NOVA SCOTIA PARENTS' PERCEPTIONS ON THE USE OF

SMARTPHONE HEALTH APPLICATIONS IN IMPROVING

FAMILY NUTRITION AND PHYSICAL ACTIVITY HABITS

By

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DEDICATION PAGE

I dedicate this Masters thesis to my family.

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ABSTRACT

Busy families of Nova Scotia and similar populations find it challenging to make healthy nutrition and exercise choices due to time constraints (Chircop et al, under review; Jabs et al, 2007; Devine et al, 2006). Smartphone application technology can provide health behavior change interventions in a mobile and fast format (Breton, Bernard, Fuemmeler, Lorien & Abroms, 2011). Using focus groups, this research addressed parent's perceptions on how smartphone application technology can support nutrition and physical activity habits within their family and what, if any, barriers exist in adopting this form of health behavior intervention. Findings revealed this population believes smartphone health applications can improve family nutrition and physical activity as long as barriers are minimized and requirements for adoption are met. Diffusion of Innovations theory was used to understand the adoption rate within the target population. Thoughts on future work efforts for related health behaviour interventions is discussed.

LIST OF ABBREVIATIONS USED

TIME	Tools, Information, Motivation, and Environment
SCT	Social Cognitive Theory
TTM	Transtheoretical Model of Behaviour Change
BMI	Body Mass Index
SPARK	Sports, Play, and Active Recreation for Kids
CATCH	Coordinated Approach to Child Health
ICT	Information and Communication Technology
eHealth	Web-based Health Care
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome
mHealth	Mobile-based Health Care
HCI	Human-Computer Interaction
FDA	Food and Drug Administration
MMA	FDA's Mobile Medical App guidance document
GPS	Global Positioning System
COPD	Chronic Obstructive Pulmonary Disease
CVD	Cardiovascular Disease
HRM	Halifax Regional Municipality
SMS	Short Message Service

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CHAPTER 1

INTRODUCTION

The province of Nova Scotia has one of the highest rates of adult and child obesity in

Canada (Tjepkema, 2006; Shields, 2006). In addition, according to Campagna et al (2005)

provincial statistics reveal that few Nova Scotia youth are meeting dietary and physical activity

recommendations. Only 10% of Nova Scotia youth in grades 7-9 are meeting nutritional

guidelines (Chircop et al, under review). A contributor to poor nutrition and exercise habits is

time constraints on the family unit (Chircop et al, under review). Jabs et al (2007) found

working parents (mothers specifically) experience feelings of time scarcity around meal time for

their children. While these mothers prioritized feeding their families first, there also exists a

need to complete the meals quickly in order to move onto other tasks or scheduled activities.

Devine et al (2006) interviewed working parents and found this population to describe "work-

family spillover" and a "role overload" as a normal part of daily life that dominates and

influences the food choices they make for their family. This population used food choice coping

strategies to redefine the meanings and expectations for food and eating, and trade off food and

eating against other family needs. Chircop et al (under review) found that families who are over-

scheduled have limited opportunities for healthy meal planning and that nutrition is often

sacrificed due to scheduling of recreational physical activities. Organizing extracurricular

activities can limit the perceived feasibility of healthy meal planning; therefore, it is important to

support healthy food choices within the family unit while recognizing the time constraints that

this population faces.

To support healthy nutrition practices, health professionals may turn to behaviour change

interventions to understand and support improvements in unhealthy behaviours surrounding food

purchasing, preparation and consumption. Health behaviour change interventions use communication networks and marketing, educational materials and actions to improve one's health status (Health Canada, 2002). Health behaviour change is a social, emotional, and cognitive process. Interventions that identify the optimal combination of the social, emotional, and cognitive components of the behaviour change process are more likely to achieve a higher success rate (Schwarzer, 2008). When the targeted behaviour change is preventive in nature (such as quitting smoking to reduce the risk of developing lung cancer), the adoption of the behaviour appears to occur more slowly (Sharma & Kanekar, 2008). This may be due to the challenge of realizing a health risk that is not currently being experienced.

