SURVEY OF NUTRITION AND PHYSICAL ACTIVITY DURING PREGNANCY:
The SNAP Study

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ABSTRACT

Aims: 1) to compare pregnant women's energy intake (EI), physical activity (PA) and gestational weight gain (GWG) to current recommendations 2) to explore PA and GWG health professional (HP) advice and 3) to determine behaviors associated with GWG.

Methods: Women (n = 81) were recruited from prenatal classes. Current weight and pre-pregnancy weight were documented. Pregnancy PA levels and HP advice for PA and GWG were surveyed using questionnaires. Dietary recalls and pedometer steps were recorded.

Results: Participants included women with normal body mass indices (BMI), average EI (2237 kcal/d) and EE (2328 kcal/d). Most exceeded GWG recommendations despite receiving HP advice regarding GWG (74%) and PA (73%). Majority were classified as low active (36%, < 7500 steps/d). Women who achieved >8.5 MET-hr/wk were most likely to achieve appropriate GWG.

Conclusion: Pregnant women need to receive appropriate PA and GWG guidelines. Development of pregnancy step and MET-hr/wk recommendations are warranted.

SOMMAIRE

Buts: 1) l'apport énergétique (AE), la pratique de l'activité physique (AP) et le gain de poids gestationnel (GPG) pour établir si les femmes enceintes observent les recommandations, 2) étudier l'impact des conseils reçus des professionnels de la santé sur le GPG et la pratique d'AP, 3) déterminer les comportements associés au GPG recommandé.

Méthodes: Les femmes enceinte (n=81) ont été recrutées. Le poids, AP actuels et le conseil de pourvoyeur pour le AP et GWG a été étudié en utilisant des questionnaires. La consommation alimentaire et les pas d'un pédomètre ont été enregistrés.

Résultats: Les participantes à l'étude avaient un indice de masse corporelle (IMC) moyen de 23.3 ± 4 kg/m^2 avant la grossesse, un AE moyen de 2237 kcal/jour et une dépense énergétique moyenne de 2328 kcal/jour. Par contre, celles-ci ont eu un GPG hebdomadaire supérieur aux recommandations malgré avoir reçu des conseils au sujet de GPG (74%) et de l'AP (73%). La plupart des femmes étaient sédentaires (< 5000 pas / jours) ou légèrement active (36%, < 7500 pas / jours). Les femmes ayant un niveau d'AP supérieur à 8.5 MET-hr/sem avait plus de change d'avoir un GPG approprié.

Conclusion: Les femmes enceintes doivent recevoir les conseils relatifs à l'AP et au GPG. L'élaboration de recommandations pour le nombre de pas quotidien durant la grossesse et le nombre de MET-hr/sem est justifié pour encourager la pratique de l'AP lors de la grossesse.

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LIST OF ABBREVIATION

AE:	Apport énergétique
AP:	Activité physique
BMI:	Body mass index
BMR:	Basal metabolic rate
CSEP:	Canadian Society for Exercise Physiology
CSSS:	Centre de santé et de services sociaux
DRI:	Dietary reference intake
EE:	Energy expenditure
EER:	Estimated energy expenditure
EI:	Energy intake
GPG:	Gain de poids gestationel
GWG:	Gestational weight gain
HC:	Health Canada
IMC:	Indice de masse corporelle
IOM:	Institute of Medicine
KPAS:	Kaiser Physical Activity Survey
LTPA:	Leisure time physical activity
MET:	Metabolic Equivalent
NHLBI:	National Heart, Lung and Blood Institute
PA:	Physical activity
PARmed-X:	Physical Activity Readiness Medical Examination
PPAQ:	Pregnancy Physical Activity Questionnaire
PP-BMI:	Pre-pregnancy body mass index
SES:	Socioeconomic status
SNAP:	Survey of Nutrition and Physical Activity
SOGC:	Society of Obstetricians and Gynecologists of Canada
TEE:	Total energy expenditure
WHO:	World Health Organization

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I dedicate this thesis to all those who believe that we should "*SNAP out of it, and STEP into it*!" And make physical activity apart of daily lifestyles.

"Life is a workout, the world is my gym."

CONTRIBUTION OF AUTHORS

The research presented in this project was developed in collaboration with Dr. Kristine Koski and Dr. Hugues Plourde. Tamara R. Cohen participated in the development of the study design, which includes the development of all tools (i.e. home visit assessment forms, pedometer log book and dietary kits), recruitment and home visits. Drs. Koski and Plourde assisted with the statistical analysis, and writing and editing of the thesis and manuscript.

I. OVERVIEW

The World Health Organization has estimated that by 2015, 2.3 billion adults will be overweight and 700 million will be obese (FAO/WHO, 2009). This rise in obesity affects all genders, age groups and classes. As a result, health care providers and governmental agencies have begun creating programs aimed at preventing chronic diseases caused by obesity. As more women present with pre-pregnancy body mass indices (PP-BMI) (BMI= kg/m^2) as overweight or obese entering into pregnancy and are exceeding their recommended gestational weight gains (GWG), the obstetrical community is equally as concerned (Dye et al., 1997; Kinnunen et al., 2007a). Women who are overweight or obese place themselves and their developing fetus and eventually their child at an increased risk of chronic disease (Aittasalo et al., 2008; Wanjiku & Raynor, 2004). Consequently, pregnancy is now being seen as *obesogenic* as women augment the likelihood of presenting overweight or obese postpartum (Rossner, 1999). As a result, the term 'fit pregnancy' has emerged with an emphasis on appropriate energy intakes (EI) and energy expenditures (EE) which will ultimately help one achieve an appropriate GWG (Entin & Munhall, 2006).

Despite evidence based-research strengthening the necessity to achieve a healthy GWG, it is estimated that only 30% to 40% of women gain within targeted limits (Abrams et al., 2000; Olson et al., 2003a). A recent retrospective cohort study found that the proportion of women gaining excessive weight during pregnancy increased from 15.5% in 1988 to 19.5% in 2003 (Helms et al.; 2006). Moreover, overweight women are at a higher risk of exceeding GWG recommendations, further compounding the existing problem of excessive weight gains (Helms et al., 2006). Weight gain recommendations

during pregnancy need to be targeted correctly, understanding that a women's PP-BMI needs to be addressed and the weight gain tailored appropriately not only to PP-BMI but also to height (Kinnunen et al., 2007a).

It is important to recognize that attaining a "fit pregnancy" does not necessarily require mothers to participate in structured, routine exercise regimens but rather to avoid a sedentary lifestyle. Research suggests engaging in a "physically active lifestyle" is more realistic for this population, and accounts for the majority of EE during this phase in life. More specifically, household and family activities and not the "sport-type" of activities describe the larger proportion of total activity during pregnancy (Chasan-Taber et al., 2004; Clarke & Gross, 2004).

One particular methodological concern for researching PA during pregnancy is that not one tool alone can capture total PA and EE due to the dynamic changes that naturally occur during pregnancy (Chasan-Taber et al., 2007; DiNallo et al., 2008). Additionally, many studies have not correctly differentiated between PA and exercise, using different exercise prescriptions and intervention approaches (Asbee et al., 2009; Gray-Donald et al., 2000; Hui et al., 2006; Kinnunen et al., 2007a; Olson et al., 2004; Polley et al., 2002.).

Current research has not identified the percentages of Canadian women that are meeting PA or exercise recommendations. Furthermore, it is unknown what percentages of Canadian women are receiving GWG advice and whether those instructions are helping women target appropriate GWGs. To our knowledge, this research was the first Canadian study to examine weight gain, to measure both dietary intake (DI) and physical activity during pregnancy using both qualitative and quantitative assessment tools. The

purpose of the study was not to provide advice but rather to survey pregnant women's current practices and beliefs regarding weight gain and activity during pregnancy.

II. LITERATURE REVIEW

There currently exist GWG (FAO/WHO 2004; Institute of Medicine, 1990), nutrition (FAO/WHO, 2004; Health Canada, 2007a) and exercise (Davies et al. 2003b; Health Canada, 2007b) recommendations for the pregnant woman. Despite research acknowledging walking as the most common forms of activity during pregnancy (Mottola & Campbell, 2003) and the use of pedometers in research as a practical means of assessing activity in this population (Evenson et al., 2004; Schneider et al., 2004), there are no physical activity (walking) recommendations for pregnant women,

To date, few studies have correctly defined or classified women's activity patterns according to current recommendations creating confusion when conducting a literature review (Borodulin, 2008). Additionally, few studies have examined the impact of EI and EE on modulating GWGs (DiNallo et al., 2008). Moreover, there is increased confusion when attempting to differentiate the literature as research has not distinguished between exercise and physical activity as it relates to energy expenditure.

Research has acknowledged that certain types and intensities of activities are performed more than others with pregnant women (Chasan-Taber, 2007) and that certain socio-demographics may predict an active mom (Ning et al., 2003). However, trials whose aims are to prevent excessive GWG remain inconclusive, despite the additional advice/ information sessions regarding exercise, diet and weight. This is surprising considering the advice or written information sources a woman received regarding weight gain and PA during pregnancy has been shown to affect behaviors during pregnancy (Symons-Downs & Hausenblas, 2004).

The following literature review will address these aspects and will conclude with the study rationale, objectives and hypotheses.

1.0 REVIEW OF CURRENT RECOMMENDATIONS ON ACHIEVING A "FIT PREGNANCY": GESTATIONAL WEIGHT GAIN, DIET AND ACTIVITY

Gestational Weight Gain Recommendations

Gestational weight gain recommendations during pregnancy are based on a women's pre-pregnancy body mass index (PP-BMI). Currently, there exist three BMI classification systems that use different definitions of BMI cut-off points: (1) Institute of Medicine Classification (Institute of Medicine, 1990); (2) Health Canada Classification (Health Canada, 2007b); (3) World Health Organization Classification (FAO/WHO, 2004) (**Table I**).

Table I: Recommended Total Gestational Weight Gain According to Body Mass Index Classification Systems

Body Mass Index (kg/m^2)	Total GWG (kg)	Rates of GWG (kg/wk)*
Institute of Medicine (IOM) Classification		
Low (<19.8)	12.5 - 18.0	0.5
Normal (19.8 - 26.0)	11.5 - 16.0	0.4
High (26.0 -29.0)	7.5 - 11.5	0.3
Obese (>29)	6.0	0.3
Health Canada (HC) Classification		
Low (<20)	12.5 - 18.0	Not Specified
Normal/ Healthy (20 - 27)	11.5 - 16.0	Not Specified
High (>27)	7.0 - 11.5	Not Specified
World Health Organization (WHO) Classification†		
Underweight (<18.5)	12.5 - 18.0	0.4- 0.6
Normal (18.5 - 24.99)	11.5 -16.0	0.3- 0.4
Overweight (25.0- 29.9)	7.0 -11.5	0.2- 0.3
Obese (≥ 25.0)	5.0 - 9.0	0.1- 0.2

* Calculations assume a 0.5–2 kg (1.1–4.4 lbs) weight gain in the first trimester (FAO/WHO, 2009)
† FAO/WHO Guidelines represent the most current guidelines

For the past fifty years, weight gain recommendations during pregnancy have been controversial. In the past, obstetricians were asking women to restrict their weight gain to prevent toxemia, difficult births and maternal obesity (Abrams et al., 2000; Helms et al., 2006; Langhoff-Ross et al., 1987). However, by the mid 20th century, research was beginning to link these restrictions to high infant mortality, disability and mental retardation (Institute of Medicine, 2009). This prompted refinement of policies with new guidelines recommending increases in GWGs, suggesting that appropriate GWGs are strongly associated with more desirable birth outcomes (Institute of Medicine, 1990; Institute of Medicine, 2009).

The reason for prescribing GWG recommendations is to lower infant morbidity and mortality. However, today's pregnancy profile is changing as society now has women who conceive at an older age, present with higher PP-BMI and are exceeding weight gain requirements. As a result, in May 2009, the Institute of Medicine published a brief report highlighting the need to update GWG recommendations. Supporting the latest population trends, the IOM is now suggesting the use of the PP-BMI categories of the World Health Organization (WHO) which have more restrictive BMI classifications for the overweight and obese. The WHO Classification in **Table I** summarizes these new guidelines.

Dietary Recommendations

A women's dietary intake during pregnancy has a large influence on pregnancy outcomes, such as fetal growth, birth defects, preeclampsia, childhood cognitive development, adiposity and atopic disease (Abrams et al., 2000; Kaiser & Allen, 2002; Reilly, 2000; Rifas-Shiman et al., 2006; Williamson, 2006). As such, energy requirements during pregnancy are critical for many reasons, such as the deposition of energy to form new tissue (e.g., placenta, amniotic fluid), growth of existing maternal tissues (e.g., breasts, uterus), extra maternal fat deposition, increases in tissue synthesis and oxygen consumption (Williamson, 2006).

In the past, women were encouraged to eat without restriction to promote weight gains. However, it is now recognized that pregnant women do not have to "eat for two" but should consume balanced diets that are comprised of a variety of foods (Williamson, 2006).

Energy Requirements

It is necessary that energy requirements during pregnancy be individualized (Giroux et al., 2006) and account for pre-pregnancy body mass, height, age, appetite and PA (Freisling, 2006; Prentice et al., 1996; Stein et al., 2003).

Research suggests that energy requirements be based on multiples of basal metabolic rates (BMR) in order to take into account physical activity levels during pregnancy (Lof & Forsum, 2006). Longitudinal data using doubly labeled water techniques have confirmed that total energy expenditures (TEE) increase to an average 16.5% in the third trimester (1%, 6%, 17% in the first, second and third trimesters

respectively), resulting in a 12 kg weight gain (Butte et al., 2004). The higher energy requirements in the second and third trimester are necessary to reflect the increased basal metabolic rates (BMR) which promote higher GWGs to aid with fetal growth (Butte et al., 2004).

Current energy requirements for the pregnant women are based on the Institute of Medicine Recommendations (Institute of Medicine, 2005). These guidelines differ for women under and over thirty years, with those under thirty requiring an additional 100 kcal.

Using the IOM derived estimated energy requirements (EER) equation of: **354 - (6.91 x age [y]) + PA x {(9.36 x weight [kg]) + (726 x height [m])}**, a pregnant women's EER can be individualized with no increases in the first, an additional 340 in the second and 452 kcal in the third trimester.

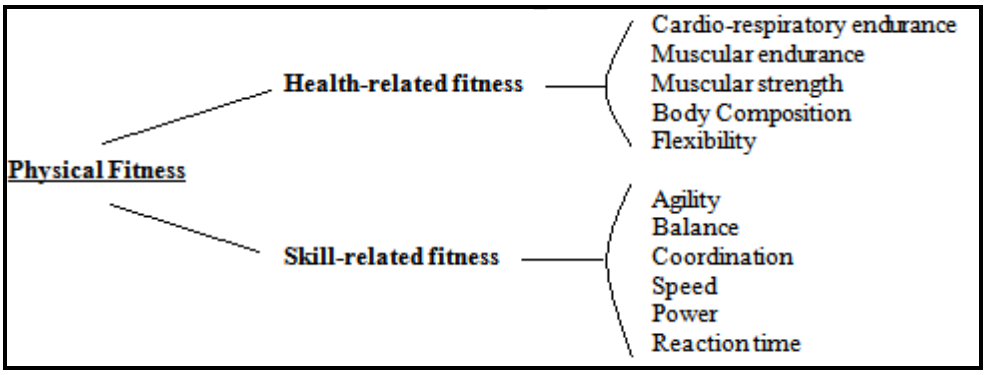
Activity Recommendations

Exercise versus Physical Activity: Definitions and Differentiating the Research

Individual studies on pregnant women assess either exercise or PA during pregnancy. Those that address exercise during pregnancy usually involve controlled laboratory based trials examining the recommended guidelines for exercise as they relate to maternal and fetal outcomes (Giroux et al., 2006; Kramer & McDonald, 2006). Conversely, research dealing with PA during pregnancy is typically community based and includes household, leisure time and work related activities (Chasan-Taber et al., 2004; Lindseth & Vari, 2005).

As such, it is important to define and distinguish terms that are commonly confused with one another. Elements of both physical activity and exercise include bodily movement via skeletal muscles that result in energy expenditures (kcal) that vary from low to high. Physical activity and exercise are both positively correlated with physical fitness. Unlike PA, exercise is planned, structured and repetitive and has as an objective to improve or maintain physical fitness components (Caspersen et al., 1985). In this context, PA relates to overall lifestyle and can be captured by steps taken per day. Exercise is assessed by addressing frequency, intensity, time and type of activity performed. **Figure I** highlights the components of physical fitness, as described by Caspersen et al. (1985).

