. Slightly disagree

2. Disagree

1. Strongly disagree

8. People respect me

7. Strongly agree

6. Agree

5. Slightly agree

4. Mixed or neither agree nor disagree 3. Slightly disagree

2. Disagree

1. Strongly disagree

[Scoring: Add the responses, varying from 1 to 7, for all eight items. The possible range of scores is from 8 (lowest possible) to 56 (highest PWB possible). A high score represents a person with many psychological resources and strengths.]

International Physical Activity Questionnaire (IPAQ)

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think *only* about those physical activities that you did for at least 10 minutes at a time.

1. *During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?*

   _____ *days per week*

   No vigorous physical activities Skip to question 3

2. *How much time did you usually spend doing vigorous physical activities on one of those days?*

   _____ *hours per day* _____ *minutes per day*

   Don't know/Not sure

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. *During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.*

   _____ *days per week*

   No moderate physical activities Skip to question 5

4. *How much time did you usually spend doing moderate physical activities on one of those days?*

   _____ *hours per day* _____ *minutes per day*

   Don't know/Not sure

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. *During the last 7 days, on how many days did you walk for at least 10 minutes at a time?*

   _____ *days per week*

   No walking Skip to question 7

6. *How much time did you usually spend walking on one of those days?*

   _____ *hours per day* _____ *minutes per day*

   Don't know/Not sure

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the last 7 days, how much time did you spend sitting on a weekday? _____ hours per day

_____ minutes per day

Don't know/Not sure

Social Support and Exercise Survey

Below is a list of things people might do or say to someone who is trying to exercise regularly. Please rate each question twice. In the 'family' column, rate how often anyone living in your household has said or done what is described during the last three months. In the 'friends' column, rate how often your friends, acquaintances, or coworkers have said or done what is described during the last three months.

Please write one number from the following rating scale in each space.

None	Rarely	A Few Times	Often	Very Often	Does Not Apply
1	2	3	4	5	8

During the past three months, my family (or members of my household) or friends:	**Family**	**Friends**
1. Exercised with me		
2. Offered to exercise with me		
3. Gave me helpful reminders to exercise ("Are you going to perform your intervals tonight")		
4. Gave me encouragement to stick with an exercise program		
5. Changed their schedule so we could exercise together		
6. Discussed exercise with me		
7. Complained about the time I spend exercising		
8. Criticized me or made fun of me for exercising		
9. Gave me rewards for exercising (bought me something or gave me something I like)		
10. Planned for exercise on recreational outings		
11. Helped plan activities around my exercise		
12. Asked me for ideas on how they can exercise		
13. Talked about how much they like to exercise		
14. Told me how proud they are of me for exercising		

Postpartum Social Support Questionnaire items (PSSQ)
Each item assesses the frequency of occurrence of a specific socially supportive behavior using a 7-point Likert scale, where 1 equals ‘‘almost never’’ and 7 equals ‘‘very often’’.

1. Almost Never	2. Rarely	3. Occasionally	4. Sometimes	5. Frequently	6. Often	7. Very Often

1. How often does your partner help to take care of the baby (feeding, diapering, bathing, etc.)?
2. How often do they play with the baby?
3. How often do they soothe the baby when he/she is upset?
4. How often do they watch the baby so you can go out by yourself?
5. How often do they help out in other household chores?
6. How often do they help out with family meals?
7. How often do they help with grocery shopping?
8. How often do they disagree with you about how the baby should be handled?
9. How often do they indicate to you by words or behavior that they know that it is hard work to take care of a baby?
10. How often do they indicate dissatisfaction with the change in routine since the baby’s birth?
11. How often do they indicate dissatisfaction with the amount of time you have to spend together since the baby’s birth?
12. How often do you talk about the baby with your partner?
13. How often do you confide in, share your problems with, or tell your troubles to your partner?

14. How often do you have contact with other relatives or friends in person?
15. How often do your other relatives or friends help out with the baby?
16. How often do your relatives or friends baby-sit for the baby?
17. Do you feel you can count on other relatives or friends for financial support if you should need it?
18. How often do other relatives or friends help out with other practical matters (errands, household tasks)?
19. How often do you and the baby spend time with your other relatives or friends (i.e., social activities, shopping, or visiting together)?
20. How often do you confide in, share your problems with, or tell your troubles to your relatives or friends?
21. How often do your relatives or friends confide in you?
22. How often do other relatives or friends provide advice or guidance about child care?
23. How often do you discuss your concerns about the baby with other relatives or friends?
24. Do you feel that you have someone to whom you can turn for expert advice about the baby? (i.e., pediatrician, family doctor, public health nurse)
25. Do you feel you have someone (besides family or friends) available to baby-sit?
26. In general, do you feel your relatives have been supportive since the birth of the baby?
27. In general, do you feel your friends have been supportive since the birth of the baby?

