

Supporting Physical Activity in Pregnancy

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Submitted in partial fulfillment  
of the requirements for the degree of

Master of Science

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## Abstract

Physical activity is considered a key therapy for reducing obstetric complications, yet more than 3 in 4 individuals fail to meet physical activity recommendations during pregnancy (Gaston & Vamos, 2012). Differing approaches to physical activity counseling have been implemented to address this issue (Pearce et al., 2013). This study aimed to investigate the effect of one such counseling method, termed motivational interviewing (MI; Miller & Rollnick, 2013). It involved two approaches for communicating physical activity information – a guiding style embodying the autonomy-supportive mindset of MI, or a directing style involving specific advice and recommendations. Each of these approaches was depicted through a written vignette, showcasing a consult between an exercise professional and a pregnant client. Based on random assignment, participants ( $N = 123$ ) read one of the two vignettes, then indicated the vignette client's physical activity level for three time points post-consult. Participants assigned to the guiding style ( $n = 56$ ) reported higher scores on the six manipulation check items compared to those assigned to the directing style ( $n = 67$ ). While the mixed model ANOVA demonstrated no significant group  $\times$  time interaction effect, the analysis revealed a significant main effect of group and time on physical activity levels. Specifically, those in the guiding style condition reported more physical activity on average than those in the directing style condition, with levels decreasing over time in both groups. In sum, a guiding communication style, generated in accordance with MI-based evidence, shows promise for improving prenatal physical activity levels and merits further investigation.

*Keywords:* Prenatal physical activity, pregnancy, motivational interviewing (MI), physical activity counseling, experimental vignette methodology

## **Acknowledgements**

Thank you first and foremost to my supervisor Phil, best known for his smiling face and sunny disposition... :) Joking aside, I feel extremely fortunate to have had you as my supervisor, and to have been a part of the BHSRL. In addition to all of the lessons learned from you as a researcher, you've taught me invaluable life lessons about advocating for myself and being confident in my abilities. Thank you. To Diane, thank you so much for all of your dedication and support with my thesis work and preparation. I am incredibly grateful for your feedback, your unrelenting kindness and, of course, your help in normalizing my love of desserts. I am truly appreciative of the care that both you and Phil have shown me.

Thank you Dr. Nagpal for the crucial insight and knowledge you brought to my study, I am so glad that you were able to be a part of the project and that I had the opportunity to work with you. Thank you as well to Dr. Bassett-Gunter for your thoughtful comments and contributions which helped to improve this work.

To mom and dad, thank you for instilling in me a sense of passion, the value of a good work ethic, and most importantly, a belief in myself. I'm so grateful for the sacrifices you've made and continue to make to be able to support me in the ways that you do. I love you.

A special thank you to Lauren, for the hours of video calls, countless laughs and unwavering support. It meant so much to me to have you along for this journey.

Finally, thank you to Cassidy, Max, Allie and Melanie, for putting up with my technical difficulties, sitting through my thesis presentation 74 times, and always being there to listen. You've all helped to make these last two years so memorable.

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## Introduction

Pregnancy is a unique stage of life, involving dramatic physical changes. Unfortunately, with this transformational period comes the risk of dangerous health outcomes such as preeclampsia (Leeman et al., 2016; Say et al., 2014) and excess gestational weight gain (Deputy et al., 2015). These conditions are a threat to both parent and child. In severe cases, preeclampsia and other hypertensive disorders contribute to pregnancy-related mortality (Say et al., 2014). Beyond this, those who experience excess gestational weight gain have a higher incidence of both preeclampsia and related neonatal complications, such as fetal macrosomia (Kominiarek & Peaceman, 2017). In nearly 47% of pregnancies, weight gain recommendations are exceeded (Deputy et al., 2015), meaning that a vast number of pregnant individuals are at greater risk for life-threatening complications (Cheng & Lao, 2014; Say et al., 2014). The relevance of this issue cannot be overstated, considering that approximately 85% of Canadian cisgender women will have given birth by the time they are 50 (Provencher et al., 2018).

Research has shown that physical activity lowers the risk of several obstetric health conditions, including those linked to pregnancy-related deaths. Moreover, it leads to improvements in pregnancy outcomes as well as parental and fetal health. For instance, physical activity has been associated with a 40% lower incidence of preeclampsia (Davenport, Ruchat, et al., 2018). Physical activity also exhibits a protective effect against gestational diabetes and hypertension (Davenport, Ruchat, et al., 2018). Another particularly relevant link is that between physical activity and lower gestational weight gain (Ruchat et al., 2018). Given the high prevalence of excess weight



gain in pregnancy, it is evident that the potential to minimize this problem is extremely valuable. Those who take advantage of this relationship will also have a reduced risk for neonatal complications such as macrosomia (Davenport, Meah, et al., 2018; Evenson et al., 2019).

Beyond the reductions in disease risk, physical activity has numerous advantages for pregnant individuals. Physical activity is associated with increased fitness, and strengthened parental and fetal cardiovascular health (May et al., 2010; Melzer et al., 2010). Specifically, individuals who are active in pregnancy have a lower sleeping heart rate and higher  $VO_2$ max than inactive individuals, both of which are indicators for good cardiovascular health (Melzer et al., 2010). Regarding the health of the fetus, May et al. (2010) found that fetal cardiac autonomic control was improved through regular aerobic exercise during pregnancy. There are also potential long-term benefits for children of individuals who exercise during pregnancy and whose gestational weight gain falls within recommendations. While further evidence is needed in order to fully understand this relationship (Davenport, Meah, et al., 2018), the prospect of such a benefit remains intriguing. Finally, Evenson et al. (2019) reported that individuals who are physically active throughout pregnancy experience fewer operative deliveries and faster postpartum recoveries.

Physical activity has not been associated with increased risks for the parent or fetus (Evenson et al., 2019), further reinforcing the case for participation during pregnancy. In view of the multitude of benefits of physical activity for pregnant individuals, and the reassurance of its safety, the Canadian Society for Exercise Physiology (CSEP) encourages regular physical activity throughout pregnancy (Mottola

et al., 2018). Specifically, CSEP guidelines suggest that pregnant individuals engage in 150 minutes of moderate intensity physical activity per week. The guidelines indicate that the 150 minutes should be accumulated over a minimum of three days per week, though daily activity is encouraged. Experts advise participation in both aerobic and resistance training, and gentle stretching is also recommended. The final element of the physical activity guidelines involves daily pelvic floor muscle training to lower the incidence of urinary incontinence (Mottola et al., 2018).

It should be noted that these guidelines apply to individuals without contraindications to exercise (Mottola et al., 2018). CSEP states that individuals with absolute or relative contraindications should, respectively, refrain from strenuous physical activity completely, or discuss the risks and benefits with their healthcare provider before exercising. However, the physical activity recommendations are applicable for individuals who were previously inactive, those with gestational diabetes, as well as those with a BMI that is classified as overweight or obese.

### **Physical Activity Participation in Pregnancy**

Despite these guidelines and the extensive evidence in favour of physical activity participation in pregnancy, reports from Ontario, Canada show that over 75% of pregnant individuals fail to meet physical activity guidelines (Gaston & Vamos, 2012). Other research has suggested even lower participation rates, with Borodulin et al. (2008) reporting that only 3 to 15% reach recommended physical activity levels. Overall, as pregnancy progresses, physical activity tends to decline further, with only 3 to 11% of individuals meeting guidelines in the third trimester (Borodulin et al., 2008).

There are a variety of factors, modifiable or otherwise, that may contribute to these low rates. Research has repeatedly demonstrated that individuals who already have a child or children at home tend to be less active during pregnancy (Fell et al., 2009; Mottola & Campbell, 2003; Pereira et al., 2007). Certain socioeconomic factors also affect physical activity levels. Specifically, pregnant individuals with lower incomes or education levels tend to engage in less activity (Mudd et al., 2009). Mental health disorders including anxiety and depression are also negatively associated with physical activity (Omidvar, 2018). Lastly, physical limitations and discomfort are a large deterrent to exercise during pregnancy (Cramp & Bray, 2009). While these correlates are complicated and difficult to address, they are important to acknowledge when studying physical activity levels of this population. Meanwhile, other barriers to physical activity during pregnancy may be more easily targeted through the techniques discussed in this thesis.

Several studies have highlighted the cognitive or affective barriers to physical activity shared by pregnant individuals. The belief that physical activity during pregnancy is unsafe is one that has the potential to lower physical activity participation (Mudd et al., 2009). Correspondingly, fear of harm to the unborn baby has been reported as a barrier to exercise (Clarke & Gross, 2004). Other psychological factors negatively impacting physical activity behaviour during pregnancy include perceived lack of time and reduced motivation (Clarke & Gross, 2004). Each of these barriers should be considered when investigating prenatal physical activity behaviour. Two factors which have been positively associated with physical activity behaviour in pregnancy include self-efficacy (Cramp & Bray, 2009), as well as intention to exercise (Hamilton et al.,

2019). These characteristics may be of particular importance given their relevance for assessing one's likelihood to change a behaviour. Perhaps the most critical determinant of prenatal physical activity behaviour is pre-pregnancy physical activity level.

Individuals who are active before pregnancy tend to remain active once becoming pregnant (Fell et al., 2009; Pereira et al., 2007), making this a key factor to consider not only during pregnancy, but within the preconception stage if possible.