Figure I: Components of Physical Fitness (Caspersen et al., 1985)



Exercise Recommendations

In 2003, the Society of Obstetricians and Gynaecologists of Canada (SOGC) with the Canadian Society for Exercise Physiology (CSEP) created a joint set of guidelines for exercising during pregnancy. These recommendations are based on a MEDLINE search that included studies performed from 1966 to 2002 related to exercise in pregnancy. Evidence suggests that women should exercise during pregnancy and are encouraged to commence exercise regimens during their second trimester if previously sedentary.

Based on the Canadian Task Force on the Periodic Health Exam evidence based guidelines, a set of six recommendations were published (Davies et al., 2003b):

i. All women without contraindications are encouraged to participate in aerobic and strength-conditioning exercises as part of a healthy lifestyle during their pregnancy;

ii. Reasonable goals of aerobic conditioning in pregnancy should be to maintain a good fitness level throughout pregnancy without trying to reach peak fitness or train in athletic competitions;

iii. Women should choose activities that will minimize the risk of loss of balance and fetal trauma;

iv. Women should be advised that adverse pregnancy or neonatal outcomes are not increased for exercising women;

v. Initiation of pelvic floor exercises in the immediate post-partum period may reduce the risk of future urinary incontinence;

vi. Women should be advised that moderate exercise during lactation does not affect the quantity or composition of breast milk or impact infant growth.

Prior to engaging in any form of exercise, women are encouraged to complete a four-paged *Physical Activity Readiness Medical Examination for Pregnancy (PARmed-X for Pregnancy)* with their physicians (Wolfe & Mottola, 2002). The PARmed-X for Pregnancy is a tool used to help women and the attending physician create a safe individualized exercise program that involves information on frequency, intensity, time and type of exercises.

Physical Activity Recommendations

Physical activity is related to overall lifestyle practices and can easily be incorporated in daily routines, such as daily household work (Tudor-Locke, 2002). Often evaluated in "walking steps" performed during one day, there currently exist Canadian PA guidelines for youth, adult and older adults at both national and provincial levels (Government of Quebec, 2005; Ministry of Health Promotion, 2005). For instance, the Government of Ontario has created a strategy program titled: "*ACTIVE2010*: Ontario's Sport and Physical Activity Strategy" (Ministry of Health Promotion, 2005). *ACTIVE2010* addresses walking as "the activity of a lifetime" and strongly encourages an increase in PA by adding walking steps into daily routines. Similarly, the Government of Quebec has stated PA programs, addressing walking as an important component in healthy living (Government of Quebec, 2005).

Despite the recommendations set by the federal and provincial governments, there are no step recommendations for the pregnant population. Research suggests that the average North American adult is sedentary and accumulates only 3,000- 5,000 steps per day. As such, it is recommended that one adds 2,000- 3,000 more steps per day, reaching the target goal of 10,000 steps per day (Tudor-Locke & Bassett, 2004).

Researchers in the field of pregnancy and exercise/ PA are beginning to acknowledge the use of pedometers to assess PA levels during pregnancy. There presently exist studies that have used pedometers in the pregnant population (Chasan-Taber et al., 2007b; Symons Downs et al., 2009; Lindseth & Vari, 2005; Morris & Udry, 1970; Ota et al., 2008; Tomkins et al., 2007; Yeo et al., 2008).

One study by Symons Downs et al., (2009) addressed the need to examine 1) the feasibility of pregnant women wearing pedometers and 2) women's self-reported and objectively measure physical activity behaviors. The authors found that 50% of pregnant women were sedentary and classified as low active in the second trimester (mean steps 6310, SD 731). Although women's 20-week mean steps classified women as healthy (mean= 7,300 steps/ day) their 32-week mean steps placed pregnant women in the range of individuals with disabilities and chronic illness (5,400 steps/day) (Symons Downs et al., 2009).

Assessment of Physical Activity

Physical Activity Assessment tools

Researchers face many challenges when assessing physical activity in free-living populations, and even more challenges when dealing with the pregnant population as women's physiology is continuously changing (Chasan-Taber et al., 2007). There exist several techniques for assessing physical activity, each with advantages and disadvantages. Cost and time burden on participants and researchers are important to consider when choosing the technique of choice (Washburn, 1986; Zhang & Savitz, 1996; Zhang et al., 2003).

Currently there is no standard or consistent method for assessing activity patterns in the pregnant population. No single tool alone can capture total activity if scientists wish to express activity as energy expenditures as well as quantify types (i.e. weight bearing, flexibility, strength and aerobic exercises), frequencies and durations of activity (Kriska & Caspersen, 1997). Moreover, qualitative and quantitative tools, such as activity diaries and accelerometers, are thought to underestimate by 400kcal/day (Stein et al., 2003).

Both subjective and objective tools have their place with pregnant women: Subjective tools (e.g., questionnaires, recalls, diaries) allow for categorizing, ranking and sometimes analyzing activity as energy expenditure. Objective tools (e.g., heart rate monitors, accelerometers, pedometers) assess energy expenditure and steps. A majority of studies use subjective tools and rely less frequently on objective measurement tools (Chasan-Taber et al., 2007b; Kriska & Caspersen, 1997; Sallis, 2000). Although subjective assessment tools are the most widely used, there are important strengths and

limitations to address. Validity, reliability, and practicality must be considered. To date there are only two validated questionnaires appropriate for capturing current PA practices with the pregnant population (Chasan-Taber et al., 2004; Schmidt et al., 2006a). Limitations for using self-reporting tools include participant bias leading to over-reporting, cognitive state of participants, and questionnaire readability (i.e. the use of ambiguous words or terms) (Sallis, 2000).

More recently, study designs have included objective measures, such as heart rate monitors, accelerometer and pedometers (Chasan-Taber et al., 2007). Study designs should consider using objective measures as these tools are more likely to detect significant and meaningful associations with study outcomes measures (Janz, 2006). However, limitations to these assessment tools include cost, feasibility for larger study sample sizes and validity with different population groups.

For the purpose of this literature review, only the tools used in this study will be discussed. They include the subjective tool (the Pregnancy Physical Activity Questionnaire (PPAQ) (Chasan-Taber et al., 2004)) and the objective tool (pedometer).

The Subjective Assessment tool: The Pregnancy Physical Activity Questionnaire (PPAQ)

To our knowledge, there currently exist only two validated PA questionnaires for use in the pregnant population: The Pregnancy Physical Activity Questionnaire (PPAQ) developed in 2004 (Chasan-Taber et al., 2004) and the Kaiser Physical Activity Survey (KPAS) for Pregnancy developed in 2006 (Schmidt et al., 2006a).

The PPAQ measures type, frequency, and duration of activity and uses the Compendium of Physical Activities for assigning intensity values (Ainsworth et al., 2000). This questionnaire was used to validate the KPAS (Schmidt et al., 2006a) and was more recently validated in the Vietnamese pregnant population (Ota et al., 2008). The PPAQ is a self-administered, semi-quantitative questionnaire composed of 32 activities with 4 domains: Household care giving [13 questions], occupational [5 questions], sports/exercise [8 questions], transportation [3 questions], and inactivity [3 questions]. Estimated time to complete the survey is ten minutes. Based on the goal to group women as least to most active, participants are asked to select the time spent per activity (day or week) during the current trimester. The PPAQ allows for open-ended questions (two options) for activities that may not be listed on the questionnaire.

This tool has been validated and tested for reproducibility. Authors found the reliability of the PPAQ to show an intra-class correlation coefficient of 0.78 for total activity. The reproducibility for activity- intensities ranged from 0.78 to 0.82. Compared to a seven day accelerometer reading, the validity of the PPAQ showed a modest correlation (r= 0.08 to 0.43).

To date there is only one study that has used this questionnaire (Ota et al., 2008). Authors validated the questionnaire using a digital pedometer (Digiwalker Pedometer

SW-200, Yamax Corp, Japan) where women wore the devices for ten days and completed two PPAQs. Reliability for the two administrations of the questionnaire was strong (intra-class correlation coefficient of 0.88 for total activity). Although authors validated the PPAQ, they used a different assessment tool (pedometer and not an accelerometer), which does not allowing for detailed results relating intensity to type of activity scores.

The only other questionnaire tested and validated for PA during pregnancy is the Kaiser Physical Activity Survey (KPAS). As seen with the PPAQ, the KPAS assesses multiple domains of activity: household/ family care activities, occupational activities, active living habits and sports/exercise. This questionnaire has been tested for reliability and validity (subjectively using the PPAQ and objectively using an accelerometer).

Differences between the PPAQ and the Kaiser are shown in **Table II**. Although both questionnaires are validated for use with the pregnant population, the PPAQ was chosen for use in this study due to its length and user-friendly design.

Table II: Pregnancy Physical Activity Questionnaires

	Pregnancy Physical Activity Questionnaire (PPAQ)	**Kaiser Physical Activity Survey (KPAS)**
	Chasan-Taber et al. (2004)	*Schmidt et al. (2005)*
Purpose	Ability to discriminate between subjects regarding PA EE; allows for ranking in quartiles of activity	Designed specifically to assess physical activity in women; measure full range of activity
Validity	Yes	Yes
Reliability	Yes	Yes
Total and Type of Questions (#)	**35 questions** Household/ care giving (13) Occupation (5) Transportation (3) Sports/ exercise (8) Inactivity (3)	**41 questions** Household/ care giving (11) Occupation (11) Active living (transportation) (4) Sports/ exercise (15)
Comments	Self-administered Not lengthy Easy to read (user friendly) Allows for participants to put in own activities not listed MET-h/week analysis Sophisticated analysis	Self-administered Lengthy Hard to read (not user friendly) MET-h/week analysis Sophisticated analysis

The Objective Assessment tool: The Pedometer

Measurement devices have been promoted as an effective method of assessing PA in the pregnant population (Chasan-Taber et al., 2007; DiNallo, 2008; Iqbal et al., 2006; Rousham et al., 2005; Stein et al., 2003) and have been used to validate PA questionnaires (Ota et al., 2008). The majority of studies have used accelerometers rather than pedometers to capture measurements of activity (Chasan-Taber et al., 2004; DiNallo, 2008; Iqbal et al., 2006; Schmidt et al, 2006a). Accelerometers provide both frequency and intensity movements versus pedometers which only capture steps. As walking is one

of the most common forms of activity during pregnancy (Mottola & Campbell, 2003), pedometers are considered as a practical tool for use with this group (Chasan-Taber et al., 2007; Evenson et al., 2004; Lindseth & Vari, 2005; Morris & Udry, 1970; Ota et al., 2008; Schmidt et al., 2004; Symons Downs et al., 2009; Tomkins et al., 2007; Yeo et al., 2008).

Table III briefly outlines the differences between the use of accelerometers and pedometers in free-living populations. The pedometer was chosen for use in this study due to lower cost and less burden on researchers and participants (Dishman, 2001). When compared with 13 models of pedometers, the Yamax Digi-walker SW-200 resulted in the most accurate results and was shown to be the most suitable for free-living populations (Schneider et al., 2004). This study therefore used the SW-200 model.

Table III: Objective Physical Activity Assessment Tools (Dishman et al., 2001)

	Accelerometer	**Pedometer**
Study Cost	(>$50.00 CND)	($18.00 CND)
Time	Low to High	Low to Medium
Effort	Low to Medium	Low
Interference	Low to Medium	Low to Medium
Acceptability		
Person	Yes	Yes
Social	Yes	Yes
Activity Specific	No Steps, calories, intensity, duration	No Steps
Pregnancy Studies	Yes	Yes

A recently published US study addressed walking during pregnancy and quantified steps using a pedometer (Symons Downs et al., 2009). Women (n=30) were asked to self-report PA and wear a pedometer for one week. Results classified women as sedentary (23%; mean steps= 3410, SD=1363), low active (35%; mean steps= 6310, SD=731), somewhat active (28%; mean steps= 8719, SD= 616), and active (14%; mean steps= 13,375, SD= 3705). When comparing pedometer steps to self-reported PA levels, authors found that women underestimated their PA levels (86% pedometer-determined inactive compared to 67% self-reported inactive). This study suggests that objective assessment tools should be used in addition to subjective tools to provide more accurate assessments of PA.

Although pedometers have been used with the pregnant population, limitations should be noted (Schneider et al., 2003). Previous studies have shown that a pedometer threshold and sensitivity will affect its accuracy in counting steps, all which differ among the different models (Bassett et al., 1996; Crouter et al., 2003; Schneider et al., 2003). Moreover, researchers acknowledge that when compared to direct observation, pedometer accuracy changes over fixed distances (Bassett et al., 1996; Schneider et al., 2003) and fixed treadmill speeds (Bassett et al., 1996; Crouter et al., 2003). Study designs that employ pedometers should consider subject reactivity (Clemes, 2008), placement (Horvath et al., 2007) and participant compliance (Downs et al., 2009). Pedometer sensitivity changes with an increased waist circumference and thus affecting pedometer accuracy (Corder et al., 2007). Despite these limitations, researchers still suggests that pedometers remain a viable tool for assessing activity during pregnancy as walking is the most commonly reported physical activity (Evenson et al., 2004).

Intensity and Types of Physical Activity during Pregnancy

Patterns of PA performed during pregnancy differ in intensity and type compared to other populations (Clarke et al., 2005; Evenson et al., 2004; Hausenblas et al., 2008; Pereira et al., 2007; Petersen et al., 2005; Watson, 2007; Zhang & Savitz, 1996). Intensity scores are categorized in levels of sedentary, light, moderate and vigorous while type scores are classified as occupational, transportation, household/ care giving and sport/ leisure time activities (Chasan-Taber et al., 2004; Schmidt et al., 2006b).

Compared to public health recommendations, pregnant women are not meeting exercise guidelines (Evenson et al., 2004; Zhang & Savitz, 1996). Evenson et al. (2004) found that two-thirds of women reported engaging in physical activity during pregnancy, but only one-sixth of those women met exercise during pregnancy recommendations. Similarly, results from a National US survey (1988 National Maternal and Infant Survey) (n=9953) found that 42% of women did not exercise 3x /week before or during pregnancy, that 13% exercised before pregnancy but not during pregnancy and that 7% began exercising only during pregnancy and not before pregnancy. Thirty-five percent continued activity throughout pregnancy (Zhang & Savitz, 1996).

Trends of PA have been examined and research has established that overall PA declines as pregnancy progresses (Domingues & Barros, 2007; Evenson et al., 2004; Haakstad et al., 2007; Pereira et al., 2007; Petersen et al., 2005; Zhang & Savitz, 1996), quantifying a 2.7% decrease in metabolic equivalents (MET) reduction in total physical activity from the second to third trimester (Watson, 2007). Despite past physical activity levels being identified as predicting PA during pregnancy, few studies have evaluated and compared pre-pregnancy physical activity levels to current levels during pregnancy

(Blaudeau, 2006; Clarke et al., 2005; Retnakaran et al., 2009; Rousham et al., 2005; Schmidt et al., 2006b).

Comparable research found that overall activity during pregnancy either decreased (39.8%) or remained the same as prior to pre-pregnancy (39.8%) (Hinton, 2001). Similar results were seen in a cohort of 336 pregnant women, where 60% reduced their exercise markedly in early pregnancy and stopped by the 18th week (Clapp, 1984). Research from Southern Brazil (n=4471) found that 12.9% were active during pregnancy but that 4.3% (n=194) continued activity throughout pregnancy. As pregnancy progressed, activity levels declined (first trimester: 10.4%, second trimester: 8.5%, third trimester: 6.5%) (Domingues & Barros, 2007).

Although not included as an intensity score, scientists often report on sedentary activities when assessing PA. This activity category includes watching television and reading, and has been reported to attribute as much as 39% and 76% of a woman's time during the weekdays and weekends respectively (Haakstad et al., 2007). Women who present as overweight PP-BMI were found to be more sedentary (Clarke et al., 2005; Haakstad et al., 2007; Oken et al., 2006).

Intensity

Physical activity may be quantified as an intensity score to further understand the nature of the activity being performed (Chasan-Taber et al., 2007). Intensity scores are typically represented as metabolic equivalents expressed as hours per day (MET-hr/day) or as a total amount in hours per week (MET-hr/week). These can be translated into energy expenditures (EE), expressed as calories (kcals). Intensity scores are composed of sedentary (<1.5 METs), light-intensity (1.5- <3.0 METs), moderate-intensity (3.0- 6.0 METs) and vigorous-intensity (>6.0 METs) (Chasan-Taber et al., 2007).