Exercise-related cognitive errors questionnaire (ECE-Q)
The following short scenarios represent people's reactions to different situations they might encounter when trying to exercise. Please indicate the degree to which the reactions in the following scenarios are similar to how you would think.

The following scenarios might not be exactly applicable to you and your situation (Example: while the type of sport depicted in the scenario is one you would never consider doing, you could still react to the scenario).

Please try to put yourself in the situation and rate how similar the thought expressed in the scenario is to how you might react. If the scenario is absolutely not applicable to you, please leave it blank.

1 (not at all like I would think) to 9 (almost exactly like I would think).

1. Not at all like I'd think	2.	3.	4.	5.	6.	7.	8.	9. Exactly how I'd think

1. You have just come off holidays and haven't exercised in two weeks. When it comes time to exercise, you think to yourself, "it's been so long since I've exercise that I'm going to be painfully sore for days."

2. You are considering starting to cycle with a local club. Every time you consider going to the club to join, you think to yourself, "I haven't biked in years, I'm going to get way too tired to even be able to finish the ride."

3. Your doctor recommends jogging/running at a higher intensity than you are used to. When considering the doctor's recommendations, you think to yourself, "going that fast is going to really aggravate my medical condition."

4. You are just getting home from a vacation. You're a bit tired, but you want to go exercise today. You think to yourself, "since I'm not going to have the energy to complete my usual routine I'll will just start next week."

5. You're having a pretty busy week. You plan to exercise tonight, but when you get home from work you think to yourself, "I can't justify exercising because I have so many other things to do."

6. Because your exercise class is cancelled this week, you think to yourself, “I’m going to take the week off because I have no exercise class”.

7. You hear that you have to exercise 150 minutes a week to get health benefits. You think to yourself, “I’m never going to be able to achieve that.”

8. Your friends want to go try a new fitness class (or a new sport you’ve never tried). You remember that the last time you attempted to exercise you took a wrong step and twisted your ankle. You think to yourself, “I shouldn’t go because I am going to injure myself again.”

9. You consider starting an exercise routine, but think to yourself, “I’m not good at sticking with anything. I’ll probably quit after a month so why start.”

10. You plan to exercise today, but you think to yourself, “I am not going to because I will be completely tired afterward.”

11. You plan to exercise for the first time in a while today, but think to yourself, “I’d better not, I know how sore I'm going to be after exercise.”

12. You know the health the benefits of exercise, but think to yourself, “exercising is a big drain on all the other fun things I could be doing.”

13. You decide that it’s time to get back into the exercise routine and that starting next week you are going to exercise. However, when next week rolls around, you think to yourself, “I don’t really feel excited about it this week, I can start it next week.”

14. You’ve been exercising for a few weeks. However, you’re getting frustrated because you aren’t seeing changes and the exercises aren’t getting easier. You think to yourself, “this is way too hard and no fun and decide to stop going to the gym.”

15. You have been feeling down and even depressed all day, you think to yourself, “I should just stay home instead of going to the gym today.”

16. You feel awkward and lost in the first gym/fitness class you attend. You think to yourself, “I feel so uncomfortable that I don’t want to go back.”

Perceived Barriers Measurement

A perceived barrier to physical activity is person's judgement that some social, personal, environmental, or economic thing/factor is an obstacle that, if encountered, poses a sufficient enough degree of challenge to slow or stop the individual from enacting a desired behaviour or reaching a desired goal.

Below is a list of perceived barriers to exercise that people report. Think about your specific exercise goals and the activities you do, please check all barriers that you would encounter in the next month.

Using the scale below as a yardstick, please answer the following: How confident are you that you could exercise under each of the following conditions over the next 6 months?

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Not at all confident				Somewhat confident			Absolutely confident			

I could exercise…..

1. When tired
2. During or following a personal crisis
3. When feeling depressed
4. When feeling anxious
5. During bad weather
6. When slightly sore from the last time I exercised
7. When on vacation
8. When there are competing interests (like my favorite TV show)
9. When I have a lot of work to do
10. When I haven't reached my exercise goals
11. When I don't receive support from family or friends
12. Following complete recovery from an illness which has caused me to stop exercising for a week or longer
13. When I have no one to exercise with
14. When my schedule is hectic