### **Attempts to Address Physical Activity Behaviour in Pregnancy**

In considering the low levels of physical activity participation during pregnancy, as well as the numerous barriers cited, it is evident that attempts to address this problem should be made. Fortunately, research has demonstrated that pregnancy is a unique period of time which lends itself well to making lifestyle changes (Kominiarek & Peaceman, 2017). The parental desire to protect the health of the baby as well as the increased interactions with health professionals throughout pregnancy are fruitful conditions for changing health-related behaviour, including physical activity participation (Phelan, 2009). Several types of interventions have targeted physical activity behaviour in pregnant individuals, ranging from those involving information provision or supervised exercise classes (Haakstad et al., 2017), to organized walking programs (Kong et al., 2014). While some have resulted in increased physical activity participation, others have demonstrated little effectiveness (Pearce et al., 2013).

### **Motivational Interviewing: A Brief Overview**

Motivational interviewing (MI) is one approach that is aimed at targeting health behaviours that has not been widely used to address physical activity in pregnant individuals. This evidence-based counseling style is grounded in empathetic and

compassionate conversations, and serves to evoke a client's personal reasons or motivations for change (Miller & Rollnick, 2013). It has been applied in a variety of settings, from sports teams to healthcare settings (Miller & Rollnick, 2013), and has been shown to be useful for addressing physical activity behaviour (Rubak et al., 2005).

Aside from the core MI tenants of compassion, acceptance, evocation and partnership, this approach centres on several key concepts which have received varying levels of attention over the years (Miller & Rollnick, 2013). The theme of listening is one that is overarching as an MI concept. Practitioners are urged to listen to and show interest in the client's thoughts, and respect him or her as an autonomous individual. Connected to this concept is the notion of the client as the expert. When adopting this mindset, practitioners must avoid providing advice or solutions for the client, contrary to what is seen in the traditional client-practitioner relationship. This is otherwise known as a directing style of communication. Instead, practitioners should guide clients in realizing their own reasons for making behaviour changes, while empowering them to overcome barriers and achieve their goals. This is appropriately termed a guiding style. Information can be provided in this fashion using specific approaches that deliberately get the client involved in the discussion (Miller & Rollnick, 2013).

MI is operationalized through four main skills or techniques, often remembered with the acronym O.A.R.S. These include open-ended questions, affirmations, reflections and summaries (Miller & Rollnick, 2013). Practitioners are encouraged to use open-ended questions whenever possible, as they prompt clients to reflect on their thoughts in order to provide a more detailed response. This is useful for eliciting the

client's potential motives or ideas for behaviour change which may not have surfaced otherwise (Miller & Rollnick, 2013).

Affirmations are positive statements used to highlight an individual's efforts or progress toward a goal (Miller & Rollnick, 2013). They help clients to realize their strengths, while reinforcing positive behaviours and promoting increases in self-efficacy. The third MI skill of reflections, refers to statements made by practitioners that reiterate or reframe the client's ideas. Reflections demonstrate active listening on the part of the practitioner, while also allowing clients to think about what it is they have said, and to clarify or expand on their thoughts if needed. Reflecting on clients' ideas also brings awareness to what they have accomplished and what they may need to overcome for further change to occur (Miller & Rollnick, 2013).

Summaries are the final MI skill, and they are imperative for connecting the ideas that a client has shared in order to paint a big picture of what has been discussed. Summaries include statements about the key components of the conversation, such as a client's feelings about or motives for change, or plans and goals related to the targeted behaviour (Miller & Rollnick, 2013). Each of these skills plays a critical role in the MI approach, and can generate powerful results when used correctly. More recent iterations of MI literature have also described a set of processes to guide discussions between clients and practitioners. These include engaging, focusing, evoking and planning (Miller & Rollnick, 2013). Briefly, these processes centre around building rapport and trust with a client, choosing a main topic of discussion, determining a client's reasons for change, and helping the client to set specific goals for behaviour change (Miller & Rollnick,

2013). Evidently, the MI approach is intricate and multifaceted, yet its client-centred focus makes it a unique method for targeting behaviour change.

### **Literature on MI in Pregnancy**

While MI has been used to address health behaviours in populations of pregnant individuals, there has often been a focus on clinical outcomes over behavioural outcomes (Ainscough et al., 2017). For instance, Bogaerts et al. (2013) implemented an intervention which used MI to target lifestyle behaviours such as diet and exercise participation. Yet, the authors collected measures of gestational weight gain rather than diet or exercise behaviour. While this study did not, therefore, provide insight into the utility of MI for improving lifestyle behaviours, the intervention was effective for minimizing weight gained during pregnancy. Other research has shown similar results, though again has not reported on physical activity participation, despite targeting this behaviour (Bogaerts, 2014; Claesson et al., 2008). One study in particular that targeted physical activity behaviour and diet using an MI-based video counseling approach demonstrated improvements in both of these behaviours. That is, participants who received counseling on physical activity and eating habits reported significantly greater exercise and improvements in diet at follow-up than the control group (Jackson et al., 2011). To further elucidate these findings, there is a need for MI-based research with a primary focus on prenatal physical activity behaviour.

The potential for MI to impact pregnancy-related behaviours is promising given results of previous studies. For example, Elliott-Rudder et al. (2014) found increases in breastfeeding rates for intervention groups which incorporated MI. Additionally, a study on childbirth preparation classes found that individuals in an MI-based intervention group

were more likely to attend the classes than those in a lecture-based intervention or control group (Rasouli et al., 2017). In fact, 90% of those in the MI-based group attended the childbirth classes, while only about 60% and 27% attended in the lecture and control groups, respectively. Presumably, success of MI-based counseling on these types of behaviours could be seen with adoption of other behaviours, such as physical activity.

Research on factors impacting physical activity participation during pregnancy could arguably act as support for the use of an MI approach. As stated earlier, pregnant individuals have several perceived barriers to exercise which reduce their likelihood of participating. MI is partly focused on identifying a client's unique obstacles or barriers to behaviour change, and developing a plan to overcome them. As such, MI may be a practical approach to change for this population. Also discussed earlier in this thesis was the significance of self-efficacy in influencing physical activity behaviour in pregnancy (Cramp & Bray, 2009). Importantly, research has demonstrated that MI has the potential to increase self-efficacy for exercise in both pregnant individuals (van Poppel et al., 2019) and other populations (Bennett et al., 2008). This mechanism of MI therefore appears to be useful for targeting prenatal physical activity levels.

Further, Gaston et al. (2013) demonstrated that pregnant individuals with higher levels of autonomous motivation, specifically in the form of identified regulation, engaged in more physical activity. In this form of autonomous motivation, individuals value performing a behaviour and feel that it is important to them on a personal level (Ryan & Deci, 2000). MI is perhaps an optimal method for enhancing autonomous motivation, given that it centres on evoking an individual's personal reasons for change, while emphasizing client autonomy (Miller & Rollnick, 2013). In fact, it has been shown



that MI is associated with increases in motivation (Copeland et al., 2015). Lastly, research has indicated that identified regulation in pregnant individuals is negatively related to barriers to exercise (Gaston et al., 2013). Thus, if MI is able to increase an individual's autonomous motivation, this may result in fewer impediments to being physically active in pregnancy. Taken together, these relationships constitute potential mechanisms by which an MI counseling approach may increase prenatal physical activity.

This study holds the potential to expand on both the prenatal physical activity and MI focused literature. It centres on the behavioural outcome of physical activity level, which is unfortunately often overlooked in interventions targeting prenatal health behaviours, in favour of clinical outcomes (Ainscough et al., 2017). Collecting information on physical activity behaviour helps to fill this gap, especially as it pertains to the value of an MI-based intervention in this population. This study is also unique in that it includes a complete description of what information is shared with participants. More specifically, written scripts (vignettes) were developed for the two study conditions, and will be accessible to others along with the methods for this study. This transparency may prove to be valuable for those conducting future research in this area. This is particularly important considering the lack of information provided by researchers regarding the nature of MI-based interventions.

### **Study Purpose, Research Question, and Study Hypothesis**

As stated above, there is a lack of research that concerns both MI and prenatal physical activity. The purpose of this study was therefore to examine the effect of an MI counseling approach on physical activity behaviour in pregnancy. Specifically, this

research compared two communication styles used for providing physical activity information – the MI guiding style, and a directing style, in terms of their utility for increasing prenatal physical activity. This is articulated in the following research question: Does an MI-based consult with a guiding style of information provision increase perceived physical activity levels of the hypothetical study target, as compared to a consult using a directing style?

The following hypothesis refers to the physical activity levels of the target (Ava) who is depicted in the study vignettes. It was hypothesized that individuals exposed to an MI-based consult delivered in a guiding style would report higher perceived physical activity than those exposed to a consult delivered in a directing style. This hypothesis is consistent with findings of the aforementioned research, which demonstrated success of an MI counseling approach in improving pregnancy-related behaviours (Elliott-Rudder et al., 2014; Jackson et al., 2014; Rasouli et al., 2017).

## **Methods**

### **Participants**

The target sample size for this project was 170 participants. This was based on a priori sample size calculations with estimated statistical power (0.80), a fixed level of statistical significance ( $p = 0.05$ ) and Cohen's (1988) guidelines for a small effect size ( $F < 0.25$ ). Pregnant individuals who were at least 18 years of age were eligible to participate. Those who were not pregnant or were not fluent in English were not eligible. Finally, in order to participate, individuals required access to the internet, as the study took place on an online platform.

## **Instrumentation**

The full range of items included in this study questionnaire is presented in Appendix A.