There are studies that have reported intensity scores for the pregnant population (Chasan-Taber et al., 2007; Clarke et al., 2005; Hausenblas et al., 2005; Laraia, 2007a; Lof & Forsum, 2006; Ning et al., 2003; Schmidt et al., 2006b). As pregnancy progresses, total energy expenditure (MET-hr/day) declines in both volume (Chasan-Taber et al., 2007) and overall intensity (Clarke et al., 2005; Lof & Forsum, 2006).

Studies that have attempted to quantify intensity scores have found similar results (Hausenblas et al., 2005; Laraia, 2007a; Schmidt et al., 2006b). For instance, Schmidt et al. (2006b) found significantly lower levels of sedentary-intensity activities in the second trimester, with light-intensity and moderate-intensity activities higher among second and third trimesters. Vigorous-intensity activities were low across all trimesters (Schmidt et al., 2006b). Similarly, data presented from the Pregnancy, Nutrition and Infection prospective study (North Carolina, USA) illustrated that only 8% of women during the first trimester (mean MET-h/wk=3.8, SD=3.1) and 3% of women in the second trimester (mean MET-h/wl=2.9, SD=2.3) engaged in vigorous leisure time physical activity (Laraia, 2007a). Equally, Hausenblas (2005) found that although “mild exercise” did

not differ across trimesters, 39.0%, 34.1% and 29.3% of women reported engaging in three or more bouts of moderate and/ or strenuous exercise during the first, second and third trimesters respectively.

Type

As with intensity of activity, there are different types of activities that account for total EE during pregnancy. Pregnant women are most likely to engage in walking, followed by swimming and aerobics activities (Evenson et al., 2004; Haakstad et al., 2007; Mottola & Campbell, 2003; Petersen et al., 2005; Zhang & Savitz, 1996). Household and care giving activities have been reported as highest median energy expenditures (Borodulin, 2008; Chasan-Taber et al., 2004; Schmidt et al., 2006b; Watson, 2007) and either remained the same (Clarke et al., 2005; Mottola & Campbell, 2003) or increased as trimesters progressed (Chasan-Taber, 2007; Schmidt et al., 2006b). A retrospective Canadian study also found that with the exception of walking, occupational and sport related activities decreased as pregnancy progressed (Mottola & Campbell, 2003). It is thought that a woman's pre-pregnancy activity is strongly correlated with household activities ($r= 0.62$); occupational activities ($r= 0.28$) and sport/ exercise ($r= 0.49$) ($p<0.0001$) types of activities during pregnancy (Chasan-Taber, 2007).

Occupational Activities

Evaluating the type of leisure time and occupational activity that pregnant women should or should not engage in is controversial (Bonzini, 2007). Despite the suspicion that occupational activities (i.e. prolonged working hours, lifting, shift work and heavy physical workload) have an adverse impact on pregnancy outcomes, a recent systematic review identified 35 reports on preterm delivery and 34 reports on birth weight. The authors concluded that the evidence continues to be insufficient to warrant restrictions to pregnant mothers (Bonzini, 2007).

Occupational-related activities are found to account for less of a women's total energy expenditure and steadily decline as pregnancy progresses (Borodulin, 2008; Chasan-Taber, 2007; Clarke et al., 2005; Haakstad et al., 2007; Mottola & Campbell, 2003; Schmidt et al., 2006b; Watson, 2007) and their practices at work do not involve lifting objects (Borodulin, 2008; Haakstad et al., 2007; Watson, 2007). Occupational-related activities decrease from 32% to 26% in the first to second trimesters respectively, as the amount of time women reported standing at work decreases (Mottola & Campbell, 2003).

Transportation-Related Activities

Transportation-related activities account for minimal total energy expenditures (Borodulin, 2008; Haakstad et al., 2007; Schmidt et al., 2006b), as most women drive (52.9%) or use public transportation to and from work (31.7%) (Haakstad et al., 2007). This remains relatively the same during second and third trimesters (Borodulin, 2008).

Leisure time/ Sport Related Activities

Research suggests that the majority of pregnant women participate in non-structured exercise (Mottola & Campbell, 2003; Schmidt et al., 2006b). A Canadian survey of pregnant women showed that during the third trimester, majority of women engaged in walking activities (30%), aerobic (5%), and muscle (2%) (Mottola & Campbell, 2003).

Household/ Care giving Related Activities

Pregnant women engage in household/ care giving-related activities (Chasan-Taber, 2007; Chasan-Taber et al., 2004; Clarke et al., 2005; Schmidt et al., 2006b). Results have shown that domestic activities did not change significantly during pregnancy, but rather a shift from less to more work towards the end of pregnancy (Clarke et al., 2005; Mottola & Campbell, 2003) or remained the same throughout pregnancy (Borodulin, 2008). Low to moderate intensity activity has been attributed mainly to household activities that include vacuuming, cleaning and shopping (Haakstad et al., 2007).

3.0 BEHAVIORS AND SOCIO-DEMOGRAPHICS ASSOCIATED WITH GESTATIONAL WEIGHT GAINS

Correlations exist between physical activity, pregnancy, socio-demographic, behavioral and health characteristics (Borodulin, 2008; Chasan-Taber, 2007; Chasan-Taber et al., 2007; Evenson et al., 2004; Mottola & Campbell, 2003; Pereira et al., 2007; Petersen et al., 2005; Poudevigne & O'Connor, 2006; Schmidt et al., 2006b; Symons Downs & Hausenblas, 2004). For instance a study that examined the factors related to quitting regular structured exercise programs during pregnancy were related to having children (OR=1.67; 1.05-2.67), having a pre-pregnancy BMI of >25 (OR=1.79; 1.04-3.13) or having gained excessively during pregnancy (Mottola & Campbell, 2003).

Pre-Pregnancy BMI

PP-BMI has been shown to predict total GWG (Abrams et al., 2000; Brawarsky et al., 2005; Laraia et al., 2007b; Stotland et al., 2005). Stotland et al. (2005) found that women classified as high PP-BMI were four times more likely to report a personal target weight gain above the IOM recommendation for this BMI classification.

Dietary Intake during Pregnancy

Research has examined the dietary intakes of pregnant women and its relation to gestational weight gain and has found that women exceeded weight gain recommendations if they were previously dieting (Siega-Riz et al., 2004). More specifically, women who regarded themselves as “restraint eaters” prior to pregnancy gained more weight compared to women who were “un-restrained eaters” despite similar nutrient intakes (Conway, 1999). Consuming more or less food during pregnancy was

associated with greater (3.67 lbs, $p<0.01$) or less (-3.16lbs, $p<0.01$) weight gains compared to women who maintained their food intakes (Olson & Strawderman, 2003). Dietary energy density was also significantly associated with total gestational weight gain (Deierlein, 2008). Women who consumed more fruit and vegetables (3 or more servings) gained less weight (-1.81 lbs, $p<0.05$) than those who consumed less (Olson et al., 2003).

Weight Gain during Pregnancy

Correlates of weight gain and physical activity have been assessed (Haakstad et al., 2007; Olson & Strawderman, 2003). A Norwegian cohort study published in 2007 found a weak correlations between time spent walking as a means of transportation and high weight gain ($r=-0,117$, $p=0.015$). No correlations were seen between women who did or did not work during pregnancy and less weight gain (<16 kg, $r=-0.021$, $p=0.694$). The authors found that in the third trimester, women who exercised regularly (>4 times per week, > 60 min) had lower weight gains than those who were inactive (Haakstad et al., 2007). A study by Olsen & Strawderman (2003) found that decreases in physical activity were associated with greater gestational weight gains (2.74 lbs, $p<0.01$) then maintaining or increasing physical activity.

Overall a woman's social support has been shown to significantly impact her weight gain, as women who have less encouragement regardless of PP-BMI classifications resulted in more weight gain (2.81 lbs, $p<0.01$) than women who reported receiving either average or high levels of family support (Olson & Strawderman, 2003).

Types of Physical Activity

Household Activities

Age, parity, and ethnicity positively correlated with higher household/ care giving activities during pregnancy (Chasan-Taber, 2007).

Recreational and Leisure-time Activities

Recreational and leisure-time activity was seen more in younger (18- 34 years) women with higher education (Evenson, et al., 2004; Haakstad, et al., 2007). Evenson et al., (2004) reported no associations with race/ethnicity, parity, employment and marital status for recreational activities. Research also suggests that black (44% active) and white (42% active) women reported similar leisure-time activities during pregnancy (Zhang & Savitz, 1996). A study from the UK found that mean recreational activity declined between the 25^{th} (200 min (SD 164 min)) and 38^{th} (133 min (SD 170 min)) week of pregnancy ($p<0.001$) (Clarke et al., 2005).

Occupational Activities

As the trimesters progress, mean occupational activities have been seen to decline (Clarke et al., 2005). Higher levels of occupational-related activities during pregnancy were found among older women with higher education and household incomes (Chasan-Taber, 2007). Women will less children were found to be more active at work (Chasan-Taber, 2007).

Pre-Pregnancy Physical Activity

Research continues to suggest that a woman's pre-pregnancy activity level may be a determinant of her PA practices during pregnancy (Chasan-Taber, 2007; Ning et al., 2003; Pereira et al., 2007; Poudevigne & O'Connor, 2006). Women who were active as teenagers were found to be more likely to engage in high-intensity physical activity during pregnancy (Ning et al., 2003). Moreover, physical activity before pregnancy is inversely associated with the likelihood of insufficient leisure-time activity during pregnancy presenting an odds ratio of 0.86 (95% CI: 0.83- 0.90) (Pereira et al., 2007).

Socio-Demographics

Age

Younger women are more active during pregnancy (Ning et al., 2003; Petersen et al., 2005). Evenson et al. (2004) found that women of a younger age (18- 24 years and 25-34 years) compared with 35-44 years were significantly more active and presented an odds ratio of 2.3 (95% CI: 1.3- 4.0) of participating in any leisure time activity.

Ethnicity

Conflicting results suggest that ethnicity may or may not be associated with PA during pregnancy. One study found no association with ethnicity (Evenson et al., 2004) whereas other studies have stipulated that higher-intensity activities were most likely to occur with Caucasian women (Chasan-Taber, 2007; Petersen et al., 2005). Ning et al. (2003) found that non-white women were 40- 60% less likely to engage in PA compared to white pregnant women.

Marital Status

There is no consistent data linking marital status and PA during pregnancy. Some studies show that there is no difference (Ning et al., 2003; Petersen et al., 2005; Zhang & Savitz, 1996), whereas another one results in unmarried women being active than married women (Petersen et al., 2005).

Education

Research has found that a women's education may determine the type of PA practiced during pregnancy. For instance, studies suggests that university educated women spend less time engaging in household activities (Watson, 2007) and more time performing activities of higher-intensity (Ning et al., 2003; Petersen et al., 2005). More specifically, a study by Watson & McDonald (2007) found that in the second trimester, university-educated women spent a median of 96 min on walk/ household activities compared to 144 min for other women ($p=0.024$). In the seventh month, women with a university education spent less time on stand/walk activities than for other women (39 min compared to 63 min, $p=0.009$).

Parity

Only one study has quantitatively reported on the effects of parity and GWG and found that nulliparous participants gained more weight than parous participants (36.5 lbs ± 14.5 compared to 27.7 lbs ± 12.7, $p<0.01$) (Asbee, 2009). There are no studies that have linked parity to PA practices during pregnancy.

Income

Research from New Zealand found that women of low socioeconomic status (SES) engaged in more household/ care giving activities when compared to those of higher SES (Watson, 2007). Low SES women spent 35% more time and women on welfare 19% less time, on walk/ household activities when compared to high SES women, both in the forth ($p=0.022$) and ninth month of pregnancy ($p=0.007$). Types of activities differ between low and high SES. For instance, women from higher-SES engage in more swimming and gardening activities (Ning et al., 2003; Petersen et al., 2005). Higher socioeconomic status (SES) women swam and gardened more than lower-SES women (Zhang & Savitz, 1996). Women with lower incomes have been shown to exceed recommended weight (Olson et al., 2004).

4.0 MANAGEMENT OF GESTATIONAL WEIGHT GAIN

Provider Advice and Information Sources

Physical Activity and Exercise

Research suggests that women turn to family members and not health care providers when seeking information about lifestyle practices during pregnancy (Lewallen, 2004). Correspondently, it is thought that a woman's participation in exercise during pregnancy is significantly influenced by their partner, husband and/ or family members (Symons Downs & Hausenblas, 2004; Symons Downs & Ulbrecht, 2006; Thornton et al., 2006; Wolfe & Weissgerber, 2003). According to Symons Downs & Ulbrecht (2006), husbands and partners have the strongest social influence (57%) and that a woman's exercise belief is positivity associated with her exercise behavior.

Although obstetricians and other health care professionals play an important role in the prenatal care of women, research has found that a significant percentage of obstetricians seldom advise exercise or PA during pregnancy, despite being aware of the benefits (Entin & Munhall, 2006). One study found that only 52% of pregnant participants specifically discussed exercise with their physician (Entin & Munhall, 2006). Similarly, preliminary prospective surveys from the UK have found that although PA was discussed at least once during pregnancy with their physician (96%), that most of the women's information was being obtained from books and magazines and not from health professionals (Clarke & Gross, 2004). A similar trend has been seen when exploring the beliefs of PA during pregnancy in different cultures. Thornton et al. (2006) found that it is not the health care provider but rather husbands and family members that were the

primary sources for emotional, instrumental and informational support for weight, diet and activity related behaviors and beliefs in pregnant women (Thornton et al., 2006).

Gestational Weight Gain

It is estimated that 27% of women in the United States reported having received no advice or inappropriate advice from health care providers concerning weight, with an estimated twenty percent having to inquire themselves about GWG information (Wiles, 1998). There are differences between a woman's received weight advice, her personal target weight gain and what she actually gains. A woman's personal weight gain goal is associated with the advice she receives (Stotland et al., 2005).

Cogswell et al. (1999) identified a significant relationship between the advised and targeted weight gains. This study reported that 27% of women received no weight gain advice. Of the women who received advice, 22% were advised to gain more than recommended. Women's actual versus advised weight gains showed that 42% gained more than what was recommended. In addition, women who were advised to gain more were 3.6 times more likely to gain more than recommended. Overall, those who did not receive any weight related advice also exceeded target ranges (Cogswell, 1999).

A similar study by Stotland et al. (2005) (n=1,198) found that 33% did not receive any weight related advice. Of those who received advice, 7% were told to gain less than desirable, 48% within appropriate ranges, and 11% above their personal targets. In this study, 24% reported a target weight gain that exceeded the IOM weight gain recommendations. In this same study, 87% of women who were at a normal PP-BMI reported advice that would place them at exceeding weight targets versus 35% of women

with low PP-BMI reported advice that would lead to under gaining compared to recommendations (Stotland et al., 2005)

In summary, although health care providers are instrumental components to the prenatal care of women, research suggests that spouses, partners and family members are not only important support systems but are also acting as main sources of advice and information regarding pregnancy practices. Woman's beliefs, targets and actual weight gains can all be influenced by their PP-BMI and the advice provided to them either by health care providers or family.

Intervention Trials

With the increasing prevalence of women exceeding GWG recommendations, researchers have been conducting intervention trials to help women gain more appropriately (Absbee et al., 2009; Gray-Donald et al., 2000; Hui et al., 2006; Kinnunen et al., 2007b; Olson et al., 2004; Polley et al., 2002). Majority of these trials have consisted of behavioral components in the form of additional prenatal care information or guidance on weight, physical activity/ exercise and diet with the aims of further understanding which of these factors play a significant role in modulating a GWG (Absbee et al., 2009; Gray-Donald et al., 2000; Hui et al., 2006; Kinnunen et al., 2007b; Kuhlmann et al,. 2008; Olson et al., 2004; Polley et al., 2002). **Table IV** summarizes methodology and study results of trials among pregnant women.