Health behaviour change interventions are most successful when tailored to the needs of the user and have evolved over time from paper format, to web-based, to mobile and smartphone applications. As the interventions have become more technologically advanced, the level of tailoring has increased (Lustria, Cortese, Noar & Glueckauf, 2009; Cugelman, Thelwall & Dawes, 2011; Brug, Oenema & Campbell, 2003); with smart technology based interventions being the most tailored to the user's needs (Kreuter, Farrell, Olevitch & Brennan, 2000). Smartphone health applications have become increasingly popular, with downloads of these applications on the rise, from 300 million in 2009 to 5 billion in 2010 (Mobile Future, 2010 & Microsoft as cited in Kamel Boulos, Wheeler, Tavares, & Jones, 2011). Over 12,000 healthcare and fitness applications are currently available to users with 15% of this number being weight loss and diet specific (Breton, Fuemmeler, & Abroms, 2011). The Canadian population is ahead of the global market in utilizing smartphone technology (Mansfield, 2011); use has risen by as much as 50% since 2010 (Maloney, 2011). Thus, a smartphone health application to aid in

improving both nutrition and physical activity habits in busy Nova Scotia families may be a health behaviour change intervention worth pursuing.

Health behaviour change interventions using smart technology arrive at a critical time for Canada as evidenced by our rising health care costs, which have increased by 20 billion dollars over the last two years (Canadian Institute for Health Information, 2011). Tailored forms of health behaviour change interventions may reveal a more cost effective approach than non tailored interventions (Krukowski at al., 2011). Arguably, tailored interventions may also require fewer resources (more cost effective) to attain and maintain a healthy behaviour over time. This may be due to the intervention's efficiency in achieving initial health behaviour change goals (versus the use of follow up interventions to achieve the desired health behaviour change) (Noar et al, 2007). At the same time, the development and implementation of a tailored health behaviour change intervention such as a smartphone nutrition application can be challenging (Garel, 2011) and therefore, it is important to understand the needs of the user to have a greater likelihood of the intervention being adopted (Cugelman, Thelwall & Dawes, 2011). The Diffusion of Innovations theory (Rogers, 2003) explains that if the needs of the user are not met then the likelihood of the user adopting the innovation (in this case a health behaviour change intervention) is small. It is therefore important to understand the needs of the target population (busy Nova Scotia families) to ensure that smartphone health application interventions aimed at creating health behaviour changes are tailored to meet the needs of this population, who in turn will support the continued use of such an application.

Study Objective and Rationale

The objective of this study was to understand the perceptions of busy Nova Scotia parents, whose children are involved in recreational activities (participation in a scheduled physical activity), on the use of smartphone health applications in improving family nutrition and physical activity habits. An additional objective was to understand what, if any barriers exist in adopting this method of health behaviour change intervention. This study was part of a much larger multi-year study called "TIME (Tools, Information, Motivation, and Environment) for Health: A multilevel intervention to promote healthy eating in children and their families". The purpose of the TIME project was to improve family home and recreational facility food environments in the Halifax Regional Municipality. Specifically in the home, the researchers are interested in improving fruit and vegetable intake. This Masters research focused on the home level only and discussed physical activity in addition to fruit and vegetable intake.

To improve the food environment within the family home, The TIME project team designed a smartphone health application for the busy Nova Scotia family. The busy Nova Scotia family is defined in this research as a parent or parent who have children that are involved in recreational activities (specifically, scheduled physical activity). This Masters study sought to better understand the needs of this target population through four focus groups conducted across the Halifax Regional Municipality. As the current thesis is part of the overall TIME project, focus group questions were confined to the application design, the logistics of implementing a health application intervention into one's life, and comfort level with GPS (global positioning system) tracking. The specific research questions pertaining to this thesis were: Do you believe that a healthy eating and physical activity application could help support healthy nutrition and

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activity habits in your family? How could a healthy eating and physical activity application help

your family eat healthier and achieve physical activity goals? And, what might be the barriers to

using such an application? The answers to these research questions will provide smartphone

health application developers and health professionals who are implementing these interventions

with information to build, develop, and implement the most tailored smartphone health

behaviour change interventions possible. The objective would be to achieve a higher adoption

rate within this population. In turn, through the adoption of this health behaviour change

intervention, busy Nova Scotia families who utilize this application may increase their

consumption of fruits and vegetables and possibly decrease their risk of obesity-related disease.

CHAPTER 2

LITERATURE REVIEW

The Health of Nova Scotians and the Rising Cost of Health Care

Rates of obesity in Canada have increased since 1996, from 2% to 10% for boys (aged 2-17 years old), and from 2% to 9% for girls (same age range) with Atlantic Canadian children at the top of this range (Kuhle et al, 2011). Nova Scotia provincial statistics reveal that only a small proportion of youth actually meet Canada's Food Guide recommendations (Campagna et al, 2005). Nova Scotia has among the highest rates of obesity in Canada (Tjepkema, 2006) and a particularly high child and youth obesity rate (Shields, 2006). The World Health Organization (2013) defines obesity as having abnormal or excessive fat accumulation that may impair one's health. Children in Nova Scotia are 40% more likely to be overweight than children living in other provinces (Williams, Tremblay & Katzmarzik, 2003).