**Demographics.** Descriptive information was collected with self-report items regarding age, stage and status of pregnancy, parity, and socioeconomic status which have been included in previous pregnancy research (Ockenden et al., 2016; Sanders et al., 2020). Levels of current and past physical activity participation were also collected.

**Manipulation Check.** Six questions were used as a manipulation check to determine whether participants were sensitive to the differences in vignette conditions. Participants were asked to respond to the questions at the start of the questionnaire, after having read their assigned vignette (see Appendix B). Items reflected the MI mindset (Black & Deci, 2000; Kahler et al., 2017; Shumway et al., 2015), as well as the concepts of elicitation and information provision (Black & Deci, 2000). Each of the items included a 5-point scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). To illustrate this, an example is as follows: “During this consult, the exercise professional encouraged Ava to work with them.”

**Physical Activity Behaviour.** During one session, participants completed 3 copies of a modified version of the Behavioural Risk Factor Surveillance System (BRFSS). Only the physical activity related items were used, similar to those outlined by Wilson et al. (2006). Items were modified such that participants were asked to report expected physical activity behaviour of the pregnant client who was depicted in the vignette condition. The first questionnaire referred to physical activity levels expected one week following the consult (13 weeks pregnant), with the second and third referring to expected levels at 26 and 36 weeks pregnant, respectively. This allowed for

measurement of an immediate effect as well as observation of change from mid to late pregnancy.

### **Research Design**

This study used a randomized experimental, post-test only research design with repeated measures of the dependent variable. Participants received one of two written vignettes serving as the independent variable, and designed in accordance with experimental vignette methodology (Aguinis & Bradley, 2014) and vignette resources (Substance Abuse and Mental Health Services Administration, 2014). These vignettes depicted a hypothetical consult between an exercise professional and a sedentary pregnant client. The client was described as entering her second trimester, and as having an uncomplicated pregnancy such that exercise would not be contraindicated. Specific aspects of the vignette target were selected to align with characteristics of pregnant individuals in Canada. For instance, the target's age is near to the average age at time of delivery in Canada (Statistics Canada, 2021b). She is described as having one child at home, as is the case for about one third of individuals who gave birth in 2020 (Statistics Canada, 2021a). Finally, her inactive status is reflective of the physical activity levels of over three quarters of pregnant individuals in Canada (Gaston & Vamos, 2012).

In the treatment condition, the depicted consult matched recommendations of Miller and Rollnick (2013) for provision of information using the elicit-provide-elicited technique and an MI guiding style. Conversely, the control condition was based on a directing communication style, similar to work by Butler et al. (1999).

## **Data Collection Procedures**

Participants were invited to participate through social media posts and invitations on various platforms including Facebook and Twitter (see Appendix C). Postings were made in social media groups and community websites for pregnant individuals (see Appendix D), and were also shared with relevant professionals, such as midwives in provincial midwives' associations across Canada (see Appendix F). Interested individuals were directed to the study components including informed consent (see Appendix J) and information regarding the incentive used for the study. Those who did not provide consent were directed away from the study webpage and thanked for their time. Those who agreed to participate were directed to a webpage with instructions to carefully read the assigned vignette and then respond to the study questionnaires developed with Qualtrics software. Prior to beginning the questionnaires, participants were reminded of the option to withdraw from the study at any point in time.

## **Data Analyses**

Descriptive statistics were calculated to provide information about the sample. Further analyses of the demographic variables were not conducted for this study. It is known that pre-pregnancy physical activity is one of the key determinants of prenatal activity level (Fell et al., 2009; Pereira et al., 2007), yet performing an analysis of covariance when covariates are correlated with the dependent variable can dilute 'true' intervention effects (Miller & Chapman, 2001). Responses to the manipulation check items were analyzed with a one-way multivariate analysis of variance, with the responses to the manipulation check serving as the dependent variables, and study condition as the independent variable. A mixed model ANOVA with 95% confidence intervals and effect

size estimates was used to assess the effect of group assignment and time on physical activity behaviour, as well as potential group  $\times$  time interaction effects.

## Results

### Preliminary Analyses: Missing Data

In total, 190 participants accessed the study questionnaire, 26 of whom did not provide data for any survey items. These 26 individuals were classified as non-responders and removed from the dataset. Of the 164 remaining participants, 41 did not provide physical activity data for any of the three time points and were therefore removed from the dataset as well. Also removed were two participants who provided no physical activity data for the first assessment point, four who did not provide data on the third assessment point, and 19 individuals who provided no physical activity data for both the second and third assessment points. One additional participant was removed as responses was missing for both physical activity items in the third assessment point, and one of the two items for the second time point. Little's Missing Completely at Random (MCAR) test was non-significant ( $\chi^2 = 7.88$ ,  $df = 13$ ,  $p = .85$ ) such that data could be considered missing completely at random. Removal of these cases resulted in 97 individuals who provided complete physical activity data.

### Participant Characteristics

Demographic and pregnancy details were provided by 104 participants ( $M_{\text{age}} = 32.9$  years,  $SD_{\text{age}} = 4.3$  years). The majority of participants were white (82.7%), married/common-law (96.2%), full-time employed (76.0%), had a university or college degree (59.4%) and were residing in Ontario (58.7%). The sample used in this study appeared to share similarities with pregnant individuals in Canada, including age and

employment status. In particular, the average age at time of delivery in Canada is 31.3 (Statistics Canada, 2021b), while demographic data regarding employment showed that over 75% of individuals were employed during pregnancy (Public Health Agency of Canada, 2009). A full list of participant demographics can be found in Table 1. In addition, participants' pregnancy and physical activity details are provided in Table 2. Of note, 66% of participants reported that they had not received any exercise advice from their healthcare provider.

### **Preliminary Analyses: Manipulation Check**

Before conducting this preliminary analysis of manipulation check items, assumptions of a multivariate analysis of variance were tested. The assumption of independence was satisfied, with responses to the manipulation check items provided through mutually exclusive observations due to the study design and random assignment.

Given that the manipulation check items were posed using a Likert-style response scale, the range of potential responses was limited. Based on Mahalanobis distances, no multivariate outliers were detected. Regarding the assumption of univariate normality, skewness and kurtosis values indicate that the data deviate from a normal distribution. However, the MANOVA is robust to violations in this assumption given that there are over 20 cases for each combination of independent and dependent variables (Tabachnick & Fidell, 2013).

Results of Bartlett's Test of Sphericity were significant ( $\chi^2 = 398.74$ ,  $df = 15$ ,  $p < .001$ ), suggesting that the assumption of linearity was met. Finally, based on results of Box's Test of Equality of Covariance Matrices, the assumption of homogeneity of variance-covariance matrices was tenable (Box's  $M = 25.96$ ,  $p = .266$ ).

The one-way MANOVA demonstrated that the study groups differed on the manipulation check items at an aggregate level on average, with the effect size being large ( $F(6, 116) = 21.77, p < .001, \eta_p^2 = .53$ ). This finding suggests that participants were sensitive to the differences between the study conditions. More specifically, for five of the items, participants assigned to read the guiding style consult reported higher scores than those assigned to the directing style group. These items included evocation ( $F(1, 121) = 91.24, p < .001, \eta_p^2 = .43$ ), compassion ( $F(1, 121) = 39.08, p < .001, \eta_p^2 = .24$ ), information provision ( $F(1, 121) = 8.11, p = .005, \eta_p^2 = .06$ ), elicitation ( $F(1, 121) = 46.75, p < .001, \eta_p^2 = .28$ ), and acceptance ( $F(1, 121) = 91.11, p < .001, \eta_p^2 = .43$ ). In contrast, the two groups did not score significantly differently on the partnership item ( $F(1, 121) = 3.72, p = .056, \eta_p^2 = .03$ ) despite the differences in the vignette. Further information regarding the MANOVA for the manipulation check items is available in Table 3.<sup>1</sup>

### **Main Analyses: Intervention Effects**

Assumptions of a mixed model analysis of variance were tested prior to running the main analysis. Firstly, requirements pertaining to research design were met, with a continuous dependent variable, a within-subjects factor involving three time points, and a between-subjects factor containing two independent groups. Five cases were identified as outliers and removed, as their standardized scores were greater than  $|3.00|$  standard deviations from the mean on some or all assessment points.

Visual inspection of histograms and plots of residuals suggested that the assumption of normality was violated. Yet, ANOVAs are typically considered fairly robust to violations of this assumption (Maxwell et al., 2017). Further, normality



violations are less problematic if the sample is sufficiently large (Schmider et al., 2010). Levene's Test of Equality of Error Variances based on median values of the dependent variable was used to assess homogeneity of variances. This assumption was tenable at week 13 ( $F(1, 90) = 0.04, p = .84$ ), week 26 ( $F(1, 90) = 3.23, p = .08$ ), and week 36 ( $F(1, 90) = 3.85, p = .05$ ).

Lastly, Mauchly's Test of Sphericity indicated that the assumption of sphericity was not met ( $\chi^2 = 22.30, df = 2, p < .001$ ). As such, the Huynh-Feldt correction was used in interpreting the results of the main analysis.

To start, no significant interaction was found between time and condition ( $F(1.682, 151.372) = 0.34, p = .67, \eta_p^2 = .004$ ). However, the mixed model ANOVA revealed a significant main effect of time on total physical activity with a small effect size ( $F(1.682, 151.372) = 19.82, p < .001, \eta_p^2 = .18$ ). Post hoc tests using a Bonferroni correction demonstrated that between assessment points one and three, perceived weekly physical activity decreased by an average of 25.70 minutes ( $p < .001$ ). The reduction between time points two and three was also significant, with an average decrease of 19.52 weekly minutes of physical activity ( $p < .001$ ).