Table IV: Study Descriptions of Intervention Trails among Pregnant Women

Study/ Location	Methods	Main outcome measures	Control	Treatment				GWG Results
			Design	Design	Exercise	Diet	Weight	
Asbee et al., 2009/ USA	Obstetrical clinic	Proportion of women who gained within recommendation (IOM)	(n=43) SMC	(n=57) GC	Not defined	H	I-Rx (IOM)	Less weight gain with treatment (28.7 ± 12.5 lbs) compared to control (35.6 ± 15.5 lbs) (p=0.01).
Hui et al., 2006/ Canada	Obstetrical clinic	Incidence of excessive GWG compared to recommendation (HC)	(n=21) SMC	(n=24) GC	45 min 4x/wk Video DVD	D	Not defined (HC)	Greater incidence of excessive GWG in control (33%) versus treatment (21%), p=0.70.
Polley et al., 2002/ USA	Obstetrical clinic for	Proportion of women who gained above, within or below GWG recommendations (IOM)	(n=59) SMC	(n=61) IC	Walking/ Active lifestyle	H	GWG grid; (IOM)	Less weight gain with treatment then control for women with normal PP-BMI (p<0.05). No effect among overweight women in treatment (p=0.09) but in the opposite direction.
Kinnunen et al., 2007b/ Finland	Obstetrical clinic	Proportion of women gaining weight over BMI-specific recommendation (IOM)	(n=49) SMC	(n=56) IC	30 min 5x/wk Group exercise: 40-60 min 1x/wk	I	I-Rx (IOM)	No significant difference between treatment and control for total GWG; treatment group exceeded (46%) GWG recommendations compared to control (30%).
Olson et al., 2004/ USA	Obstetrical clinic	Proportion of women who exceeded GWG recommendations (IOM)	(n=381) SMC	(n=179) IC	Not defined	H	GWG grid (IOM)	Intervention group significantly reduced excessive GWG (OR =0.41, 95% CI=0.20, 0.80) compared to control.
Gray-Donald et al., 2000/ Canada	Obstetrical clinic	Evaluating impact of intervention aiming at improving diet, GWG and glycemic levels	(n= 107) SMC	(n= 112) GC, IC	Walking groups	H	I-Rx (IOM)	No significant difference in rate of GWG between intervention (0.53 kg/wk [SD 0.32]) and control (0.53 kg/wk [SD 0.27]).

SMC: Standard Maternity Care; GC: Group Counseling; IC: Individual Counseling; D: Dietitian; H: Handout; I: Individual; Rx: Prescription

Positive Effect on GWG

A recent study by Asbee et al. (2009) assessed the differences between routine prenatal care and intensive dietary and lifestyle counseling. Women in the treatment group (n=57) gained significantly less weight than did those women who received standard prenatal care (n=43) (28.7 ± 12.5 lb compared to 35.6 ± 15.5 lb, p=0.01). When analyzing the two groups based on PP-BMI, the most predictive factor for gaining within IOM recommendations regardless being in treatment or control was having a normal PP-BMI. Women who exceeded their weight gains consumed higher total energy intake and are typically classified as sedentary. More specifically, total energy intake (kcal) and the consumption of dairy and fried foods were directly associated with excessive gestational weight gain. Women who engaged in walking and vigorous activities and ate vegetarian diets gained less weight (Asbee, 2009).

A Canadian study by Hui et al. (2006) also found that the additional information and guidance on diet and PA that included discussing overall lifestyle practices greatly impacted GWG. More specifically, those women who received the additional guidance on lifestyle practices were more likely to reduce excessive GWG than those who received "standard or typical" care which did not include advice on PA (Hui, et al., 2006). This study highlights not only the importance of including PA discussions but also suggested that pre-pregnancy lifestyle practices and beliefs play a critical role in modulating her health and decision making during pregnancy.

Polley et al. (2002) used a behavioral intervention approach in addition to usual prenatal care in a low-income obstetrical clinic in the United States. Participants received individual education about weight gains, guidance on healthy eating practices and

exercise. Differences in GWG were seen only in women with normal PP-BMI ($p<0.05$). For women classified with PP-BMI as overweight, striking results occurred with women in the treatment group (59%) gaining more than the control group (32%) ($p<0.09$). These investigators also concluded that weight gain during pregnancy is strongly associated with pre-pregnancy BMI (Polley et al., 2002).

No Effect on GWG

Studies that present with similar study designs do not present with uniform results. For instance, Kinnunen et al., (2007b) investigated the effects of additional individual counseling that focused specifically on diet and leisure time physical activity (LTPA) for controlling excessive GWG. Authors found that the additional information had no effect on GWG (Kinnunen et al., 2007b). Even more surprising, this study found that women in the treatment group exceeded weight gain recommendations more often when compared with the control group. The odds of gaining more than the target GWG recommendation did not differ in both groups. The researcher concluded that counseling women on GWG was unsuccessful.

A second study by Olson et al., (2004) concluded similar results. The aims of this study were to examine the effects of additional information in preventing excessive weight gains in low-income earning women. Authors found that low-income women in the intervention group reduced their risk of excessive GWG (odds ratio= 0.42, 95% CI = 0.20- 0.81). Despite the rates of gestational weight gain not differing between the treatment and control groups, 72 % of overweight women in the control group gained more than the treatment group (44%). Results were similar for women who enrolled with

normal PP-BMI; weight gain recommendations were exceeded in 45 % and 29 % for the control and intervention groups respectively. The effects of this trial were more pronounced with overweight women than with those of normal PP-BMI (Olson et al., 2004).

Finally Gray-Donald et al. (2000) conducted a study with the Canadian Cree Community examining the effects of additional diet and activity information on weight gain. Despite using different intervention strategies (modeling, skill training, contracting and self-monitoring) using a wide variety of activities (local radio broadcasts, pamphlets, supermarket tools, individual counseling and group activities), weekly GWG did not differ between groups regardless of PP-BMI.

Limitations to Studies

Although research acknowledges the impact of exercise and diet on GWG, no concluding message can be formulated. Firstly, study designs are not comparable as some use individual interventions (Kinnunen et al., 2007b; Olson et al., 2004; Polley et al., 2002) while others use group interventions (Asbee et al., 2009; Hui et al., 2006) or both (Gray-Donald et al., 2000). Furthermore, the studies are not using the same exercise prescriptions; some advise strict routines, such as walking 4 min, 4x/wk (Hui et al., 2006) versus others are not defined (Asbee et al., 2009; Olson et al., 2004) creating confusion when addressing this specific component as it relates to a weight gain. Thirdly, the activity components are not quantitative nor are they assessed using validated assessment tools.

A similar theme presents when reviewing the study designs of the different intervention groups, as dietary intakes are neither measured nor assessed in similar manners. For instance, some study designs offer individual counseling by a registered dietitian (Gray-Donald et al., 2000; Hui et al., 2006) whereas others provide a simple diet handout (Asbee et al., 2009; Hui et al., 2006; Kinnunen et al., 2007b; Olson et al;. 2004; Polley et al., 2002) Finally, the weight gain components are either not clearly defined or are using sophisticated grids to monitor woman's progress. It is therefore difficult to extrapolate a simple conclusion resulting in the need to explore quantitative measures of PA and diet and use validated assessment tools suitable for this population.

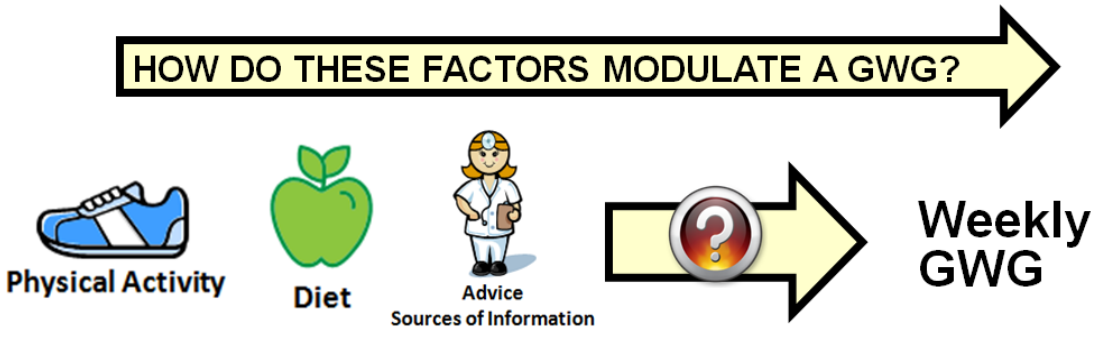
III. STATEMENT OF PURPOSE

Rationale

Research acknowledges associations between dietary intake and physical activity during pregnancy and their interrelationship with excessive gestational weight gain (Asbee, 2009). Although health care providers are instrumental components of the prenatal care team, research highlights spouses, partners and family members as main sources of information for the pregnant woman (Clarke et al., 2004).

Literature states that a large portion of a pregnant woman's energy expenditure comes from daily activities from occupational, home and family care and transportation (Chasan-Taber, 2007). As such, it is important that research is qualitative and quantitative, assessing not only the types of PA but also quantifies the activities. Unlike other studies that have attempted to understand how PA, diet and information sources modulate a GWG, this study employed both subjective and quantitative assessment tools (**Figure II**).

Figure II: The SNAP Model



Study Hypotheses

The hypotheses of this study are that pregnant women are surpassing their recommended weekly gestational weight gain because women are exceeding their estimated energy requirements (energy intake) and have low energy expenditures (EE). Secondly, pregnant women are not receiving appropriate advice for GWG and PA during pregnancy.

Study Objectives

The objective of this study was to survey and provide a "snap shot of the daily life" of pregnant women attending prenatal classes in Ottawa (ON) and Montreal (QC). The specific objectives of this study were three-fold: 1) to measure daily EI, PA and GWG to observe if these pregnant women were meeting recommendations 2) to explore the impact of health care provider advice on PA and GWG and 3) to determine behaviors associated with recommended weekly GWG.

IV. MANUSCRIPT: Are Canadian Women Achieving a Fit Pregnancy? A Pilot Study

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INTRODUCTION

The obesity epidemic affects all health professionals, including the obstetrical community, as women exceed gestational weight gains (GWG) increasing their risk of pregnancy complications (Institute of Medicine, 1990). The concept of a "fit pregnancy" is emerging as women are trying to achieve optimal health outcomes for their unborn child and for themselves (Entin & Munhall, 2006). Women can attain a "fit pregnancy" by achieving an appropriate GWG by balancing energy intake (EI) with energy expenditure (EE). Currently there exist dietary (Institute of Medicine, 1990; FAO/WHO, 1994; Health Canada, 2007a), exercise (Davies et al., 2003b; Health Canada, 2007b) and GWG (FAO/WHO 2009; Institute of Medicine, 1990), guidelines for pregnant women.

Nutritional requirements during pregnancy are based on Dietary Reference Intakes (DRI) by the Institute of Medicine (IOM) (Institute of Medicine, 1990). Recently the Institute of Medicine (IOM) adopted the World Health Organization (WHO) GWG recommendations, that state that women aim for total weight or weekly weight gains based on their pre-pregnancy BMI (PP-BMI) (Institute of Medicine, 2009). Joint SOGC/ CSEP Clinical Practice Guidelines encourage women to exercise if they have no contraindications (Davies et al., 2003b). Currently there exist Canadian step recommendations for youth, adult and older adult but none for pregnant women (Government of Quebec, 2009; Ministry of Health Promotion, 2005).

Despite recommendations, obstetricians seldom recommend PA (Clarke & Gross, 2004; Entin & Munhall, 2006) but PA participation is influenced by family members (Clarke & Gross, 2004; Stotland et al., 2005; Symons Downs & Hausenblas, 2004; Symons Downs & Ulbrecht, 2006). When health care providers do promote appropriate

GWG, by discussing weight goals, PA, and reviewing nutritional requirements during pregnancy, women who receive advice are more likely to target appropriate weight gains (Stotland et al., 2005). However, intervention trials have not been uniformly successful (Absbee et al., 2009; Gray-Donald et al., 2000; Hui et al., 2006; Kinnunen et al., 2007b; Olson et al., 2004; Polley et al., 2002).

Research to date for pregnant women has focused on the strict exercise routines and not daily PA as it relates to EE (Chasen-Taber et al., 2004). Daily PA can be addressed by quantifying total steps taken per day and by using validated questionnaires (Chasen-Taber et al., 2004). To date, one Canadian study has assessed PA patterns during pregnancy, citing walking as the most frequently performed type of PA during pregnancy (Mottola & Campbell, 2003), but none have examined the impact of PA on pregnancy outcomes.

The purpose of this study was to: 1) to measure daily EI, PA and weekly GWG to observe if pregnant women were meeting public health recommendations 2) to explore the impact of health care provider advice on PA and GWG and 3) to determine behaviors associated with recommended weekly GWG.

METHODS

Subject Recruitment

Ethics approvals were obtained from McGill University, Ottawa Public Health Ethics Board, Centre de Santé et de Services Sociaux (CSSS) West Island and Cavendish. Inclusion criteria were for women >12 wk gestation and free of medical risks for PA, as described in the Physical Activity Readiness Medical Examination for Pregnancy (PARmed-X for PREGNANCY) (Wolfe & Mottola, 2002). Benefits of participating in the study included a pedometer and study feedback. From August 2008 to December 2008, bilingual information sessions in Ottawa (ON) and Montreal (QC) public prenatal classes informed women about the study. Women interested in participating provided contact information and were scheduled for a home visit.

During the home visit, women signed the consent form. Subjects were asked to self-report age, height, pre-pregnancy weight and date of last menses. Women were weighed using a Tanita HS-301 Digital Bathroom Scale (Tanita Corporation of America, Inc. Arlington Heights, Illinois). Weekly GWG was calculated using current pregnancy weight minus pre-pregnancy weight (kg) divided by week gestation minus twelve (Institute of Medicine, 1990; Sante Canada, 1999). Socio-demographics characteristics were obtained. Women orally answered questions regarding sources of GWG and completed a questionnaire about sources of advice via PA.

Physical Activity Assessment

Daily PA was assessed using the validated Pregnancy Physical Activity Questionnaire (PPAQ) (Chasen-Taber et al., 2004) during the home visit. It contains 32 questions that assess usual time spent performing different types of activities over the course of one day. This questionnaire permits assessment of activity by intensity, type as well as by daily EE (kcal) and metabolic equivalents (METs). METs are a method of expressing the energy needed to perform activity compared to at rest (Haskell et al., 2007).

Translation of the Joint SOGC/ CSEP Clinical Practice Guidelines suggests women would expend 8.5 MET-hr/wk if they were meeting these recommendations. This falls within the recommendations of achieving 7.5- 12.5 MET-hr/wk for non-pregnant adult populations (Haskell et al., 2007).

Average EE, recorded in metabolic equivalent hours per week (MET-hr/wk) and kcals, was calculated by multiplying time spent for each activity by its intensity. Total average MET-hr/wk was calculated using the sum of sedentary, light-intensity, moderate-intensity, vigorous-intensity, household/care giving, occupation and sports/exercise as previously described (Chasen-Taber et al., 2004).

Currently there are no step recommendations for the pregnant population. Health Canada defines “active lifestyles” as those that achieve >10,000 steps/d (Government of Quebec, 2009; Ministry of Health Promotion, 2005).

As walking is the most reported activity during pregnancy (Mottola & Campbell, 2003), women were asked to wear a pedometer ([New Lifestyles Digi-Walker SW-200 pedometer (Less Summit, MO, USA)] for one week and to record their steps in a log

book. The Digi-Walker has been used in pregnant populations and has been tested for accuracy (Crouter et al., 2003; Schneider et al., 2003). Sources of information and provider advice concerning PA during pregnancy were assessed using open-ended questionnaires.

Dietary Assessment

Women participated in three non-consecutive 24-hour telephone food recalls to calculate average daily EI during the week they wore the pedometer. Dietary interview kits were provided to assist with estimating food portion sizes during recalls. The Canadian Nutrient File 2007 (Health Canada, 2009) and ESHA Research Food Processor (version 9.1) (Salem, OR) were used to analyze food recalls for total energy (kcals), protein (g), fat (g) and carbohydrate (g). Estimated energy requirements (EER) were calculated using the formula from the DRI which estimates the EER based on age, PA level, height and the additional requirement associated with pregnancy (FAO/ WHO, 2004; Institute of Medicine, 1990).

Statistical Analyses

Data analyses used SAS [Version 9.2, 2002-2003] (SAS Institute Inc., Cary, NC). Data were tested for normality and log transformed for GWG and EI. Differences between women who received provider advice and met or exceeded GWG recommendations as well as those who accumulated >8.5 MET-hr/wk versus those who did not were computed using independent t-tests. Differences between WHO PP-BMI classifications for weekly GWG (kg/wk), EE (kcals and MET-hr/wk) and steps (steps/d)

were analyzed using ANOVA with no adjustments. Univariate logistic regressions were used to compute odds ratios (OR) for achieving recommended GWG based on five variables: PA, EI, PP-BMI, provider advice and socio-demographic variables. Statistical significance was set at $p<0.05$.