Lack of time is perceived as a major constraint for making healthy food choices for families in Nova Scotia (Chircop et al, under review). When focusing on the parents within the family unit, Slater, Sevenhuysen, Edginton, and O'Neil (2012) found that the mothers were the primary food and nutrition givers for their families, and preferred to make homemade foods that they could share with their families. However, this population of mothers found this to be a challenge due to lack of time. These mothers felt that the lack of time emanated from working outside of the home, having a busy family, and their children's involvement in extracurricular activities. Adolescents have also been found to view lack of time as a barrier to eating healthfully (Croll, Neumark-Sztainer, & Story, 2001). The aforementioned findings are important for the TIME project and my thesis. These results suggest that this population is in need of a health behaviour change solution that recognizes the importance of healthy eating and

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the time constraints that this population faces. It is evident that families who are over-scheduled

exist in an environment where the stress of organizing extracurricular activities can limit the

perceived feasibility of healthy meal planning which could lead to unhealthy food choices.

Unhealthy diets and a lack of physical exercise are public health concerns as these

factors are mediators in the development of obesity and obesity-related health care costs (Public

Health Agency of Canada and the Canadian Institute for Health Information, 2011). Some

obesity-related health care costs include the treatment/management of diabetes, high blood

pressure, high cholesterol, and asthma (Mokdad, et al, 2003). Research has shown that

overweight and obese children incur higher health care costs than their normal weight peers

(Kuhle et al, 2011). Creating effective health behaviour change is important as Canada's

spending on healthcare rises. In 2009, Canada spent over $182 billion dollars on health care. In

2010, this figure reached over $192 billion dollars. In 2012, Canada was forecasted to spend

$207 billion dollars on health care (Canadian Institute for Health Information, 2012). According

to a report published by the Public Health Agency of Canada and the Canadian Institute for

Health Information (2011), obesity costs the Canadian economy between 4.6 and 7.1 billion

dollars a year. These costs are split between both direct healthcare costs (physical and

institutional care) and indirect costs (lost productivity at work). The rising cost of healthcare

presents a fair argument for developing health behaviour change intervention strategies that are

effective and aimed at improving health outcomes using a wide variety of technologies that fit

the needs of individuals today. Smartphone health applications could provide a modality where

access to health information can be fast and the application tailored to the user.

Health Behaviour Change

Many successful obesity treatment programs show an average of 10% reduction in obesity prevalence in both adult and child/adolescent populations (Jeffery et al, 2000, as cited in Stice, Shaw & Marti, 2006). One of the most effective types of program is a behavioural family-based intervention, producing more persistent weight loss effects than programs that focus solely on one individual (Epstein, Valoski, Wing, & McCurley, 1990; Flodmark, Ohlsson, Ryden, & Sveger, 1993, as cited in Stice, Shaw & Marti, 2006). While this research focuses on weight loss only, the use of the behavioural family-based intervention is the foundation of the TIME project. One of the objectives of the TIME study is to change the nutrition-related behaviour of busy Nova Scotia families by making the home environment one that promotes healthier nutrition choices. By making healthier food choices for themselves and their children, busy Nova Scotia parents may reduce the prevalence of childhood obesity in the province, and prevent the onset of obesity related diseases. The TIME project is built on the foundation of health behaviour change theory. Health behaviour change theories help health researchers, health providers and health policy makers build the science of prevention by directing research questions, selecting appropriate populations to study, determining intervention approaches, aiding in the creation of models of healthcare delivery, and guiding public health practice and health policy (Shumaker, Ockene & Riekert, 2009, p. 4). It is important to understand health behaviour change theory as this has guided the TIME research team in building the specific health behaviour change intervention for the population of interest. To provide an understanding and examples of different health behaviour theories, I will discuss four different health behaviour change theories/models: Social Cognitive Theory, the Social Ecological Model, the Continuum Model, and the Stage Model. The TIME research team made use of the Social

Ecological Model as a guiding framework for their study. The smartphone application that will be implemented in the later phases of the TIME project is based on Social Cognitive Theory. The Continuum Model and the Stage Model are both major theories/models used in health behaviour change and are important in helping to compare different viewpoints in this field.