Results also revealed a significant main effect of group on physical activity behaviour, approaching a small effect size ( $F(1, 90) = 7.97, p = .006, \eta_p^2 = .08$ ). When group differences are averaged across time, those in the guiding condition reported higher perceived physical activity levels than those in the directing condition. Means and standard deviations from this analysis can be found in Table 4, while a plot of the data is available in Figure 1.

## Discussion

MI is a logical and intriguing approach to behaviour change, yet little is known about its effect on physical activity levels in pregnancy specifically. In order to examine this issue, this study involved a comparison of two communication styles, in terms of their impact on prenatal physical activity. A focus was placed on the aspect of information provision, delivered through a guiding communication style grounded in MI techniques, or a directing style inspired by a traditional healthcare consultation. It was hypothesized that those exposed to an MI-based guiding style consult would report higher perceived physical activity than those exposed to a directing style consult. Importantly, participants were asked to provide physical activity data pertaining to the vignette target described in their assigned condition. The study findings suggest that differences between the vignettes were detected, according to the study manipulation check items. These items corresponded to various characteristics which were carefully scripted throughout the hypothetical consult to reflect the two different conditions. As a whole, the scores between groups differed as expected, with participants in the guiding condition reporting higher scores on five of the six manipulation check items.

Results pertaining to the main purpose of the study were in line with the research hypothesis. Specifically, those in the guiding condition reported, on average, higher perceived levels of physical activity for the vignette target than those in the directing condition. Regardless of group assignment, a decline in perceived physical activity levels was reported over time. Overall, study findings point towards a superior effect of the guiding communication style on prenatal physical activity.

### **Main Effect of Group Assignment**

As mentioned, physical activity differences between groups were in the expected direction, with higher levels reported in the guiding condition than the directing. While the impact of these communication styles on prenatal physical activity has not received great attention in the existing literature, there is comparable research that appears to support this study's findings. Namely, work by Jackson et al. (2011) involving a combined prenatal physical activity and diet intervention noted an improvement in these behaviours when incorporating the use of MI. Others have found MI interventions to have beneficial effects for the distinct but related outcome of gestational weight gain (Bogaerts, 2013; Bogaerts, 2014; Claesson et al., 2008). Given that the guiding communication style is built upon core aspects of MI, including compassion, partnership and acceptance, the current study's findings seem reasonable.

Though the mechanisms behind the group differences in this study are not evident, one may look to the area of motivation for a potential explanation for the results. Previous research has demonstrated that autonomous forms of motivation are the strongest predictors of physical activity in pregnancy (Gaston et al., 2013). The notion of autonomy was a focus when developing the guiding style vignette, in contrast to the directing style which utilized controlling language. Autonomy is considered one aspect of the larger MI mindset (Miller & Rollnick, 2013), upon which the guiding condition was based. It is plausible that the autonomy supportive language used within the guiding style vignette contributed to the higher perceived physical activity levels reported by this group.

Though not targeted directly within the study vignettes, other psychological correlates, such as self-efficacy, may have played a potential role in the physical activity differences reported between groups. Exercise self-efficacy of pregnant individuals has been shown to improve following exposure to MI (van Poppel et al., 2019). Further, self-efficacy is positively related to physical activity during pregnancy (Cramp & Bray, 2009). As such, the guiding condition, modeled after the MI framework, may have elicited such an effect. In future work, the psychological variables of autonomous motivation and self-efficacy might be measured as mediators of the relationship between communication style and physical activity. To test potential causal effects, the use of conditions representing high or low levels of the mediator, such as high/low autonomy support, could be implemented.

Ultimately, these results provide unique insight into the value of an MI-based style of communication, specifically as it pertains to the provision of prenatal physical activity information. This is an especially useful finding seeing that traditional attempts at information provision are often considered ineffective for producing behaviour change (Kelly & Barker, 2016; Marteau et al., 2015). Of note, relatively small changes in wording were sufficient to elicit differing responses. These differences occurred even though participants were asked to respond based on a vignette target, rather than themselves. Should the effect be tested in a clinical setting, one might expect to see results in the same direction. Given the research concerning the effectiveness of MI on physical activity behaviour, it is anticipated that the magnitude of this effect would be small (Frost et al., 2018). In terms of practical significance, Wright et al. (2021) suggest that a small effect, in the context of physical activity interventions, equates to an

additional 15.6 minutes of physical activity per day. Future work might look to investigate the clinical impact of an MI-based physical activity intervention in a pregnant population.

### **Main Effect of Time**

In both groups, perceived physical activity decreased over time, and was lowest at the final assessment point, which corresponded to the third trimester of pregnancy. Encouragingly, this finding is consistent with prior research, which shows that there is a decline in physical activity throughout pregnancy, and especially towards the third trimester (Borodulin et al., 2008). The presence of this main effect of time, seen in previous literature, helps to further substantiate this study's findings. Notably, this effect was evident despite there being no information provided about the vignette target at future time points or later stages of pregnancy. This seems to suggest an underlying belief about physical activity behaviour throughout pregnancy.

One possible explanation for this clear decrease in physical activity levels over time comes from Duncombe et al. (2009), who examined changes in participants' reasons for exercising throughout pregnancy. Authors determined that towards later pregnancy, there was a decrease in several motives for participating in physical activity, such as fitness, weight loss and enjoyment. At the same time, reports of feeling too tired or too uncomfortable to exercise went up (Duncombe et al., 2009).

The current study did not examine potential reasons behind the apparent decline in physical activity levels. It seems plausible that participants considered the aforementioned motives for exercise when reporting perceived physical activity levels

over time. Regardless, it is important to acknowledge the presence of this time effect, and the impact it has on the health of pregnant individuals.

### **Interaction Effect on Physical Activity Behaviour**

Though a main effect of both time and condition were present, the results did not reveal a significant interaction effect between these variables. In other words, the effect of condition was not dependent upon time, with the converse also being true. As outlined above, perceived physical activity levels decreased significantly throughout pregnancy in both groups, falling in line with effects commonly reported in the literature (Borodulin et al., 2008). As such, it is somewhat unsurprising that the trajectory of physical activity levels over time did not change, despite the beneficial effects of the guiding style condition.

It should be noted that the study intervention involved only one consult, which was set in early pregnancy. While even brief sessions of MI have been shown to be effective in changing behaviour, research has demonstrated that a higher number of sessions correlates to a greater likelihood of success with behaviour change (Rubak et al., 2005). As such, incorporating additional consults for later stages of pregnancy may have helped to reduce the decline evident in perceived physical activity levels. Given that motives for physical activity are known to shift throughout pregnancy (Duncombe et al., 2009), providing multiple consults would also allow for further opportunities to explore this dynamic relationship. These represent important aspects to consider for future research. Finally, from a statistical perspective it would be prudent to acknowledge the role that power and effect sizes have on tests of interactions. As indicated by Aiken and

West (1991), low power to test interactions can often result in small interaction effects going undetected. This point may be of relevance to the current study.

### **Limitations**

This study has a number of limitations that should be noted when interpreting its results, several of which will be discussed below. These points are accompanied by a list of potential directions for future research involving MI and prenatal physical activity. Firstly, for the purposes of feasibility, this study involved the use of non-probability sampling. Though participants were recruited from across Canada using a variety of recruitment strategies, there is limited ability to determine the generalizability of the sample given the lack of random sampling (Daniel, 2012). It does appear, however, that the demographics of the study sample are consistent with those of pregnant individuals in Canada, in some regards (Public Health Agency of Canada, 2009; Statistics Canada, 2021b). The applicability of the study findings to those outside of Canada is unknown. Future studies might expand this research to include individuals from various nations.

This study warranted the use of a post-test only design, as data for the dependent variable consisted of participants' responses specific to a character described in the two vignettes. That said, this type of design does not reveal any information about variables prior to receiving treatment, which complicates the aspect of causation within this study (Trochim & Donnelly, 2006). In subsequent work, this could be addressed by involving baseline measures of the vignette character prior to exposing participants to the intervention aspect.

The use of self-report measures comes with limitations, such as non-response or the tendency to repeat certain response patterns (Paulhus & Vazire, 2007). In order to

minimize such occurrences, participant burden was considered throughout the entirety of the survey development process. In addition, survey items were adapted from previous work that had been used in similar populations. Experimental vignette methodology may also help to guard against certain issues with self-report, as participants are asked to provide responses based on a character rather than about themselves. Specifically, it has been suggested that the use of vignettes may aid in reducing socially desirable responses (Hughes & Huby, 2002), increasing the appeal of this technique for future research. Perhaps more relevant to the current study was the issue of non-response, as several cases failed to provide information for all survey items. However, Little's MCAR test indicated that these values were missing completely at random, and as such the cases of non-response were not deemed problematic.

A final limitation of this study, understanding that not all could be accounted for in this space, was the generation of a novel vignette and manipulation check items. Written scripts are rarely included in publications of MI-based studies, which required that the vignettes be developed using limited research. Similarly, evidence of manipulation check items for vignette-based studies is not readily available. As such, these items were adapted from a variety of sources in related literature. To further address this gap in the literature, studies should aim to document and publish the interactions that take place within interventions, such as through written scripts or recordings of a dialogue between the participant and stakeholder.