RESULTS

Population Characteristics

One-hundred and forty two women were informed about the study (18 prenatal class visits) of which 81 provided contact information (response rate= 52%). Those 81 women (second trimester: n=40, third trimester: n=41) were visited at home and consented. All women completed the PPAQ. Seventy-four (91%) participated in telephone dietary recalls and 61 (75%) completed pedometer logbooks. A total of 60 women (74%) completed all components of the study. Mean age was 32 ± 5 years. Of the 81 women, 65% were married, 28% were cohabiting/engaged and 7% reported being single/divorced/separated. The majority (74%) had pre-university college degrees and 25% had completed university. Most were nulliparious (78%), Caucasian (85%) with household incomes >$50,000/yr (75%).

The mean PP-BMI was normal at 23 ± 4 kg/m^2. **Table V** summarizes our sample characteristics. Regardless of BMI classification, average GWG was higher than recommended. Average steps/day was 6118 ± 2187. Most women were classified as "sedentary" (34%) or "low active" (36%). Total mean MET-hr/wk averaged 6.4 ± 2.5. Additional analyses revealed that weekly GWG was negatively correlated with mean

steps ($r = -0.31$, $p<0.01$). Less than 30% met weekly GWG, steps/day, and MET-hr/wk recommendations while 57% exceeded EER.

EI and EE Characteristics

Women met recommended energy distributions (53% carbohydrate, 17% protein and 30% fat), but only 43% consumed appropriate EER. Second trimester EI (2231 ± 533 kcal) did not differ significantly from third trimester EI (2242 ± 480 kcal), nor were there differences across PP-BMI classifications (**Table V**). In contrast, EE significantly differed between women classified as normal (BMI 18.5- 24.9) and overweight/ obese (BMI >25) ($p<0.002$). The mean energy differences (EI- EE) were also significantly different between similar PP-BMI classifications ($p<0.004$).

Provider Advice for Weight and PA

The majority (79%) received advice about GWG: 44% books/ internet, 32% from a physician, and 14% from another health professional (dietitian, nurse or midwife). Ten percent referenced multiple sources. Recommended total GWG were: <25 lbs (12%), 25 lbs-35 lbs (59%) and >35 lbs (7%). **Table VI** compares weekly GWG by PP-BMI classification and whether the women received advice or not. On average, women exceeded GWG recommendations and provider advice did not lower rates of weight gain.

Advice for PA was less structured and uniform than for GWG and came from a variety of sources, including books (73%), internet sites (69%), partners/ family or friends (63%), physicians (41%), physiotherapist/ chiropractor/ kinesiologists (35%), magazines (25%), nurses (20%), personal trainers (12%), dietitians (10%), midwives

(9%) and newspaper articles (4%). This advice both promoted PA (i.e. "…keep active…", "… walk, bike and swim…") and discouraged PA (I.e. "… don't feel guilty if inactive…", "…no biking, no sex, no running, don't exercise…") and was not consistent.

PA Characteristics

Across trimesters there was no significance difference in steps/d. However, within a trimester, active women averaged 8745 ± 911 versus inactive women, who took fewer than 4990 ± 944 steps/d. No differences were found in the number of steps/d when classified by PP- BMI.

Using the PPAQ, 39 % of the score was attributed to sedentary activities (<1.5 METs), 36% to light-activities (1.5- 3.0 METs) and 25 % to moderate-intensity (3.0- 6.0 METs). Fifty seven percent of the PPAQ score was attributed to occupationally-related activities followed by household/ care giving activities (38%) and leisure time/ sport related activities (4%). There were no differences in PPAQ scores among PP-BMI classifications or between trimesters.

Women who engaged in more hours of light-intensity and moderate-intensity activities in the form of household/ care giving, occupational and leisure time PA accumulated >8.5 MET-hr/wk, the calculated value associated with meeting the current Joint SOGC/ CSEP Clinical Practice Guidelines [6] (**Table VII**).

Behaviors Associated with GWG

Table VIII summarizes univariante logistic regression analyses used to predict behaviors associated with achieving appropriate GWG. Only women who accumulated 8.5 MET-hr/wk achieved their recommended GWG. No significant odds ratios were observed for women who accumulated more than >5000 steps/d or received advice concerning GWG.

DISCUSSION

Our results show that women who were active as represented by PPAQ score are more likely to achieve appropriate GWG rather than those that focus on EI. Thus, to assume that diet alone affects GWG is incorrect. Most women in the study were physically inactive and were not accumulating sufficient steps from walking. Only 30% of our women met the adult steps recommendations (Government of Quebec, 2009; Ministry of Health Promotion, 2005). Although occupational and household/ care giving types of activities were continued by all women, only those who accumulated >8.5 MET-hr/wk equivalence influenced GWG. Moreover, the provider advice regarding PA was not focused or consistent making achievement of any PA goal during pregnancy difficult.

Our findings also show that our pregnant women exceeded weekly GWG most likely in part to: 1) health care providers not conveying the correct information and 2) targeted GWG recommendations based on PP-BMI classification not being achieved, as others have shown (Absbee et al., 2009; Gray-Donald et al., 2000; Hui et al., 2006; Kuhlmann et al., 2008; Kinnunen et al., 2007b; Olson et al., 2004; Polley et al., 2002). Most pregnant women cited 25 - 35 lbs as an appropriate weight gain. We suspect that

they did not understand that GWG is based on PP-BMI and that targeting the upper ranges may be inappropriate depending on their PP-BMI and height (Stotland et al., 2005). Limitations to our study include the use of self-reported data, small sample size and participant burden. Our findings also suggest that any public health message should target women prior to pregnancy and focus on their achieving healthy PP-BMIs.

CONCLUSION

This study highlights an important public health message: women were exceeding GWG recommendations and were inactive. Governmental agencies are highlighting the importance of healthy lifestyles to reduce obesity; similar efforts are needed for the pregnant population. Public health initiatives targeted toward pregnant women are warranted to emphasize the importance of appropriate GWG, PP-BMI and sufficient PA during pregnancy.

Future research agendas should include the use of validated assessment tools and should study appropriate steps/day and MET goals for the pregnant population. PA in combination with a well balanced diet and appropriate GWG needs to become part of the public health message for achieving a “fit pregnancy”.

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Table V Population Characteristics

Characteristics*	(n) $\bar{X}$ ± SD [range]
Rate of Gestational Weight Gain (kg/week), n=81	
World Health Organization (WHO)	
Underweight (BMI <18.5)	(2) 0.48 ± 0.20 [0.34- 0.62]
Normal (BMI 18.5 - 24.9)	(55) 0.71 ± 0.44 [-0.34- 2.5]
Overweight (BMI ≥ 25.0)	(19) 0.44 ± 0.33 [0.04- 0.80]
Obese (BMI ≥ 30)	(5) 0.77 ± 0.33 [0.21- 1.55]
Energy Intakes (kcal), n=74	
Mean Energy Intake (kcal)	**2237 ± 504 [1080, 3763]**
Underweight (BMI <18.5)	(2) 2953 ± 396 [2673, 3234]
Normal (BMI 18.5 - 24.9)	(50) 2220 ± 500 [1079, 3762]
Overweight (BMI ≥ 25.0)	(19) 2234 ± 515 [1508, 2958]
Obese (BMI ≥ 30)	(3) 2052 ± 370 [1637, 2349]
Energy Expenditure by WHO BMI Classification (kcal), n=81	
Mean Energy Expenditure (kcal)	**2328 ± 894 [728, 5494]**
Underweight (BMI <18.5)	(2) 1258 ± 283 [1058, 1458]
Normal (BMI 18.5 - 24.9)	(55) 2161 ± 758 [900, 4530]
Overweight (BMI ≥ 25.0)	(19) 2820 ± 1098 [728, 5493]
Obese (BMI ≥ 30)	(5) 2733 ± 691 [2040, 3802]
Pedometer steps (steps/day), n=61	**6118 ± 2187 [845, 11 090]**
"Sedentary" (<5000 steps/d)	(21) 3820 ± 1142
"Low active" (5,000- 7,499 steps/d)	(22) 6161 ± 745
"Active" (> 7,500 steps/d)	(18) 8745 ± 911
Total MET-hr/wk (MET-hr/wk) [†], n=81	**(81) 6.3 ± 2.5 [1, 14]**

* BMI: Body Mass Index (weight [kg]/ height [m]^2)

[†] MET-hr/wk, metabolic equivalent hours per week, is a method of expressing the energy needed to perform activity compared to at rest [22]. The Total MET-hr/wk is calculated by taking the sum of all the Pregnancy Physical Activity Questionnaire (PPAQ) Scores.

Table VI Impact of Advice on Weekly Gestational Weight Gain (GWG) by Pre-Pregnancy BMI Classification[*†]

BMI Classification (kg/m^2)	WHO Target GWG (kg/wk)	With Advice[†] (n)	With Advice[†] $\bar{X}$ ± SD	No Advice (n)	No Advice $\bar{X}$ ± SD	*p-value*
Normal (BMI 18.5 - 24.9)	0.4	(42)	0.71 ± 0.39	(13)	0.68 ± 0.59	0.0553
Overweight/ Obese (BMI ≥ 25.0)	0.3/ 0.2	(21)	0.71 ± 0.34	(3)	0.61 ± 0.53	0.2330

[*] GWG: {Current weight (kg) - Pre-pregnancy weight (kg)}/ (Weeks gestation- 12) [9, 25]. For Underweight (BMI <18.5), target GWG is 0.5 kg/wk. But only two individuals fit this category; With Advice (n=1), 0.34 kg/wk; No Advice (n=1), 0.62 kg/wk.

[†]With Advice: Includes all health care professionals (physician, dietitian, nurse and midwife) and books/ internet

Table VII Comparison of Pregnancy Physical Activity Questionnaire (PPAQ) Scores of Women who Accumulate <8.5 MET-hr/wk versus >8.5 MET-hr/wk, n=81

PPAQ Scores	Accumulated <8.5 Met-h/wk $\bar{X}$ ± SD	Accumulated >8.5 Met-h/wk $\bar{X}$ ± SD	p-value
INTENSITY SCORE			
Sedentary (<1.5 METs)*	88 ± 28	82 ± 30	0.4328
Light (1.5- <3.0 METs)†	66 ± 34	124 ± 35	<.000
Moderate (3.0- 6.0 METs) ‡	36 ± 28	120 ± 67	<.0001
Vigorous (>6.0 METs) §	0.8 ± 2.6	3 ± 65	0.1587
TYPE SCORE			
Household/ Care giving ‖	48 ± 30	106 ± 62	<.0001
Occupational ¶	73 ± 45	152 ± 64	<.0001
Leisure Time Sports **	5 ± 6	10 ± 9	0.0426

* **Sedentary intensity:** *e.g.* sitting and using a computer, sitting and reading or talking on the phone, driving or riding in a car, sitting at work or in class, watching TV or a video.

† **Light intensity**: *e.g.* preparing meals, dressing, bathing or feeding a child while sitting, playing with children, light cleaning, shopping, heavy cleaning, mowing lawn while on a riding mower, walking slowly to go places, standing or slowing walking at work not carrying anything.

‡ **Moderate intensity**: *e.g.* dressing, bathing and feeding a child while standing, playing with children while walking or running, carrying children, taking care of an older adult, playing with pets, mowing lawn using a walking mower, raking, gardening, walking quickly to go places, walking slowly for fun or exercise, walking more quickly for fun or exercise, prenatal exercise classes, swimming, dancing, standing or slowly walking at work while carrying things (heavier than 1 gallon of milk jug), walking quickly at work while carrying things

§ **Vigorous intensity**: *e.g.* walking quickly up hills for fun or exercise, jogging

‖ **Household/ Care giving activities**: *e.g.* Preparing meals, dressing, bathing, feeding a child while sitting and standing, playing with children while sitting, standing, walking or running, carrying children, taking care of an older adult, light cleaning, shopping, heavy cleaning, mowing lawn while on riding mower or using a walking mower, raking and gardening

¶ **Occupational type activities**: *e.g.* sitting at work or class, standing or slowly walking at while carrying things or not (heavier than 1 gallon of milk jug), walking quickly at work while carrying things or not (heavier than 1 gallon of milk jug).

** **Leisure Time Sports activities**: *e.g.* walking slowly or more quickly for fun and exercise, walking quickly up hills, jogging, parental exercise classes, swimming, dancing

Table VIII Odds Ratio of Achieving Recommended GWG Categorized by Behavior *

BEHAVIOR	Odds Ratio	(95% CI)	p-value
PHYSICAL ACTIVITY			
Accumulated ≥7500 steps/ d	1.6	(0.38, 6.26)	0.538
Accumulated ≥ 8.5 MET-hr/wk	3.8	(1.18, 12.38)	0.025
ENERGY INTAKE			
Exceed Estimated Energy Requirements	1.0	(0.33, 3.34)	0.950
WEIGHT CLASSIFICATION			
Pre-Pregnancy- BMI was "Normal/ Healthy" (18.5 - 24.9)	4.0	(0.82, 19.31)	0.087
PROVIDER ADVICE			
Received advice regarding GWG	2.4	(0.71, 8.05)	0.160
SOCIO-DEMOGRAPHIC CHARACTERICS			
University degree or equivalent	1.9	(0.64, 5.60)	0.251
Nullparious	3.0	(0.94, 10.0)	0.060
Income >$50,000/yr	1.4	(0.32, 6.14)	0.668

*n=81, except for physical activity (steps/d, n=61) and energy intake (n=74)

V. GENERAL DISCUSSION

Major Findings

This study assessed patterns of physical activity, dietary intake and weekly gestational weight gains in a sample of Canadian pregnant women. We hypothesized that pregnant women were exceeding estimated energy requirements and were inactive (i.e. sedentary and not walking). The results from our study support one of our hypotheses, that women's behavior, specifically energy expenditures, are not being met: women are not meeting energy expenditure recommendations or step recommendations and were classified as sedentary or engaging in light-intensity activities in the form of occupational-related and household/ care giving types of activities. As seen in previous work, our pregnant women were not achieving "fit pregnancies" (DiNallo, 2008; Symons Downs et al., 2009; Evenson et al., 2004).

The most pronounced variable associated with achieving recommended gestational weight gain was physical activity participation during pregnancy. Current physical activity practices, expressed as a total-score from the PPAQ demonstrated that women who achieved the physical activity recommendation of >8.5 MET-h/wk were more likely to achieve recommended GWG (Total PPAQ Activity Score: OR=3.8, $p<0.025$). Most women (73%) did not meet MET-h/wk recommendations and as seen elsewhere (Evenson et al., 2004; Leiferman & Evenson, 2003; Olson & Strawderman, 2003), were classified as sedentary (34%) or engaged in light-intensity activities (36%), occupational-related (57%) and household/ care giving activities (38%). As we hypothesized, most women exceeded recommended energy intakes (57%) and weekly gestational weight gains (75%), suggesting that although the types of activities (i.e.

occupational and household/ care giving) were continued, the resulting EE was not sufficient to impact the women's overall energy balances.

As there are currently no step recommendations for the pregnant population, we compared our women to recommendations set for healthy adults and found that 70% of our women did not meet these recommendations. As steps are a quantitative measure of lifestyle PA levels, these results would suggest that our pregnant women are not engaging in physically active lifestyles.

Results from our study and others demonstrate that the provider advice concerning physical activity was both positive and discouraging (Pivarnik et al., 2006). It is clear that our women did not have an accurate understanding of target GWG and PA during pregnancy.

Independent of BMI classification system, we found that our women exceeded recommended GWG. As mentioned above, the provider advice concerning PA was inconclusive, suggesting that perhaps the present health education system may be failing to correct all inaccurate perceptions of the risks associated with physical active during pregnancy. As seen with PA, weight gain advice was also inconclusive, bringing to light plausible reasons as to why women are not meeting weight gain or physical activity recommendations. Our study suggests: (1) target weight gain recommendations based on PP-BMI are not being used and explained to our women, (2) health care providers are not providing the adequate advice, and (3) women are not receiving the correct advice from multiple sources. Our results also proposes that women who present with normal pre-pregnancy BMI may achieve appropriate GWGs (OR=4.0, $p<0.087$). It is clear that the

public health message should not only focus on weight gains during pregnancy, but achieving healthy weights antenatal which will help the mother and the baby.

As seen in this and in another study (Stuebe et al., 2009), research has sought to identify the associations of both physical activity and diet and how they relate to gestational weight gain. As with our study, energy intake between trimesters did not differ significantly and was not seen as significantly driving our women's excessive gestational weight gains. Research has investigated the relationship between diet and weight gain with conflicting results, and has also highlighted the possibility that it is incorrect to assume that diet alone modulates GWG (Cogswell, 1999; Olson et al., 2004; Stotland et al., 2005). Confusion arises when deciding which BMI classification system to use as it translates to different recommendations. As a result, one might assume that our women did not appreciate that gestational weight gains are based on pre-pregnancy weight. Most women cited 25 lbs- 35 lbs as appropriate weight gains, not understanding that targeting the upper ranges may be inappropriate and that this weight range may not be correct for her PP-BMI.

Strengths and Limitations of the SNAP Study

Study Design, Recruitment, and Sample Population

Our study was novel in that our recruitment efforts were from public health prenatal classes and internet websites from two Canadian cites in two languages. Our study was comprised of a small, healthy homogenous convenient sample as we excluded the definition of "high risk pregnancies". As such, our study does not represent the typical "Canadian population". Due to ethical considerations, our respondents were required to volunteer rather than enter the study by random sampling. Our sample included equal number of women in the second trimester (n=40) and third trimester (n=41). Ideally, women would have entered in the second trimester and then again in their third trimester for a second pedometer recording and PPAQ assessment. This would have provided valuable information with regards to activity patterns during pregnancy. Our recruitment days were not randomly selected but rather assigned. Study recruitment was terminated due to restrictions involving the timeline for the completion of this research project. For ethical reasons, we could not assess smoking or alcohol consumption habits. Furthermore, our study did not explore barriers to exercising during pregnancy or the combination of social, psychological and physical factors that may discourage physical activity during pregnancy (Clarke & Gross, 2004).

As seen in other findings (Symons Downs et al., 2009; Haakstad et al., 2007; Hausenblas, 2005), the majority of women in our sample were physically inactive and although our odds ratio analysis was not statistically significant, our women were not meeting step recommendations set for healthy non-pregnant women. Given the ongoing physiological changes during pregnancy, it is possible that the target steps per day for the

pregnant population may be less than current adult recommendations. We suspect this is why steps did not show significance in relation to GWG. Inferring how sedentary our sample was, it could be suggested that there was not enough of a step variation within our sample to detect differences. Research needs to examine appropriate step goals for the pregnant population.

Subject compliance burden may have limited some volunteers to complete all components of the study. Our women had to be motivated as they were required to participate in an hour long interview, wear a pedometer for a week and be available for three telephone dietary recall interviews. Our study identified sensitive areas that may have impeded participation and possibly results; our women volunteered to participate "in a survey of nutrition and physical activity" during pregnancy. Women who felt their dietary intakes were not appropriate or who were sedentary may have been turned off by our study or inaccurately report both. It cannot be discount that participants may have changed their habits (Asbee, 2009). Conversely, women who participated may have misreported their dietary intake or physical activity habits as they were aware of the study purpose.

As our pre-pregnancy weights were self-reported, underreporting must be considered (Haakstad et al., 2007). Likewise, women may have overestimated their current physical activity practices (Petersen et al., 2005). Although we used objective measurement tools, our study design was predominately subjective (Kinnunen et al., 2007b; Stotland et al., 2005) prompting women in their third trimester who exceeded their GWG to alter their answers concerning weight-related provider advice citing upper ranges as appropriate targets (Cogswell, 1999).

The homogenous nature of our sample did not allow for population based statistical analysis between different groups. For instance, we did not find socio-demographic variables to affect gestational weight gains. Research shows that ethnicity may affect dietary, physical activity and gestational weight gains during pregnancy (Borodulin, 2008; Chasan-Taber, 2007). Additionally, income has also been shown to affect pregnancy behaviors (Ning et al., 2003; Olson et al., 2004; Petersen et al., 2005; Watson, 2007; Zhang & Savitz, 1996). Majority of our women were categorized as ">$50,000/ year" and had "college degrees". Although majority of our women were nulliparous, we view this as particularly advantageous as any observed changes in activity during pregnancy are voluntary and do not reflect involuntary lifestyle changes, such as caring for another child (Clarke et al., 2005).

Our study consisted of predominately normal PP-BMI women, perhaps not reflective of the pregnant women in today's society. Surprisingly, our women classified as "normal PP-BMI" exceeded their GWG recommendations, as did those in the overweight and obese categories. However, as there is currently an obesity epidemic affecting our Canadian population, the inclusion of more overweight/ obese women in our study would have allowed for more generalized comparisons to the Canadian population. To date the majority of the research concerning pregnant women is based on large national databases using patient records, and not similar recruitment efforts as seen in this study. Recruitment from public prenatal sites provided many advantages as it was more reflective of current practices compared to retrospective analysis. We did not have access to medical files and as such could not compare women's responses to that of medical records. As a corollary, we could not identify specific barriers to guideline

adherence, including lack of awareness, familiarity and agreement with weight and physical activity recommendations (Stotland et al., 2005). Our study did not examine women's beliefs but rather sources of information regarding physical activity during pregnancy. Research suggests that self-efficacy is a strong predictor of change in physical activity during pregnancy (Hinton, 2001) which would have been interesting to examine as well.

Finally our study was carried out August through December, reflecting summer, fall and winter seasons. Although research suggests that seasonal changes have little influence on household/ care giving and occupational-related activities, it is still important to consider (Rousham et al., 2005). As activity patterns change as seasons change, studies that employ longitudinal study designs to assess activity patterns inter-participant would be ideal as they would encompass the effects of seasonality and PA during pregnancy.

Assessment Tools

No single physical activity tool fully meets the criteria of being reliable, practical, and non-interfering (Chasan-Taber et al., 2007). As physical activity is a multi-dimensional behavior, no single tool can capture it all. Self reported exercise questionnaires rank higher in acceptability, cost, practicality, low interference with usual habits and have potential for individuals to provide specific activity information over objective assessment tools (Kriska & Caspersen, 1997). Our study used both subjective and objective tools.

The strength of our study was the use of a validated subjective assessment tool that included questions regarding occupation, household activities, transportation and recreational activities. Our questionnaire addressed frequency and duration which allowed us to estimate intensity of each activity. We attempted to minimize the error of self-reporting by using interview-administered surveys allowing for clarification of definitions of activities and the subject's perceptions of the activities performed.

Nevertheless, there are limitations with the use of our questionnaires. Firstly, the PPAQ was created in the United States and does reflect our Canadian population, particularly for household, recreational and seasonal activities. The literature suggests that women are generally more active in their everyday lives, and that family care and household activities may be sufficient to obtain health benefits (Haakstad et al., 2007). Assessing activities related particularly to our Canadian population would have been ideal. For instance, the PPAQ asked our women if they mow their lawns using a seated-mower; none of our women participated in this activity. Finally, MET values created for the PPAQ taken from the non-pregnant population (Ainsworth et al., 2000).

Thirdly, we did not administer the questionnaire at different time points within a trimester to test for variations. Nor did we re-administer the questionnaire during different trimesters. As such we cannot infer that activity levels declined, but rather we can address the fact that our women were inactive. Present recommendations for exercise during pregnancy address target heart rate zones and Borg's rating of perceived exertion to address exercise intensity and do not quantify activity in terms of METs (Davies et al., 2003b). In this study, recommendations for MET-h/wk are based on the non-pregnant population, which may not reflect appropriate ranges for the pregnant population (Haskell et al., 2007).

As research acknowledges walking as the most frequently performed activity during pregnancy, the use of pedometers as our objective tool was suitable and financially feasible. Pedometer accuracy was addressed with the women during the home visit by performing the "20-step test", but we did not account for tilt-angle or gait adjustments. Although we followed up with women by telephone calls and electronic-mail, only 61 (75.3%) completed pedometer logbooks; four subjects had either broken or had malfunctioning pedometers that needed to be replaced. Women felt that wearing the pedometer and recording steps interfered with their daily living.

Seventy-four (91.4%) of 81 women completed 24-hour recalls. Reasons for this response rate included: 1) women who moved and did not provide correct phone numbers (n=3), and 2) women who were not available after ten telephone call attempts (n=4). We chose the 24-hour telephone food recall as it was the least expensive method and was less burdensome on the participant. In this study, women were asked when it would be most convenient to be phoned for the recall. As such, participants knew they would be phoned

multiple times during the week of participation. This may have altered their eating habits, and may have led to underreporting (Freisling, 2006). For congruency of our dietary analysis, we used an extensive food code list to ensure all food items were the same. We did not examine diet quality, patterns nor compare women's usual intake to the latest Canada's Food Guide to Healthy Eating. Dietary intake is difficult to measure, and as such we provided each woman with a dietary interview kit and an instruction card. Finally, we did not assess sources of nutritional information or dietary food intake influences.

Relevance to the Field of Research

With the increasing obesity epidemic, health care providers are congruently working on helping populations achieve healthy lifestyles. In order for programs to be properly developed, it is necessary to explore the current situation as it relates to desired outcomes, in this case healthy GWG with our Canadian population. This study not only provides data on current weekly gestational weight gains, but also explores correlates of weight gain including physical activity, dietary intake and provider advice. Understanding women's current practices and beliefs' greatly aids in the creation and implementation of health promotional programs.

Research has identified health care providers as being important resources for pregnant women (Stotland et al., 2005). More specifically to the field of nutrition, this study can help dietitians identify women who may be at higher risk of excessive gestational weight gain, allowing for proper preventative measures to be put in place. As health professionals, dietitians play an integral role in helping pregnant women gain appropriate amounts of weight and avoid nutritional deficiencies.

The assessment tools used in this study could be promoted for use in dietetic practice and used as an important assessment tool to promote physical activity in pregnant women. The PPAQ could be used by dietitians in protecting their clients from gaining excessive amounts of weight addressing PA in terms of MET-h/wk. Using pedometers in practice will in turn help women increase awareness of their own PA levels and walking behaviors. Furthermore, this study highlights the need for pregnancy exercise recommendations to reflect more realistic regimes that focus on healthy

lifestyles and not necessarily the “exercise prescription”. More specifically, this study draws attention to the need that recommendations need to include step recommendations.

Future Research

A study of this nature is meant to seek answers to important questions. As part of the discovery process, further questions may arise. Specifically with this study, this would include the public health policy of how best to dispense and monitor the necessary information to women who wish to become pregnant as well as to pregnant woman. The obstetrical community is facing new challenges as the pregnancy profile changes as women present with higher pre-pregnancy BMIs. There continues to be few studies that have evaluated the impact of physical activity on gestational weight gain. It is not clear if physical activity or diet or both are the most important predictors for attaining appropriate weight gains during pregnancy (Siega-Riz et al., 2004).

GWG recommendations have recently been adjusted to address the current epidemiological concerns, in this case, the increasing prevalence of overweight and obesity in our women of childbearing age. It has been established that women are exceeding weight gains, increasing risks to both the mother and developing fetus and eventually child. Scientists acknowledge the impact of PA and EI on GWG; nevertheless no congruent message can be formulated. Future studies are warranted to continue to further explore these two variables (PA and DI) as they relate to GWG.

It is evident that the public health message is not clearly distinguishing the differences between physical activity and exercise as it relates to pregnancy. In 2003, Canadian guidelines were published outlining exercise recommendations for women

without medical or obstetrical complications (Davies et al.; 2003b). Knowing that not all women are exercising prior to pregnancy, these guidelines do not seem logical or practical as exercise needs to be a part of one's daily lifestyle routine *prior* to pregnancy.

The literature on physical activity during pregnancy is sparse, inconsistent and difficult to interpret as numerous articles have different focuses and outcomes. Studies do not use validated questionnaires with the pregnancy population, creating difficulty when trying to summarize findings (Chasan-Taber et al., 2007; Poudevigne & O'Connor, 2006; Zhang & Savitz, 1996). Methodological concerns for researching physical activity during pregnancy is primarily that not one tool alone can capture total physical activity and energy expenditure because of the dynamic changes that naturally occur during pregnancy. Validated assessment tools that can be used by health care professionals are required.

Physical activity assessment tools that have been validated for this population are necessary (Chasen-Taber et al., 2004; Schmidt et al., 2006s) but more importantly it is necessary that the tools reflect the population's lifestyles as well. Assessing physical activity in a free-living population opposed to a controlled laboratory setting presents itself with many confounders. The use of self-reported physical activity assessment tools are affected by reporting bias and as such may not accurately quantify activity-related energy expenditures (Maddison, 2007).

Equally, appropriate and feasible objective physical activity assessment tools that will best reflect the population are important. Walking is reported as the most frequented activity during pregnancy (Mottola & Campbell, 2003), and as such quantifying steps is

befitting but does raise concern. Pedometer reactivity, gait and tilt angle have not been addressed with the pregnant population.

Likewise, there is a need to further understand energy expenditure during pregnancy, particularly in terms of steps. Research needs to focus on walking behaviors during pregnancy in order to create step recommendations for this group. As recommendations have been established for other populations (Ministry of Health Promotion, 2005) and future research is warranted to address this void. Current exercise recommendations are for women to engage in 30 minutes of moderate-to-vigorous activity. Recommendations need to reflect the "average" mother who will be more apt to engage in physical activity and not the exercise regimen. For instance, should pregnant women walk for longer periods of time at a pace that is comfortable for them, they may feel more inclined to continue this activity and make it apart of their everyday lifestyle.

Conflicting results from intervention trials raise concern as women in treatment groups do not necessarily benefit more than those in controls. Randomized controlled trials are needed to further examine the associations of between dietary intake and physical activity on gestational weight gain aimed at women with increased risk of exceeding GWGs (Hinton, 2001). Trials should include both social and verbal support systems and be sensitive to women's influences and barriers to activity during this time (Hinton, 2001).

Research aimed at understanding patterns of present behaviors and beliefs may provide valuable information as to how health care professionals may help women achieve successful pregnancies and subsequently healthy babies. While the literature examining both diet and activity during pregnancy is limited, the literature is consistently

focusing on women exceeding weight gain recommendations with minimal reference on how to achieve a fit pregnancy. Future trials need to focus on methods of helping women attain fit pregnancies.

Research needs to address the psychological and physiological aspects of overweight women to aid with appropriate GWG. Studies that investigate the determinants of physical activity will help with the development of programs designed to encourage women to adhere to guidelines (Ning et al., 2003).

It is equally important that health care providers explore women's beliefs regarding weight gain and physical activity, as advice can only be given if the women's beliefs are fully understood and acknowledged. Examining to what extent health care providers are knowledgeable about recommendations and are providing the correct advice is also critical (Symons Downs & Ulbrecht, 2006).

Conclusions

Consistent with our hypotheses, the women studied were not meeting both physical activity and pedometer-determined step recommendations set for the normal adult population: Seventy percent of our women did not achieve a “fit pregnancy”. Health promotion strategies need to focus on physical activity practices during pregnancy and not necessarily highlight the ‘exercise routine’. Physical activity equally equates to energy expenditures that can protect women from the *obesogenic* nature of pregnancy, helping women attain fit pregnancies.

With the current health care system being stressed, the reality is that there is limited time for counseling. This study “heeds the call” for more users friendly promotional tools that can be used by clinicians. Further research is needed to clarify what is the most desirable system for dispensing information. This study found that the burden of dispensing information has largely fallen on the physician. However, one can hypothesize that information regarding dietary intake, PA and GWG might be better shifted to other allied health care professionals, such as dietitians.

Women’s interactions with the health care system during pregnancy make it a novel time to work and direct them in diet and physical activity. Attaining a “fit pregnancy” does not necessarily require mothers to engage in physical exercise but rather to simply avoid being sedentary and staying active. Exercise prescriptions during pregnancy do not necessarily need to include structured exercise programs; the emphasis should be on leisure-time activity and daily lifestyles that include non-sedentary behaviors.

This study was honored at the 2009 Canadian Public Health Association conference in Winnipeg, Manitoba (June 7- 10, 2009), where the motto was *Strengthening Connections*. Appropriately enough, our study highlights the need for Canadian public health policy makers and health care professionals to *SNAP* out of it, and *STEP* into it. It is clear that there currently exists a gap between what our Canadian pregnant women are doing and what the scientific literature suggests. There is a need to strengthen the connection between policy makers and health care providers to ensure all Canadian women achieve healthy and fit pregnancies.