## **Summary**

The aim of this study was to explore how two modes of communicating physical activity information impacted activity levels throughout pregnancy. There was a



significant decrease in reported physical activity levels throughout pregnancy for both study conditions. Results also revealed that on average, those exposed to the guiding style consult reported greater physical activity than those exposed to the directing style consult. These findings suggest that a guiding communication style, grounded in an MI framework, holds merit for the purposes of providing prenatal physical activity information. Future studies might explore the mechanisms behind the guiding communication style and its impact on prenatal physical activity. This research could assist in the development of clinical applications of MI-based treatment for targeting physical activity throughout the entire course of pregnancy.

### Endnotes

<sup>1</sup>The multivariate analysis of variance for the manipulation check items was repeated following removal of all missing values and outliers, with a sample size of 92 participants. Once again, the MANOVA demonstrated that on average, the study groups differed at an aggregate level on these items, with the effect size being large ( $F(6, 85) = 22.15, p < .001, \eta_p^2 = .61$ ). Further, for all six items, participants assigned to the guiding style group reported higher scores than those in the directing style group. That is, evocation ( $F(1, 90) = 96.78, p < .001, \eta_p^2 = .52$ ), compassion ( $F(1, 90) = 55.52, p < .001, \eta_p^2 = .38$ ), information provision ( $F(1, 90) = 9.34, p = .003, \eta_p^2 = .09$ ), elicitation ( $F(1, 90) = 47.85, p < .001, \eta_p^2 = .35$ ) and acceptance ( $F(1, 90) = 94.10, p < .001, \eta_p^2 = .51$ ) items were all different between groups, as was the partnership item ( $F(1, 90) = 5.57, p = .02, \eta_p^2 = .06$ ). Of note, the initial MANOVA ( $n = 123$ ) revealed no significant difference between groups for the partnership item, in contrast to that above ( $n = 92$ ).

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**Table 1***Demographic Variables During Pregnancy by Group Assignment*

Characteristic	Guiding (n = 47)	Directing (n = 57)
Age (mean years)	33.40	32.47
Highest educational qualification held		
High school diploma	12.8%	7.0%
University/college degree	59.6%	56.1%
Graduate degree	25.5%	33.3%
Trade certification/diploma	2.1%	3.5%
Location currently living		
Alberta	14.9%	7.0%
British Columbia	23.4%	15.8%
Manitoba	2.1%	3.5%
New Brunswick	0%	1.8%
Nova Scotia	2.1%	0%
Ontario	53.2%	63.2%
Quebec	2.1%	1.8%
Saskatchewan	2.1%	7.0%
Ethnic origin		
White	80.9%	84.2%
Black	2.1%	3.5%
South Asian	2.1%	1.8%
Latin American	2.1%	1.8%
Chinese	2.1%	0%
Arab	2.1%	0%
West Asian	2.1%	0%
Indigenous	2.1%	1.8%
Filipino	2.1%	0%
Southeast Asian	0%	1.8%
Other	2.1%	5.3%
Marital Status		
Married/common-law	95.7%	96.5%
Single	4.3%	3.5%
Employment Status		
Full-time employed	72.3%	78.9%
Part-time employed	19.1%	7.0%
Unemployed	8.5%	14.0%

**Table 2***Pregnancy and Physical Activity Profiles by Group Assignment*

Characteristic	Guiding ( <i>n</i> = 47)	Directing ( <i>n</i> = 56)
Type of pregnancy		
Singleton	97.9%	96.4%
Multi-pregnancy	2.1%	3.6%
Provider exercise advice received		
Advised to exercise	27.7%	33.9%
Advised not to exercise	2.1%	3.6%
No advice received	70.2%	62.5%
Diagnosed with pregnancy complication	21.2%	32.1%
Number of children (excluding current pregnancy)		
0	42.6%	38.6%
1	42.6%	29.8%
2+	14.9%	31.7%
Number of weeks pregnant (mean)	23.62	20.98
Physical activity history (mean)	142.13	129.82
Current physical activity (mean)	102.28	102.86

*Note.* Physical activity history and current physical activity reported in minutes per week,

calculated as the product of sessions per week and minutes per session.



**Table 3***Manipulation Check Variables: Scores by Group Assignment*

Manipulation check item	Group 1: Guiding Style				Group 2: Directing style			
	<i>M</i>	<i>SD</i>	<i>Skew.</i>	<i>Kurt.</i>	<i>M</i>	<i>SD</i>	<i>Skew.</i>	<i>Kurt.</i>
Evocation	3.73	1.26	-0.78	-0.44	1.67	1.13	1.65	1.55
Information provision	4.38	0.87	-2.22	6.68	3.84	1.18	-1.17	0.60
Compassion	3.45	1.11	-0.40	-0.46	2.18	1.13	0.88	0.07
Elicitation	3.21	1.19	-0.30	-0.87	1.82	1.07	1.21	0.47
Partnership	2.70	1.29	0.07	-1.20	2.25	1.25	0.66	-0.78
Acceptance	3.27	1.05	-0.18	-0.36	1.60	0.89	1.83	3.55

*Note.* *M* = mean; *SD* = standard deviation.

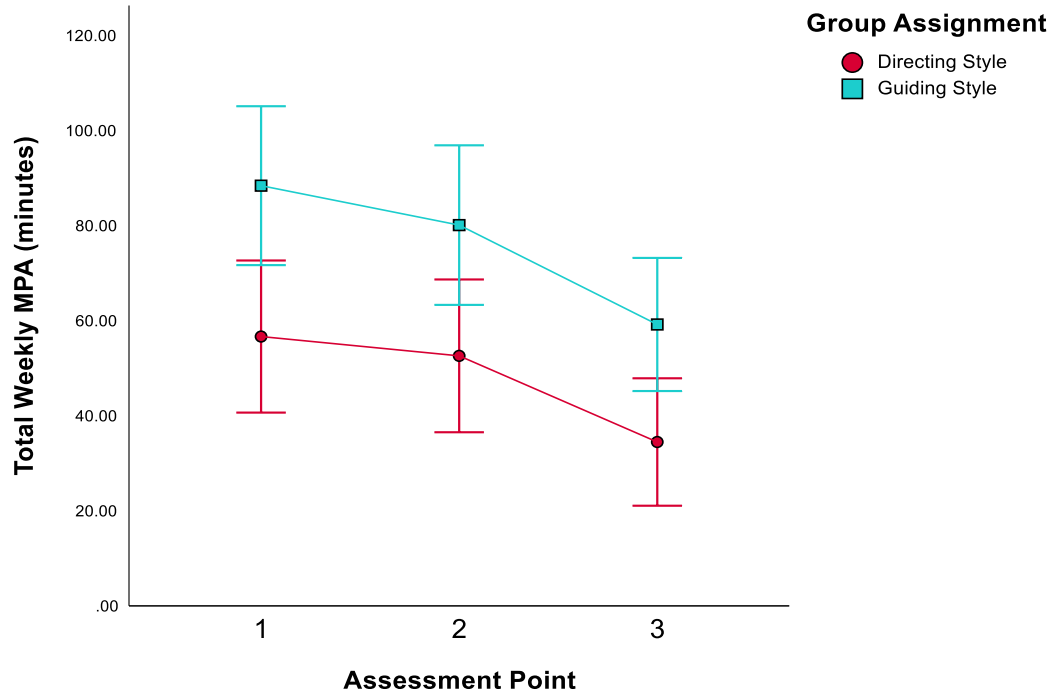
**Table 4***Physical Activity Behaviour: Scores by Group Assignment*

Dependent variable	Condition	Time 1 (13 Weeks)		Time 2 (26 Weeks)		Time 3 (36 Weeks)	
		<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Moderate intensity physical activity (minutes per week)	Group 1: Guiding style	88.41	55.81	80.11	60.98	59.20	54.10
	Group 2: Directing style	56.67	55.80	52.60	51.13	34.48	38.83

*Note.* *M* = mean; *SD* = standard deviation.

**Figure 1**

*Intervention Effects on Physical Activity Behaviour Across Time*



*Note.* Error bars: 95% confidence interval. MPA = moderate physical activity.

## Appendices

### Appendix A: Study Questionnaire

#### INSTRUCTIONS

This research is being conducted to study communication that can occur between pregnant women and exercise professionals (e.g., certified personal trainers, registered kinesiologists, etc.). You will be asked to read a brief script that depicts part of a consult between a pregnant woman and the exercise professional assigned to her case.

For this study, we ask that you:

- Please read the script carefully to yourself TWICE.
- Try to vividly IMAGINE every part of the consult described in the script.

After you read the script, we will ask you to answer some questions about the consult. Remember, there are no right or wrong answers, and your responses are entirely confidential and anonymous. We are interested in your understanding of the script and your thoughts on the details contained within (and left out of) the consult.

**Information provision using a 'guiding' style**

The client's name is Ava. She has been referred to an exercise professional for a consult by her family doctor because she is 12 weeks pregnant with her second child and not physically active. Ava is 29 years old and has no medical history that prohibits or limits physical activity. Her ultrasound showed that she is having one baby. Her pregnancy is going smoothly with no obvious complications.

The consult takes place in an outpatient program with an exercise professional specializing in prenatal fitness. This is Ava's first consult with the exercise professional. This consult began with a discussion of the reasons Ava was referred to this outpatient program. Next, Ava completed the Get Active Questionnaire for Pregnancy with the exercise professional. This is a screening tool developed by the Canadian Society for Exercise Physiology for pregnant women who are preparing for an exercise program.

The consult is currently in progress, and the exercise professional has asked about Ava's physical activity habits.

**Ava:** Yeah so I've been struggling to increase my physical activity levels...I just try to do what I can....also my doctor told me it's very important to increase my physical activity levels for my own health during this pregnancy...but this is all just making me really stressed out...I'm not really sure what it's all about...

**Exercise Professional:** So, you're not doing much physical activity right now and your doctor is saying you could benefit from being more physically active...what do you understand about your doctor's advice to get more physical activity?

**Ava:** Um, well, I'm not sure to be honest as I don't know much about physical activity at all...I've been told it's good for me...

**Exercise Professional:** Well, you're right...research indicates physical activity may help reduce complications during pregnancy such as high blood pressure and elevated blood sugars. Would it be okay if I shared some information with you about physical activity recommendations for pregnant women?

**Ava:** Yes, that sounds good, thanks...

**Exercise Professional:** Okay, the guidelines for pregnant women produced by the Canadian Society for Exercise Physiology recommends that pregnant women get 150 minutes or more of moderate-intensity physical activity over 3 or more days each week. This can include a mix of cardiovascular activities like walking or swimming combined with resistance training and flexibility exercises. What do you think about these recommendations?

**Please proceed to the next page of this questionnaire once you have read the story TWICE carefully.**

**Information provision using a 'directing' style**

The client's name is Ava. She has been referred to an exercise professional for a consult by her family doctor because she is 12 weeks pregnant with her second child and not physically active. Ava is 29 years old and has no medical history that prohibits or limits physical activity. Her ultrasound showed that she is having one baby. Her pregnancy is going smoothly with no obvious complications.

The consult takes place in an outpatient program with an exercise professional specializing in prenatal fitness. This is Ava's first consult with the exercise professional. This consult began with a discussion of the reasons Ava was referred to this outpatient program. Next, Ava completed the Get Active Questionnaire for Pregnancy with the exercise professional. This is a screening tool developed by the Canadian Society for Exercise Physiology for pregnant women who are preparing for an exercise program.

The consult is currently in progress, and the exercise professional has asked about Ava's physical activity habits.

**Ava:** Yeah so I've been struggling to increase my physical activity levels...I just try to do what I can....also my doctor told me it's very important to increase my physical activity levels for my own health during this pregnancy...but this is all just making me really stressed out...I'm not really sure what it's all about...

**Exercise Professional:** Oh, well I must tell you that your doctor is right, not being physically active during pregnancy will seriously damage your health by increasing blood pressure and elevating blood sugars. If you start getting physically active immediately then a lot of problems can be undone or avoided. Don't you know physical activity is good for pregnant women?

**Ava:** Um, well, I'm not sure to be honest as I don't know much about physical activity at all. I've been told it's good for me, but I just don't have time to fit in physical activity each day because I have another child at home which keeps me busy.

**Exercise Professional:** The Canadian Society for Exercise Physiology recommends that pregnant women get 150 minutes or more of moderate-intensity physical activity over 3 or more days each week. This should include a mix of cardiovascular activities like walking or swimming combined with resistance training and flexibility exercises.

**Ava:** Yes, okay...um thanks...but I just can't imagine doing that much physical activity every week...it feels like too much...

**Exercise Professional:** Okay, I think you must start getting more physical activity right away. If you remain inactive, you are putting your own health at risk during this pregnancy. I can set up a physical activity routine for you...

**Please proceed to the next page of this questionnaire once you have read the story  
TWICE carefully.**

*We would like to know your opinion about the physical activity consult between Ava and the exercise professional. Please answer the following questions based on your opinion after reading about the physical activity consult Ava had with this exercise professional.*

1. During this consult, the exercise professional tried to understand Ava's views about physical activity before offering recommendations.

1	2	3	4	5
Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree

2. During this consult, the exercise professional provided Ava with information about physical activity guidelines.

1	2	3	4	5
Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree

3. During this consult, the exercise professional displayed genuine care for Ava's well-being.

1	2	3	4	5
Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree

4. During this consult, the exercise professional encouraged Ava to share her feelings about physical activity.

1	2	3	4	5
Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree

5. During this consult, the exercise professional encouraged Ava to work with them.

1	2	3	4	5
Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree

6. During this consult, the exercise professional respected Ava's views about physical activity.

1	2	3	4	5
Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree

Part A: In this section, we will ask you questions about Ava's physical activity behavior **during the 7 days** following her consult with the exercise professional, when she is 13 weeks pregnant.

**Moderate intensity physical activity is any behavior lasting at least 10 minutes in duration that causes small increases in breathing and heart rate.**

In the 7 days following her consult, when she is 13 weeks pregnant...

How many session(s) per week does Ava engage in moderate intensity physical activities? **Session(s)/week**

On average, how many minutes does Ava typically engage in moderate intensity physical activity per session? **Mins./session**

Part B: In this section, we will ask you questions about Ava's physical activity behavior **during week 26 of her pregnancy**, when she is almost finished her second trimester.

**Moderate intensity physical activity is any behavior lasting at least 10 minutes in duration that causes small increases in breathing and heart rate.**

In her 26<sup>th</sup> week of pregnancy...

How many session(s) per week does Ava engage in moderate intensity physical activities? **Session(s)/week**

On average, how many minutes does Ava typically engage in moderate intensity physical activity per session? **Mins./session**

Part C: In this section, we will ask you questions about Ava's physical activity behavior **during week 36 of her pregnancy**, when she is in her final trimester.

**Moderate intensity physical activity is any behavior lasting at least 10 minutes in duration that causes small increases in breathing and heart rate.**

In her 36<sup>th</sup> week of pregnancy...

How many session(s) per week does Ava engage in moderate intensity physical activities? **Session(s)/Week**

On average, how many minutes does Ava typically engage in moderate intensity physical activity per session? **Mins./session**



Part D: This section contains questions that ask you to provide information relevant to yourself. In other words, these questions are about YOU (not Ava). They will be used to describe in general terms who participated in this study.

### Section 1: Demographic Information

What is your current age? \_\_\_\_\_ (years)

What educational qualifications do you currently hold? (Select all that apply).

- High School Diploma     
  University/ College Degree     
  Graduate Degree     
  Trade certification/diploma     
  None

Where do you currently live? Please check only one of these options.

- Alberta                     
  British Columbia                     
  Manitoba                     
  New Brunswick  
 Newfoundland & Labrador     
  Northwest Territories                     
  Nova Scotia                     
  Nunavut  
 Ontario                     
  Prince Edward Island                     
  Quebec                     
  Saskatchewan  
 Yukon                     
  I currently live outside of Canada

How would you describe your ethnic origin? Please check only one of these options.

- White                     
  South Asian                     
  Chinese                     
  Black  
 Filipino                     
  Arab                     
  Korean                     
  Latin American  
 West Asian                     
  Japanese                     
  Indigenous                     
  Southeast Asian  
 Other – Please Specify: \_\_\_\_\_

What is your current marital status? Please check only one of these options.

- Married/Common Law                     
  Widowed                     
  Single                     
  Separated/Divorced

What is your current employment status? Please check only one of these options.

- Full-Time Employed                     
  Part-Time Employed                     
  Unemployed

How many children do you have (excluding this pregnancy)? \_\_\_\_\_

## Section 2: Pregnancy Details

How many weeks pregnant are you? Please respond in terms of weeks completed (e.g., If 23 weeks and 4 days, please record 23 weeks). \_\_\_\_\_

What type of pregnancy are you having?

- Singleton (One fetus)       Multi-pregnancy (Twins or more)

Did you receive any exercise advice from your healthcare provider during this pregnancy?

- Yes, they recommended I should exercise  
 Yes, they recommended I should NOT exercise  
 No, I did not receive any exercise advice

In your current pregnancy have you been diagnosed with or told by your healthcare provider that you are at risk for any of the following (Select all that apply):

- Preterm delivery  
 Gestational hypertension  
 Gestational diabetes  
 Preeclampsia  
 Chronic pain  
 Stillbirth  
 Anxiety/Depression  
 C-Section  
 Other – Please Specify: \_\_\_\_\_  
 None of the above

## Section 3: Physical Activity History

The following questions ask about YOUR physical activity behaviours in the 3 months prior to your current pregnancy.

**Moderate intensity physical activity is any behavior lasting at least 10 minutes in duration that causes small increases in breathing and heart rate.**

<b>In the 3 months before this pregnancy...</b>	
<b>How many session(s) per week did you engage in moderate intensity physical activities?</b>	<b>Session(s)/week</b>
<b>On average, how many minutes did you typically engage in moderate intensity physical activity per session?</b>	<b>Mins./session</b>

**Section 4: Current Physical Activity Details**

The following questions ask about YOUR physical activity behaviours in the past week.

**Moderate intensity physical activity is any behavior lasting at least 10 minutes in duration that causes small increases in breathing and heart rate.**

<b>In the past week...</b>	
<b>How many session(s) per week did you engage in moderate intensity physical activities?</b>	<b>Session(s)/week</b>
<b>On average, how many minutes did you typically engage in moderate intensity physical activity per session?</b>	<b>Mins./session</b>

## Appendix B: Narratives

### INSTRUCTIONS

This research is being conducted to study communication that can occur between pregnant women and exercise professionals (e.g., certified personal trainers, registered kinesiologists, etc.). You will be asked to read a brief script that depicts part of a consult between a pregnant woman and the exercise professional assigned to her case.

For this study, we ask that you:

- Please read the script carefully to yourself TWICE.
- Try to vividly IMAGINE every part of the consult described in the script.