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VII. APPENDICES

Appendix A: Recruitment Brochure

Survey of Nutrition And Physical activity (SNAP) during pregnancy

About The SNAP Study

We want to know about your current lifestyle practices and daily routines, including eating habits and physical activity levels. We are also interested in knowing what kind of information about active living you know and who or where you received this information.

If you participate in this study, it is **very important that you do not change any of your daily routines or habits**: This study is a **SURVEY.**

Participating in the Study

Your participation may be during the second and/ or third trimester of your pregnancy as well as after you deliver. Participating in the study will involve the following:

- Being visited by a researcher at home to answer a series of questions about weight gain and to be weighed on a scale.
- Filling out an 9-page questionnaire addressing weight, past and current physical activity and information sources .
- Wearing a pedometer for one week and removing the pedometer only when showering, swimming or sleeping. You will be able to keep your pedometer.
- Recording your daily total steps from your pedometer in a log-book each night.
- Speaking to a researcher over the telephone three times during your week of participation for a 24-hour recall of what you ate the day before.
- After delivery, you will be visited at your home and weighed on a scale. During the visit you will be asked a series of questions about your weight gain throughout your pregnancy and your infant's birth weight.

Centre de santé et de services sociaux Cavendish
Centre affilié universitaire

Centre de santé et de services sociaux de l'Ouest-de-l'Île
West Island Health and Social Services Centre

You may withdraw from the study at any time. Should you need to withdraw, we ask that you please contact your primary researcher as soon as possible. Your withdrawal from the study would not in any way affect your prenatal care or access to services.

SNAP Study: Who We Are

Tamara Cohen, R.D., F.I.S. (***Project Manager***)
Tamara is a registered dietitian with the *Ordre Professional de Quebec* (OPDQ) and the *College of Dietitians of Ontario* (CDO). She has worked as a clinical and community dietitian in the Montreal area. Tamara is also a Canadian Fitness Professional, and has been certified as a Fitness Instructor Specialist for eight years.

Kristine Koski, Ph.D., R.D. (***Director***)
Director and Associate Professor, School of Dietetics and Human Nutrition.

Karine Suissa (Project Assistant)

Sarah Zlotnick (Project Assistant)

Contact Information

Ottawa:	Telephone : (613) 759-9217 Fax : (613) 828-4895
Montreal:	Telephone : (514) 801-6409 Fax : (514) 398-7739
Email address:	fit.pregnancy@yahoo.com
Address:	McGill University School of Dietetics and Human Nutrition (Macdonald Campus) 21 111 Lakeshore Rd. St-Anne-de-Bellevue (QC) H3Z 2T5

Do you have any questions about the *SNAP* Study?

Are you interested in participating?

If you are interested in participating and receiving more information, please leave us your contact information and we will be pleased to answer your questions: (***Please PRINT***)

Name ____________________

Address ____________________

____

Phone # (Home) ____________________

Phone # (Cell) ____________________

E-mail Address ____________________

In what language do you prefer to be addressed?

☐ English ☐ French

What time do you prefer to be phoned?

☐ Mornings ☐ Afternoons

☐ Noon ☐ Evenings

Would you prefer to be contacted by E-Mail?

☐ Yes ☐ No

Appendix B: Participant Consent Form

Confidential

PARTICIPANT CONSENT FORM

Research Project Title: **Survey of nutrition and physical activity (*SNAP*) during pregnancy**

Project Manager:

Tamara Cohen, R.D., F.I.S. M.Sc. (*C*)
School of Dietetics and Human Nutrition,
McGill University (Macdonald Campus)
Tel: (613) 759-9217 Fax: (613) 828-4895
e-mail: fit.pregnancy@yahoo.com

Home visit Coordinator:

Catherine Ciampini, M.Sc. Applied (*C*)
School of Dietetics and Human Nutrition,
McGill University (Macdonald Campus)
Tel: (514) 801-6409 Fax: (514) 398-7739
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Co-Investigator:

Dr. Kristine Koski, Ph.D., R.D.
School of Dietetics and Human Nutrition,
McGill University (Macdonald Campus)
Tel: (514) 398-7845 Fax: (514) 398-7739

Research Ethics Board (Secretariat): (613) 580-6744 ext 26108

Introduction
Pregnancy is a time of physical and psychological change. As your pregnancy progresses, you may adjust your daily lifestyle routines and eating habits. We want to know how your pregnancy has affected your lifestyle and what information you have learned about active living during pregnancy.

Purpose of Study
If you participate in this study, it is very important that you do not alter any of your daily routines or habits. THIS STUDY IS A **SURVEY** OF CURRENT PHYSICAL ACTIVITY AND DIETARY PRACTICES. The purpose of this study is ***not*** **to modify or change physical activity or usual patterns or healthy eating practices during your pregnancy**.

We want to know about your **current** lifestyle practices and daily routines, including eating habits and physical activity levels. We are also interested in knowing what kind of information you have about active living, where you received this information and from whom.

All individual data collected in this study is anonymous to all except researchers, who may wish to publish the grouped anonymous data in scientific journals.

Participating in the study will involve the following:

- You will receive one, two or three home visits by a researcher during your pregnancy.
- At the first visit, you will be told about the study and asked to sign a consent form. You will also fill out an 8-page questionnaire titled: "Getting to know you" that will take ~25 minutes.
- You will be weighed at each visit using a special body weight scale that records information about your body composition [bioelectrical impedance scale (BIA)].
- You will be wearing a pedometer for one week (during waking hours). We ask that you remove the pedometer only to shower, if you go swimming and when you sleep. You will be able to keep your pedometer for participating in the study.
- You will record your daily total steps from your pedometer each night in a log-book that we will provide.
- You will speak to a Registered Dietitian over the telephone three times during your week of participation. We will ask you for a 24-hour recall of what you ate the day before. At the end of the study you will be given the opportunity to request your results.
- You will be asked in your third trimester to participate again for one week. Should you be unable to participate, we will ask only that you provide us orally with your weight for that trimester.
- After the delivery of your baby, you will be contacted by a researcher who will come visit you at home and weigh you on a BIA to record a body weight measurement. During the visit you will be asked a series of questions about your weight gain throughout your pregnancy, your infant's birth weight and perceptions of weight gain throughout your pregnancy.

There is minimal harm or risk associated with participating in this study. The questionnaire and telephone interviews represent self-reported data. The pedometers function on a spring-coil and require one 1.5 V battery that is found in watches and alarm clocks: there are no negative effects reported with their usage in the pregnant population.

You may withdraw from the study at any time. Should you need to withdraw, we ask that you please contact your primary researcher as soon as possible. Your withdrawal from the study would not in any way affect your prenatal care or access to services.

Confidentiality
Your names will not be mentioned or revealed at anytime and will linked to an ID-number. All information gathered will be kept locked in a filing cabinet under the researcher's supervision at McGill University, Macdonald Campus. The research supervisor, project coordinator and research assistants will have access to the consent forms, questionnaires, log books and dietary records.

Confidential

PARTICIPANT CONSENT FORM

CONSENT FORM:

Please initial beside each statement, acknowledging your participation in this study.

INITIAL↓	
	I understand that participating in this study means I will not change anything in my daily routine.
	I understand the potential risks and benefits of being active during my pregnancy.
	I understand that all information I provide during this study will be kept under strict confidentially. All questionnaires and logbooks will be kept locked in a cabinet at McGill University, Macdonald Campus with access only to research supervisor, project coordinator and research assistants.
	I understand that any information that is collected about me during my participation in this study will be used only for the purpose of the study.
	I understand that any information collected about me during my participation in this study will be kept for a period of seven years after which time it will be destroyed.
	I understand I can withdraw from the study at any time without any questions being asked and without any consequences to me.
	I understand I can decline to answer any particular questions in the study questionnaires.
	I understand that should any changes occur with regards to my health or participation I should report them immediately to my prenatal health provider and that I should advise the Project Manager (Tamara Cohen) or Home visit Coordinator (Catherine Ciampini).

Participant's name (please print) _____ Signature _____ _____
Date

Witness's name (please print) _____ Signature _____ _____
Date

ID: ☐☐☐☐☐☐

PARTICIPANT CONSENT FORM

**** We need to ensure you fully understand the risks associated with physical activity during pregnancy.**

The medical community acknowledges evidence-base risks and benefits for active living during pregnancy but understands that "**… evidence is insufficient to infer important risks and benefits for the mother of baby**" (Kramer and McDonald 2006). More research is warranted before concrete conclusions can be drawn pertaining to physical activity during pregnancy.

CONTRAINDICATIONS FOR EXERCISE DURING PREGNANCY (*Figure 1)*

The Society of Obstetricians and Gynecologist of Canada and Canadian Society for Exercise Physiology has compiled a list of contraindications for physical activity during pregnancy. **If you have <u>or</u> develop any of the following, please let a research assistant know immediately.** It is very important you see a health care provider before you continue.

Figure 1: Contraindications to exercise during pregnancy

Absolute contraindications to aerobic activity during pregnancy	Relative contraindications to aerobic activity during pregnancy
▪ Previous spontaneous abortion ▪ Ruptured membranes ▪ Preterm labor ▪ Hypertensive disorders of pregnancy ▪ Growth restricted fetus ▪ High order multiple gestation (> triplets) ▪ Persistent 2nd or 3rd trimester bleeding ▪ Uncontrolled type 1 diabetes, thyroid disease, or other serious cardiovascular respiratory, or systemic disorder	▪ Previous spontaneous abortion ▪ Previous preterm birth ▪ Mild/ moderate cardiovascular disorder ▪ Mild/ moderate respiratory disorder ▪ Anemia (Hb <100 g/L) ▪ Malnutrition or eating disorder ▪ Twin pregnancy after 28th week ▪ Other significant medical conditions

Figure 2: Sports Activities of concern to pregnant women

High-Risk Contact Sports	Ice and Field Hockey Boxing Wrestling Football Soccer Rugby Competitive Basketball
Other High-Risk Sports	Gymnastics Horseback Riding Ice and In-line Skating Alpine and Water Skiing Hang Gliding Board and Body Surfing Vigorous Racquet Sports Power Lifting Scuba Diving Rock Climbing High-Altitude Activities

REF: Davies et al. (2003) Joint SOGC/CSEP clinical practice guideline: exercise in pregnancy and the postpartum period. Can J Appl Physiol. 28(3):330-41.

Figure 3: Published BENEFITS of activity during pregnancy

- Maintains healthy body weight and avoids excess fat accumulation
- Maintains or improves cardiovascular fitness, muscular strength and endurance, and flexibility
- Decreases musculoskeletal complaints such as back pain
- Decreases minor discomforts of pregnancy
- Improves posture and body mechanics, which may improve coordination, balance, and body awareness
- Reinforces principles of breath awareness and relaxation
- Prevents and minimizes treatment of problems associated with gestational diabetes, hypertension, and preeclampsia
- Reduces stress and enhances self-image
- Possibly eases labor and limits complications of delivery and promotes faster postnatal recovery

REF: Hammer et al. (2000) Exercise during the childbearing year. J Perinat Educ. 9(1): 1–14

ID: ☐☐☐☐☐☐

Appendix C: Home visit Assessment Form

Confidential **HOME VISIT ASSESSMENT**

Researcher name: _____ **Visit: Date:** _____

Scheduled time: _____ **Arrival time:** _____ **Departure time:** _____ **Total time of visit:** _____

Has the patient been seen before? NO YES (last visit: _____**)**

*** answer only during 3rd trimester**
† answer only during postpartum assessment

A PARTICIPANT INFORMATION

1. Contact Information

Name:	Last	First	**Birth Date:**
Address:	Street		Apt. #
	City	Province	Postal Code
Phone:	**Home:** ( )	**Cell:** ( )	E-mail:

B PREGNANCY INFORMATION

3. Date of last period: _____

4. How many weeks pregnant? _____ Expected delivery date: _____ Vaginal or Cesarean

*†5. Patient present with:

TO SAY TO PATIENT: "Before full participation in this study, we need to know if during your pregnancy if you have experienced:"

Marked fatigue?	YES ☐	NO ☐
Bleeding from the vagina ("spotting")?	YES ☐	NO ☐
Unexplained faintness or dizziness?	YES ☐	NO ☐
Unexplained abdominal pain?	YES ☐	NO ☐
Sudden swelling of ankles hands or face?	YES ☐	NO ☐
Persistent headaches or problems with headaches?	YES ☐	NO ☐
Swelling, pain or redness in the calf of one leg?	YES ☐	NO ☐
Absence of fetal movement after 6th month?	YES ☐	NO ☐
Failure to gain weight after 5th month?	YES ☐	NO ☐

**** ANY YES: Contact pre-natal health care provider before participating in the stuy**

A few more questions...

Do you have a pacemaker?	YES ☐	NO ☐
Do you have implanted medical devices (i.e. pins)?	YES ☐	NO ☐
Other significant medical conditions: _____	YES ☐	NO ☐

ID: ☐☐☐☐☐☐

C MATERNAL WEIGHT

6. **Weight**: *†a) BIA Weight: _____

b) How much did you weigh 2 months before you knew you were pregnant? _____

7. **Height:** _____

8. Is this your first pregnancy? ☐ YES ☐ NO If **NO**: How many children do you have? _____

†**9.** a) How much **weight** were you told to gain over the course of your **entire pregnancy**? _____

b) **Who** advised you to gain this amount of weight? _____

†**10.** a) How much **weight** were you told to gain **during the first trimester**? _____

b) **Who** advised you to gain this amount of weight? _____

c) How much **weight** were you told to gain **during the second trimester**? _____

d) **Who** advised you to gain this amount of weight? _____

†**11.** What do you consider as an **acceptable** weight gain during your pregnancy? _____

†**12.** What do you consider as an **un-acceptable** weight gain during your pregnancy? _____

† **13.** How much weight are **you planning to gain** throughout your entire pregnancy? _____

NOTES:

Appendix D: "Getting to know you" Questionnaire

Confidential

"GETTING TO KNOW YOU" QUESTIONNAIRE

Part A: PAST PHYSICAL ACTIVITY: Prior to this pregnancy...

Knowing about your lifestyle parctices before you became pregnant will help us understand how this pregnancy has affected your current routine. This 16-question questionnaire, adapted from Baecke, Burema et al. (1982) addresses your past years work activiy, sport activity and non-sport leisure activity. This next section should take ~ 5 minutes to complete.

What was your physical activity levels before your pregnancy? Please check the box that best describes you:

AT WORK:

1. What is/ was your main occupation? _____ Are you still working? ☐ YES ☐ NO
2. At work I sat : ☐ never ☐ seldom ☐ sometimes ☐ often ☐ always
3. At work I stood: ☐ never ☐ seldom ☐ sometimes ☐ often ☐ always
4. At work I walked : ☐ never ☐ seldom ☐ sometimes ☐ often ☐ always
5. At work I lifted heavy loads: ☐ never ☐ seldom ☐ sometimes ☐ often ☐ always
6. After working I was tired : ☐ very often ☐often ☐ sometimes ☐ seldom ☐ never
7. My job made me perspire/ sweat : ☐ very often ☐often ☐ sometimes ☐ seldom ☐ never
8. In comparison with other women my own age I think my work was physically:
   ☐ much heavier ☐ heavier ☐ as heavy ☐ lighter ☐ much lighter

PLAYING SPORTS:

9. a) Did you play sports before this pregnancy? ☐ YES ☐ NO
   - If **YES**, which sport did you play most frequently? _____

_____

- How many hours a week did you play this sport?
  ☐ less than 1 hour ☐ 1 to 2 hours ☐ 2 to 3 hours ☐ 3 to 4 hours ☐ more than 4 hours
- How many months a year did you play this sport?
  ☐ less than 1 month ☐ 1 to 3 months ☐ 4 to 6 months ☐ 7 to 9 months ☐ more than 9 months

_____

ID: ☐☐☐☐☐☐

b) Did you play a second sport before your pregnancy? ☐ YES ☐ NO

- If **YES**, which sport did you play most frequently? _____

_____

- How many hours a week did you play this sport?
  ☐ less than 1 hour ☐ 1 to 2 hours ☐ 2 to 3 hours ☐ 3 to 4 hours ☐ more than 4 hours

- How many months a year did you play this sport?
  ☐ less than 1 month ☐ 1 to 3 months ☐ 4 to 6 months ☐ 7 to 9 months ☐ more than 9 months

DURING YOUR LEISURE TIME:

What were your physical activity levels prior to pregnancy? Please check the box that best describes you:

10. In comparison with women my own age I think my physical activity during my leisure time was
    ☐ much more ☐ more ☐ the same ☐ less ☐ much less

11. During leisure time I sweated ☐ very often ☐often ☐ sometimes ☐ seldom ☐ never

12. During leisure time I played sports ☐ never ☐ seldom ☐ sometimes ☐ often ☐ always

13. During leisure time I watched television ☐ never ☐ seldom ☐ sometimes ☐ often ☐ always

14. During leisure time I walked ☐ never ☐ seldom ☐ sometimes ☐ often ☐ always

15. During leisure time I cycled ☐ never ☐ seldom ☐ sometimes ☐ often ☐ always

16. How many minutes did you walk and/ or cycle per day to and from work, school or shopping?
    ☐ less than 5 min. ☐ 5 to 15 min. ☐ 15 to 30 min. ☐ 30 to 45 min. ☐ more than 45 min.