After you read the script, we will ask you to answer some questions about the consult. Remember, there are no right or wrong answers, and your responses are entirely confidential and anonymous. We are interested in your understanding of the script and your thoughts on the details contained within (and left out) of the consult.

**Information provision using a 'guiding' style** (Applied Psychology Across Physical Conditions, 2016; Clifford & Curtis, 2016; Hettema et al., 2017; Miller & Rollnick, 2013; Rollnick et al., 2008)

The client's name is Ava. She has been referred to an exercise professional for a consult by her family doctor because she is 12 weeks pregnant with her second child and not physically active. Ava is 29 years old and has no medical history that prohibits or limits physical activity. Her ultrasound showed that she is having one baby. Her pregnancy is going smoothly with no obvious complications.

The consult takes place in an outpatient program with an exercise professional specializing in prenatal fitness. This is Ava's first consult with the exercise professional. This consult began with a discussion of the reasons Ava was referred to this outpatient program. Next, Ava completed the Get Active Questionnaire for Pregnancy with the exercise professional. This is a screening tool developed by the Canadian Society for Exercise Physiology for pregnant women who are preparing for an exercise program.

The consult is currently in progress, and the exercise professional has asked about Ava's physical activity habits.

**Ava:** Yeah so I've been struggling to increase my physical activity levels...I just try to do what I can....also my doctor told me it's very important to increase my physical activity levels for my own health during this pregnancy...but this is all just making me really stressed out...I'm not really sure what it's all about...

**Exercise Professional:** So, you're not doing much physical activity right now and your doctor is saying you could benefit from being more physically active...what do you understand about your doctor's advice to get more physical activity? (Simple Reflection – Elicit)

**Ava:** Um, well, I'm not sure to be honest as I don't know much about physical activity at all...I've been told it's good for me...

**Exercise Professional:** Well, you're right...research indicates physical activity may help reduce complications during pregnancy such as high blood pressure and elevated blood sugars. Would it be okay if I shared some information with you about physical activity recommendations for pregnant women? (Provide – Asking Permission)

**Ava:** Yes, that sounds good, thanks...

**Exercise Professional:** Okay, the guidelines for pregnant women produced by the Canadian Society for Exercise Physiology recommends that pregnant women get 150 minutes or more of moderate-intensity physical activity over 3 or more days each week. This can include a mix of cardiovascular activities like walking or swimming combined with resistance training and flexibility exercises. What do you think about these recommendations? (Provide – Elicit)

**Please proceed to the next page of this questionnaire once you have read the story TWICE carefully.**

**Information provision using a 'directing' style** (Butler et al., 1999)

The client's name is Ava. She has been referred to an exercise professional for a consult by her family doctor because she is 12 weeks pregnant with her second child and not physically active. Ava is 29 years old and has no medical history that prohibits or limits physical activity. Her ultrasound showed that she is having one baby. Her pregnancy is going smoothly with no obvious complications.

The consult takes place in an outpatient program with an exercise professional specializing in prenatal fitness. This is Ava's first consult with the exercise professional. This consult began with a discussion of the reasons Ava was referred to this outpatient program. Next, Ava completed the Get Active Questionnaire for Pregnancy with the exercise professional. This is a screening tool developed by the Canadian Society for Exercise Physiology for pregnant women who are preparing for an exercise program.

The consult is currently in progress, and the exercise professional has asked about Ava's physical activity habits.

**Ava:** Yeah so I've been struggling to increase my physical activity levels...I just try to do what I can....also my doctor told me it's very important to increase my physical activity levels for my own health during this pregnancy...but this is all just making me really stressed out...I'm not really sure what it's all about...

**Exercise Professional:** Oh, well I must tell you that your doctor is right, not being physically active during pregnancy will seriously damage your health by increasing blood pressure and elevating blood sugars. If you start getting physically active immediately then a lot of problems can be undone or avoided. Don't you know physical activity is good for pregnant women? (Righting Reflex – Closed-Ended Question)

**Ava:** Um, well, I'm not sure to be honest as I don't know much about physical activity at all. I've been told it's good for me, but I just don't have time to fit in physical activity each day because I have another child at home which keeps me busy. (Sustain Talk)

**Exercise Professional:** The Canadian Society for Exercise Physiology recommends that pregnant women get 150 minutes or more of moderate-intensity physical activity over 3 or more days each week. This should include a mix of cardiovascular activities like walking or swimming combined with resistance training and flexibility exercises. (Provide)

**Ava:** Yes, okay...um thanks...but I just can't imagine doing that much physical activity every week...it feels like too much... (Sustain Talk)

**Exercise Professional:** Okay, I think you must start getting more physical activity right away. If you remain inactive, you are putting your own health at risk during this pregnancy. I can set up a physical activity routine for you... (Scare Tactics Trap – Righting Reflex)

**Please proceed to the next page of this questionnaire once you have read the story TWICE carefully.**

### Appendix C: Twitter Script

Pregnant? Take this short survey to help #BrockU researchers learn more about physical activity & pregnancy. You must be 18+ and living in Canada to participate. Chance to win! ([survey link](#)) Please share @ #pregnancy #health REB File No. 21-074

## Appendix D: Facebook/Forum Script

Are you pregnant and living in Canada?



Researchers from the Behavioural Health Sciences Research Lab at Brock University are conducting a new study focused on physical activity and pregnancy. We are looking for pregnant individuals living in Canada to contribute to this research by completing a short survey. Those who are interested may enter a draw to win a gift card!

Want to participate? If you are 18+ and currently pregnant, click the link below to learn more about the study

<insert link to survey here>

Choosing to interact with this posting in any way (e.g., “liking”, “sharing”, etc.) may impact your anonymity with regards to the study.

This study has been reviewed and cleared for recruitment by the Health Research Ethics Board at Brock University (REB File No. 21-074-WILSON).



## Appendix E: Instagram Script

Calling all pregnant women in Canada!



Researchers from our lab are conducting a study focused on physical activity and pregnant women. We are looking for pregnant women living in Canada to contribute to this research by completing a short survey online. Those who are interested may enter a draw to win a gift card!

Want to participate? If you are 18+ and currently pregnant, click the link below to learn more about the study

<insert link to survey here>

Choosing to interact with this posting in any way (e.g., “liking”, “sharing”, etc.) may impact your anonymity with regards to the study.

This study has been reviewed and cleared for recruitment by the Health Research Ethics Board at Brock University (REB File No. 21-074-WILSON).

## **Appendix F: Midwives Association Email Script**

Good Morning/Evening,

My name is Sabrina Buchanan and I am a graduate student in the Faculty of Applied Health Sciences at Brock University. I am conducting a research study entitled 'Supporting Physical Activity in Pregnancy,' for my master's thesis, under the supervision of Dr. Philip M. Wilson (Department of Kinesiology, Brock University). Briefly, this research study is designed to examine whether certain communication techniques that may be used by health professionals are effective for increasing pregnant women's physical activity levels.

I am writing to request your assistance in advertising this research study to any pregnant clients who may be interested in participating. Specifically, this would involve sharing an email message with clients which advertises this study and/or sharing a social media post to any social media sites affiliated with your clinic. If you are willing to share the study message and/or post, please email me at this address ([sb15uj@brocku.ca](mailto:sb15uj@brocku.ca)) and I will send you a copy of the materials to be shared. The study has been reviewed and cleared for recruitment by the Health Research Ethics Board at Brock University (REB File No. 21-074-WILSON). You are welcome to contact me if you have any questions about this research study or my request for your assistance in participant recruitment.

Thank you very much for your time,

Sabrina Buchanan, BKin

### **Appendix G: Midwives Association Participant Recruitment Script**

The Behavioural Health Sciences Research Lab at Brock University is conducting a new study entitled 'Supporting Physical Activity in Pregnancy.' This study is designed to understand factors that may influence physical activity levels during pregnancy. Physical activity has numerous benefits for pregnant women, yet little is known about the role of communication from exercise professionals in relation to prenatal physical activity.

Your participation in this study will involve completing a survey that should take approximately 15-20 minutes of your time. Participation is voluntary. Data are provided anonymously and retained confidentially. Those who are interested may enter a draw to win a gift card. If you are 18 or older and currently pregnant, click here for further details about the study:

<insert link to survey here>

This study has been reviewed and cleared for recruitment by the Health Research Ethics Board at Brock University (REB File No. 21-074-WILSON).

## **Appendix H: Life With A Baby Email**

Good day Ms. Flynn-Bowman,

My name is Sabrina Buchanan and I am a graduate student in the Faculty of Applied Health Sciences at Brock University. I am conducting a research study entitled 'Supporting Physical Activity in Pregnancy,' for my master's thesis, under the supervision of Dr. Philip M. Wilson (Department of Kinesiology, Brock University). Briefly, this research study is designed to examine whether certain communication techniques that may be used by health professionals are effective for increasing pregnant women's physical activity levels.

We discussed the possibility of you advertising this study via your work with Life with A Baby (Niagara Chapter) following the preliminary study protocol details presented at Mapping the New Knowledge's conference at Brock University in April 2021. The study has been reviewed and cleared for recruitment by the Health Research Ethics Board at Brock University (REB File No. 21-074-WILSON). We are now recruiting women at any stage of pregnancy – aged 18 years or older – and would greatly appreciate your assistance. I would be happy to send you a message with further details about the study that you can share with expecting moms if you would like. Please let me know if you have any questions about the study or recruitment.

Thank you so much for your time and interest in this research.

Sabrina Buchanan, BKin.

## Appendix I: Letter of Invitation

### Letter of Invitation

**Title of Study:** Supporting Physical Activity in Pregnancy

**Principal Investigator:** Dr. Philip M. Wilson, Professor, Department of Kinesiology, Faculty of Applied Health Sciences, Brock University

**Principal Student Investigator:** Ms. Sabrina Buchanan, BKin, Graduate Student, Faculty of Applied Health Sciences, Brock University

**Introduction:** Research led by Dr. Philip M. Wilson and Ms. Sabrina Buchanan in the Behavioural Health Sciences Research Lab at Brock University is being conducted to understand how communication techniques may impact prenatal physical activity.

**Purpose:** This study is designed to examine whether communication techniques that may be used by exercise professionals affect pregnant women's physical activity levels.

**Involvement:** Should you choose to participate, you will be asked to read a short narrative and complete a survey designed for this research study. An example of a question from the survey for this research study is: "In the 3 months before your current pregnancy, how many session(s) per week did you engage in moderate intensity physical activities?" You will be asked to provide your responses to the questions contained within the survey using an encrypted website designed specifically for this study. It is expected that your participation in this research study should take no longer than 15-20 minutes of your time.

**Benefits:** There are a number of benefits associated with participating in this study. Each participant has the option to be entered in a random draw for 1 of 10 Babies "R" Us gift cards (Value = \$30 CAD). Withdrawing from the study at any time does not preclude a participant from being entered into the random draw. Additional benefits may include, but are not limited to, the following: (a) Greater awareness of the role of health professionals in influencing pregnant women's physical activity behaviour, and (b) opportunities to be involved in the research being conducted at Brock University. The study findings may be disseminated by publishing in academic journals and presenting at scientific conferences, yet no participant will be identified as a function of their involvement in this research study. Any information that is provided from study participants will be treated as confidential and access to all information provided in this study is restricted to the Principal Investigator and Principal Student Investigator noted in this letter. All data will be kept on an encrypted website accessible only to members of the research team. All data collected for this study will ultimately be destroyed 5 years post-publication.

**Participation:** Participation in this study is voluntary and you may decline to answer any question(s). There also may be risks associated with participation including answering questions that solicit personal information (e.g. age, stage of pregnancy, etc.) which may make some people feel uncomfortable or anxious. You may choose to decline or withdraw your participation at any time throughout the course of the study and will not experience any negative consequences as a result of your decision. Once data that any participant submits as a function of their involvement in this research study is received by the investigators, the data cannot be removed from the research study because all data will be provided anonymously thereby including no personal identifiers. All summary reports emanating from this study will use data that does not identify any participant individually.

You are eligible to participate in this study if:

- You are currently pregnant,
- You are at least 18 years of age or older,
- You currently reside in Canada

It is important to note that if you choose to participate, the data you provide in this study will be collected using an electronic interface ([www.qualtrics.com](http://www.qualtrics.com)) that is based in the United States of America and therefore is subject to American Homeland Security laws such as the Patriot Act.

If you wish to participate in this study, please continue to the next page. If you have any questions about this research study, please feel free to contact either Dr. Philip M. Wilson or Ms. Sabrina Buchanan using the contact details offered below:

Dr. Philip M. Wilson (e-mail: [pwilson4@brocku.ca](mailto:pwilson4@brocku.ca); Tel: 1 905 688 5550 Ext 4997)

Ms. Sabrina Buchanan (email: [sb15uj@brocku.ca](mailto:sb15uj@brocku.ca); Tel: 1 905 688 5550 Ext 5564)

If you have any questions about your rights as a research participant, please contact the Brock University Research Ethics Officer (905 688-5550 Ext. 3035, [reb@brocku.ca](mailto:reb@brocku.ca)).

Thank you for your interest and involvement in this study.

Sincerely,

Philip M. Wilson, PhD  
Sabrina Buchanan, BKin

This study has been reviewed and cleared for recruitment by the Health Research Ethics Board at Brock University (REB File No. 21-074-WILSON).

## Appendix J: Informed Consent

### INFORMED CONSENT

Project Title: Supporting Physical Activity in Pregnancy

Principal Investigator (PI): Dr. Philip M. Wilson, Professor  
Department of Kinesiology  
Brock University  
(905) 688-5550 ext. 4997; [pwilson4@brocku.ca](mailto:pwilson4@brocku.ca)

Student Principal investigator (SPI): Sabrina Buchanan, BKin, Graduate Student  
Faculty of Applied Health Sciences  
Brock University  
(905) 688-5550 ext. 5564; [sb15uj@brocku.ca](mailto:sb15uj@brocku.ca)

### INVITATION

You are invited to participate in a study that involves research. The purpose of this study is to examine whether communication techniques that may be used by exercise professionals affect pregnant women's physical activity levels. You are eligible to participate in this study if you are 18 years of age or older, currently pregnant and living in Canada.

### STUDY REQUIREMENTS

As a participant, you will be asked to read a short narrative then complete a questionnaire. Questionnaires will ask about the narrative and will also include demographic questions such as your age and your stage of pregnancy. The survey is housed on an encrypted website designed exclusively for this research study. Participation will take approximately 15-20 minutes of your time.

### POTENTIAL BENEFITS AND RISKS

Possible benefits of participation include being entered into a random draw for 1 of 10 Babies "R" Us gift cards (Value = \$30 CAD). Withdrawing from the study at any time does not preclude a participant from being entered into the random draw. Additional benefits may include, but are not limited to, the following: (a) Greater awareness of the role of health professionals in influencing pregnant women's physical activity behaviour, and (b) opportunities to be involved in the research being conducted at Brock University. There also may be risks associated with participation including answering questions that solicit personal information (e.g. age, stage of pregnancy, etc.) which may make some people feel uncomfortable or anxious. It is important to note that the data you provide if you choose to participate in this study will be collected using an electronic interface ([www.qualtrics.com](http://www.qualtrics.com)) that is based in the United States of America and therefore is subject to American Homeland Security laws such as the Patriot Act. All recorded data will be kept on an encrypted website accessible only to members of the research team. All data will be secured until summary findings have been published and any/all feedback requested from participants has been completed. All data collected for this study will ultimately be destroyed 5 years post-publication.

### CONFIDENTIALITY

All data collected in this study will be anonymous. Participants will not have any personal identifiers linked to data collected as a function of the study. Names and contact information may be provided if participants wish to receive aggregate feedback pertaining to the results of the study or be entered into the random prize draw. Data collected during this study will be stored on a password protected server for the duration of the study. All data will be secured according to the guidelines set forth by the Tri-Council Policy Statement-2: Ethical Conduct for Research Involving Humans (2014). Any printed materials (e.g., the list of participants requesting feedback and/or entered to win the prize draw) will be destroyed using a paper shredder upon completion of the study and announcement of the prize winners. Access to this data will be restricted to those

involved in the study, exclusively the principal investigator (Dr. Philip M. Wilson) and the principal student investigator (Sabrina Buchanan).

### **VOLUNTARY PARTICIPATION**

Participation in this study is voluntary. If you wish, you may decline to answer any questions or participate in any component of the study. Further, you may decide to withdraw from this study at any time and may do so without any penalty or loss of benefits to which you are entitled.

Voluntary withdrawal from the study does not preclude access to the random draw for one of the Babies "R" Us gift cards. However, once any participant submits their responses to the survey items to the study investigators, their data cannot be removed from the study because the data are anonymous and unidentifiable.

### **PUBLICATION OF RESULTS**

Results of this study may be published in professional journals and presented at conferences. Feedback about this study will be available once all data has been collected and analyzed by the researchers. It is anticipated this may take 3-6 months to complete after the final set of participants have completed their involvement in this research study. Summary feedback will be sent to participants who provide their contact details in the Participant Debriefing Form used in the study.

### **CONTACT INFORMATION AND ETHICS CLEARANCE**

If you have any questions about this study or require further information, please contact Dr. Philip M. Wilson or Sabrina Buchanan. Please retain a copy of this form for your records by printing this page before proceeding with this research study. This study has been reviewed and cleared for recruitment by the Health Research Ethics Board at Brock University (REB File No. 21-074-WILSON).

If you have any questions or concerns about your rights as a research participant, please contact the Research Ethics Office at (905) 688-5550 ext. 3035, reb@brocku.ca

Thank you for your assistance in this research study.

### **CONSENT FORM**

I agree to participate in this study described above. I have made this decision based on the information I have read in the Letter of Invitation and procedures used to secure Informed Consent. I have had the opportunity to receive any additional details I wanted about the study and understand that I may ask questions in the future at any time. I understand that I may withdraw this consent at any time. Please click the box below stating that you agree with the information stated above and consent to participate in this research study.

I consent to participate in this research study

I do not consent to participate in this research study



### Appendix K: Participant Debriefing Form

Once this study is finished, you will have the opportunity to receive feedback in terms of the main findings. The summary of main findings will not identify anyone personally in the presentation of the information.

Please click the box next to each statement that applies to you:

- I would like to receive a brief summary of the final results from this study
- I would like to be entered to win one of the gift cards from Babies "R" Us valued at \$30 CAD

If you clicked any of these boxes, a member of our research team will need to contact you directly in the future to send you (a) a summary of the study results in a .pdf file via email, and/or (b) notify you as one of the recipients of a gift card. Please provide the following details:

Name:

Contact e-mail:

It is anticipated that the draw for these prizes will take place at least 1-2 months after all data collection and analysis have been completed. This will occur after participant recruitment for this project has been completed.