REF : Baecke, J. A., J. Burema, et al. (1982). "A short questionnaire for the measurement of habitual physical activity in epidemiological studies." Am J Clin Nutr **36**(5): 936-942.

_____

Part B: CURRENT PHYSICAL ACTIVITY

We are equally interested in knowing your current physical activity levels. This next short questionnaire has been validated for use with pregnant women and will provide us with an estimate of the amount of calories you expend per day. Adapted from Chasan (2004), this questionnaire addresses household, caregiving, sports and leisure time activity. This questionnaire should take ~ 10 minutes to complete.

During this trimester, when you are NOT at WORK, how much time do you ususally spend:

1. Preparing meals (cook, set table, wash dishes)		**2. Dressing, bathing, feeding children while you are sitting**		**3. Dressing, bathing, feeding children while you are standing**	
☐	None	☐	None	☐	None
☐	Less than ½ hour per day	☐	Less than ½ hour per day	☐	Less than ½ hour per day
☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day
☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day
☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day
☐	3 or more hours per day	☐	3 or more hours per day	☐	3 or more hours per day

4. Playing with children while you are sitting or standing		**5. Playing with children while you are walking or running**		**6. Carrying children**	
☐	None	☐	None	☐	None
☐	Less than ½ hour per day	☐	Less than ½ hour per day	☐	Less than ½ hour per day
☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day
☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day
☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day
☐	3 or more hours per day	☐	3 or more hours per day	☐	3 or more hours per day

7. Taking care of an older adult		**8. Sitting and using a computer or writing, while not at work**		**9. Watching TV or a video**	
☐	None	☐	None	☐	None
☐	Less than ½ hour per day	☐	Less than ½ hour per day	☐	Less than ½ hour per day
☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day	☐	½ to almost 2 hour per day
☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day	☐	2 to almost 4 hours per day
☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day	☐	4 to almost 6 hours per day
☐	3 or more hours per day	☐	3 or more hours per day	☐	6 or more hours per day

10. Sitting and reading, or talking on the phone, while not at work		**11.** Playing with pets		**12.** Light cleaning (make beds, laundry, iron, put things away)	
☐	None	☐	None	☐	None
☐	Less than ½ hour per day	☐	Less than ½ hour per day	☐	Less than ½ hour per day
☐	½ to almost 2 hour per day	☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day
☐	2 to almost 4 hours per day	☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day
☐	4 to almost 6 hours per day	☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day
☐	6 or more hours per day	☐	3 or more hours per day	☐	3 or more hours per day

13. Shopping (for food, clothes or other items)		**14.** Heavier cleaning (vacuum, mop, sweep, wash windows)	
☐	None	☐	None
☐	Less than ½ hour per day	☐	Less than ½ hour per day
☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day
☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day
☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day
☐	3 or more hours per day	☐	3 or more hours per day

15. Mowing lawn while on a riding mower		**16.** Mowing lawn using a walking mower, raking, gardening	
☐	None	☐	None
☐	Less than ½ hour per day	☐	Less than ½ hour per day
☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day
☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day
☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day
☐	3 or more hours per day	☐	3 or more hours per day

GOING PLACES... **During this trimester, how much time do you usually spend:**

16. Walking slowly to go places (such as to the bus, work, visiting) *NOT for fun or exercise*		**17. Walking quickly to go places (such as to the bus, work, or school) *NOT for fun or exercise***		**18. Driving or riding in a car or bus**	
☐	None	☐	None	☐	None
☐	Less than ½ hour per day	☐	Less than ½ hour per day	☐	Less than ½ hour per day
☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day
☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day
☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day
☐	3 or more hours per day	☐	3 or more hours per day	☐	3 or more hours per day

For Fun or Exercise... **During this trimester, how much time do you usually spend:**

19. Walking slowly for fun or exercise		**20. Walking more quickly for fun or exercise**		**21. Walking quickly up hills for fun or exercise**	
☐	None	☐	None	☐	None
☐	Less than ½ hour per day	☐	Less than ½ hour per day	☐	Less than ½ hour per day
☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day
☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day
☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day
☐	3 or more hours per day	☐	3 or more hours per day	☐	3 or more hours per day

22. Jogging		**23. Prenatal exercise class**		**24. Swimming**	
☐	None	☐	None	☐	None
☐	Less than ½ hour per day	☐	Less than ½ hour per day	☐	Less than ½ hour per day
☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day
☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day
☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day
☐	3 or more hours per day	☐	3 or more hours per day	☐	3 or more hours per day

25. Dancing		Doing other things for fun or exercise? Please tell us what they are: 26. _____ (Name the activity)		27. _____ (Name the activity)	
☐	None	☐	None	☐	None
☐	Less than ½ hour per day	☐	Less than ½ hour per day	☐	Less than ½ hour per day
☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day
☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day
☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day
☐	3 or more hours per day	☐	3 or more hours per day	☐	3 or more hours per day

Please fill out the next section if you work for wages, as a volunteer, or if you are a student. If you are a homemaker, out of work, or unable to work, you do NOT NEED to complete this last section.

28. Sitting at work or in class		29. Standing or slowly walking at work while carrying things (heavier than 1 gallon milk jug)		30. Standing or slowly walking at work not carrying anything	
☐	None	☐	None	☐	None
☐	Less than ½ hour per day	☐	Less than ½ hour per day	☐	Less than ½ hour per day
☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day
☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day
☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day
☐	3 or more hours per day	☐	3 or more hours per day	☐	3 or more hours per day

31. Walking quickly at work while carrying things (heavier than 1 gallon milk jug)		32. Walking quickly at work not carrying anything	
☐	None	☐	None
☐	Less than ½ hour per day	☐	Less than ½ hour per day
☐	½ to almost 1 hour per day	☐	½ to almost 1 hour per day
☐	1 to almost 2 hours per day	☐	1 to almost 2 hours per day
☐	2 to almost 3 hours per day	☐	2 to almost 3 hours per day
☐	3 or more hours per day	☐	3 or more hours per day

REF: Chasan, T. (2004). "Development and Validation of a Pregnancy Physical Activity Questionnaire." Medicine and science in sports and exercise **36**(10): 1750-1760.

ID: ☐☐☐☐☐☐

Part C: PHYSICAL ACTIVITY: INFORMATION SOURCES

Beliefs about the safety of physical activity during pregnancy are unknown in Canadian pregnant women. We are interested in knowing who has spoken to you about physical activity during pregnancy and what that advice was. The next few questions have been adapted from Clarke and Gross (2004) and address sources of information about activity during pregnancy. This section should take ~5 minutes to complete.

Instructions: Please check the boxe that best describes you.

1. Has a **DOCTOR** spoken to you about physical activity during your pregnancy? ☐ YES ☐ NO

If **YES**, what was the advice? _____

If **YES**, when did this conversation take place? (weeks of gestation) _____

2. Has a **NURSE** spoken to you about physical activity during your pregnancy? ☐ YES ☐ NO

If **YES**, what was the advice? _____

3. Has a **MIDWIFE** spoken to you about physical activity during your pregnancy? ☐ YES ☐ NO

If **YES**, what was the advice? _____

4. Has a **DIETITIAN** spoken to you about physical activity during your pregnancy? ☐ YES ☐ NO

If **YES**, what was the advice? _____

5. Has a **PERSONAL TRAINER/ FITNESS INSTRUCTOR** spoken to you about physical activity during your pregnancy? ☐ YES ☐ NO

If **YES**, what was the advice? _____

6. Has your **SPOUSE/ PARTNER/ SIGNIFICANT OTHER** spoken to you about physical activity during pregnancy? ☐ YES ☐ NO

If **YES**, what was the advice? _____

7. Has a **FAMILY MEMBER/ FRIEND** spoken to you about physical activity during pregnancy? ☐ YES ☐ NO

If **YES**, what was the advice? _____

ID: ☐☐☐☐☐☐

8. Have you read a **BOOK** that discussed physical activity during pregnancy? ☐ YES ☐ NO

If **YES**, what was the name of the book? _____

What was the advice? _____

_____

9. Have you read a **MAGAZINE** that discussed physical activity during pregnancy? ☐ YES ☐ NO

If **YES**, what was the name of the magazine? _____

What was the advice? _____

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10. Have you read a **NEWSPAPER ARTICLE** that discussed physical activity during pregnancy? ☐ YES ☐ NO

If **YES**, what was the name of the newspaper? _____

What was the article about? _____

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11. Have you watched a **TELEVISION** program that discussed physical activity during pregnancy? ☐ YES ☐ NO

If **YES**, what was the name of the television show? _____

What was the advice? _____

---

12. Have you read anything off the **INTERNET** that discussed physical activity during pregnancy? ☐ YES ☐ NO

If **YES**, what was the internet site? _____

What was the advice? _____

---

13. Are there any other resources that we have not mentioned above that you have seen that discuss physical activity during pregnancy? ☐ YES ☐ NO

If **YES**, please describe: _____

REF: Clarke, P. and H. Gross (2004). "Women's behaviour, beliefs and information sources about physical exercise in pregnancy." Midwifery **20**(2): 133-141.

_____

PART D: MORE ABOUT YOU…

In July 2005, the Canadian Community Health Survey (CCHS) was conducted to survey many different aspects of Canadian life. The next few questions are adapted from this survey and should take ~ 2 minutes to complete.

1. People living in Canada come from many different cultural and racial backgrounds. Are you (check all that apply):

☐ **White?** ☐ **Korean?** ☐ **Arab?** ☐ **Southeast Asian** (e.g., Cambodian, Indonesian, Laotian, Vietnamese)?
☐ **Chinese?** ☐ **Latin American?** ☐ **Filipino?** ☐ **West Asian** (e.g., Afghan, Iranian)?
☐ **South Asian** (e.g., East Indian, Pakistani, Sri Lankan)?
☐ **Japanese?** ☐ **Black?** ☐ **Inuit, Cree, Meti?** ☐ Other- Specify _____

2. Education: Please indicate the highest level of education you have completed (check 1-answer):

☐ Elementary School (Grades 1- 6)

☐ Junior high School (Grades 7- 8/ *Secondary I*)

☐ High School (Grades 9/ *Secondary II* -12/) *Secondary V*)

☐ Partial training in a CÉGEP, community college, trade school or private commercial college, technical institute, nursing school or normal school

☐ Diploma or certificate from a technical/career program at a CÉGEP or community college, trade school or private commercial college, technical institute, nursing school or normal school

☐ Partial university training

☐ Bachelor's degree completed

☐ Graduate diploma or certificate completed

☐ Master's degree completed

☐ Doctorate completed

☐ Degree in medicine, dentistry, veterinary medicine, optometry or chiropractic completed

3. Do you have any children? ☐ YES (How many?) _____ ☐ NO

4. Are you currently:

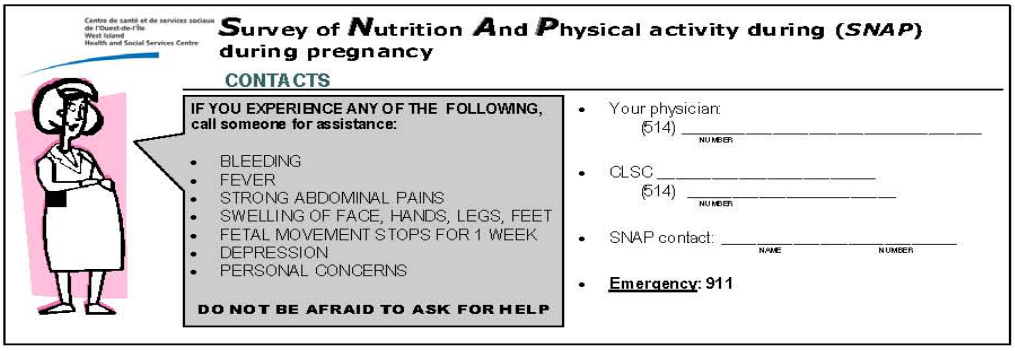
☐ married ☐ separated ☐ annulled ☐ Widowed
☐ single ☐ divorced ☐ cohabitating ☐ Engaged

5. What was your approximate total household income IN THE PAST YEAR before income tax deductions?

☐ No personal income ☐ $6,000 - $11,999 ☐ $30,000 - $39,999
☐ $1 - $999 ☐ $12,000 - $19,999 ☐ $40,000 - $49,999
☐ $1,000 - $5,999 ☐ $20,000 - $29,999 ☐ $50,000 or more

ID: ☐☐☐☐☐☐

Appendix E: Participant Emergency Contact Card



Survey of Nutrition And Physical activity during (*SNAP*) during pregnancy

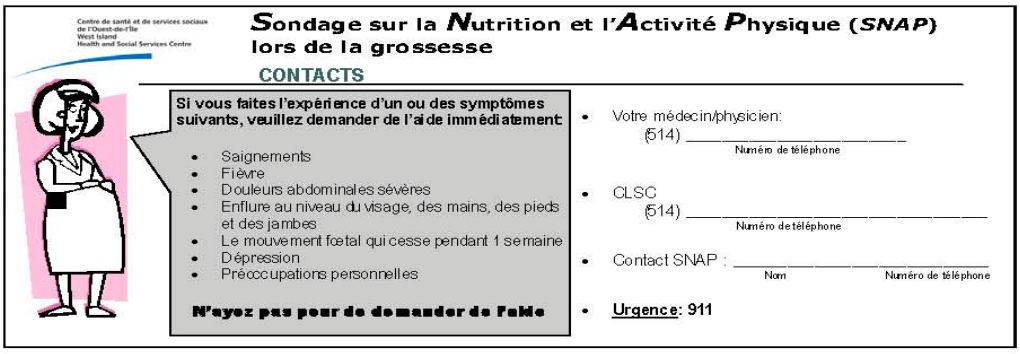
CONTACTS

IF YOU EXPERIENCE ANY OF THE FOLLOWING, call someone for assistance:

- BLEEDING
- FEVER
- STRONG ABDOMINAL PAINS
- SWELLING OF FACE, HANDS, LEGS, FEET
- FETAL MOVEMENT STOPS FOR 1 WEEK
- DEPRESSION
- PERSONAL CONCERNS

DO NOT BE AFRAID TO ASK FOR HELP

- Your physician: (514) _____ (NUMBER)
- CLSC _____ (514) _____ (NUMBER)
- SNAP contact: _____ (NAME) _____ (NUMBER)
- **Emergency: 911**



Sondage sur la Nutrition et l'Activité Physique (*SNAP*) lors de la grossesse

CONTACTS

Si vous faites l'expérience d'un ou des symptômes suivants, veuillez demander de l'aide immédiatement:

- Saignements
- Fièvre
- Douleurs abdominales sévères
- Enflure au niveau du visage, des mains, des pieds et des jambes
- Le mouvement fœtal qui cesse pendant 1 semaine
- Dépression
- Préoccupations personnelles

N'ayez pas peur de demander de l'aide

- Votre médecin/physicien: (514) _____ Numéro de téléphone
- CLSC (514) _____ Numéro de téléphone
- Contact SNAP : _____ Nom _____ Numéro de téléphone
- **Urgence: 911**

Appendix F: Permission to use the Pregnancy Physical Activity Questionnaire

Re: Ask for borrowing PPAQ

Lisa Chasan-Taber [lct@schoolph.umass.edu]

You forwarded this message on 18/06/2009 7:58 AM.

Sent: April 16, 2008 7:51 AM

To: Tamara Cohen

Attachments: PPAQ instructions.doc (78 KB) [Open as Web Page]; Pregnancy Physical Activity.pdf (134 KB) [Open as Web Page]

Hi Tamara:
We would be pleased for you to use the Pregnancy Physical Activity Questionnaire (PPAQ). Attached please find the PPAQ as well as instructions for its use.
Best of luck with your research.
Lisa Chasan-Taber

****
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