<div align="center">Social Cognitive Theory</div>

Health behaviour change interventions use varying methods to intervene at social, emotional, and cognitive levels (Schwarzer, 2008). The goal of any health behaviour change intervention is to identify the optimal set or combination of methods that will help in successfully producing a particular behaviour change (Schwarzer, 2008). Social Cognitive Theory (SCT) identifies personal, environmental and behavioural factors that influence one's behaviour (Bandura, 1986). Personal factors consist of the knowledge one possesses, one's perceived self-efficacy, and the expected outcome related to the behaviour adoption (Ramirez, Kulinna & Cothran, 2012). Bandura (2004) suggests that personal factors, especially perceived self-efficacy plays a central role in behaviour change. People have to believe that they have the power to change in order for behaviour change to occur. The outcome expectation is positively correlated with the chance of engagement in the behaviour (Bandura, 2004). Behavioural factors also influence healthy behaviour change. Making and keeping short-term attainable goals, is understood to be the most effective method in enacting this change (Bandura, 2004). The environmental factors that are found to influence behaviour are social support and barriers to behaviour adoption. In this context, social support is understood as how and to what extent others will facilitate a person's engagement in a particular behaviour (Bandura, 2004). The environmental factors (social support and barriers) measure the effects of impediments to participating in the desired behaviour. For example, the number of barriers that must be changed

is negatively correlated with the likelihood that an individual will engage in the desired behaviour (Ramirez, Kulinna & Cothran, 2012).

Social Cognitive Theory is both the most widely used and accepted in the field of health education and promotion practice (Bandura, 1997, DiLorio et al, 2000 as cited in Whitehead, 2001). SCT draws from health psychology to explain health associated behaviours, focusing on the social context of health behaviour change and related cognitive processes (Curtis, 2000, DiLorio et al, 2000 as cited in Whitehead, 2001). This theory has previously been used to understand fruit and vegetable consumption among college students, where it has been found that a mix of personal and environmental factors promote fruit and vegetable consumption, and that a multidimensional approach versus a traditional program (that only addresses change in knowledge and attitudes regarding fruits and vegetables) is needed (Harris & Murray, 1997). SCT constructs have also been associated with physical activity interventions, focusing on increasing self-efficacy. In 2006, Heitzler et al, surveyed parent-child pairs, inquiring about organized and free-time physical activity behaviour, psychosocial, and environmental variables that are potentially related to youth physical activity. The authors found that children's belief about the benefits of participating in physical activity were positively related to the parent's belief that physical activity (both organized and free-time) is important.

Within health promotion, it is argued that health care professionals need to take into account "multifaceted factors that contribute to this [health related] behaviour" (Whitehead, 2001). SCT is designed to aid health professionals in observing and predicting the factors involved in health-related behaviour (Ogden, 2000 as cited in Whitehead, 2001). In addition, this theory highlights a person's reasons for possibly adopting a health behaviour change

(Whitehead, 2001). Health promotion interventions are more likely to have a successful outcome if the reasons behind adoption of a particular health related behaviour are understood prior to introducing a health behaviour change intervention (DeAmicis, 1997, Whitehead, 2001a, as cited in Whitehead, 2001). Finally, SCT has been used successfully with the Diffusion of Innovations Theory (the theory I used to frame my research findings in the results and discussion chapter) for a school-based tobacco prevention program (Sharma & Kanekar, 2008).

All theories hold both strengths and weaknesses that must be considered. There are several strengths of SCT. Bandura (2004) highlights that making and keeping to short-term attainable goals is effective in creating change. Creating and keeping short-term goals is arguably more achievable than setting long-term goals that are complex. Another strength of SCT is the focus on the short duration and attainability of a set goal. Very few individuals are able to focus and commit for long periods of time to any particular goal, let alone one that requires a major health change (such as losing a substantial amount of body fat or adhering to a rigorous physiotherapy regimen). However small goals, that are set more frequently, will not only be attainable by a larger population, but will also provide a sense of success when achieved; and in turn, will provide confidence in one's ability to attain the next goal.

Another strength of SCT is the holistic focus of the individual's world that they live in. Meaning, the theory addresses not only the person, but also those people that surround that person, and the environmental factors that play a role in creating who he/she is as a social human being. This can be connected to the idea of "nature/nurture". While our genetic makeup may dictate much of what we physically look like, and some characteristics of our personality, it is

our social environment that we are exposed to that completes this picture and rounds out the debate on what gives a human being their unique identity.

One strength of SCT that may also be argued as a weakness is the capacity for prediction. The theory is designed to provide both observation and prediction. The ability to predict a health behaviour provides health professionals with valuable information that can aid in suggesting appropriate health care and can help in designing programs that are tailored to the predicted behaviour outcome. This in turn, can save on health care funding, and increase the efficacy of such care. However, with prediction comes the desire to assume an outcome. This leaves no room for a sudden change in behaviour or change in outcome. Just as this theory provides the ability to predict an outcome, there must also exist an assumption that predictions can, at times, be incorrect. Therefore, healthcare providers utilizing this theory must consider designing health interventions and programs with the understanding that prediction should not lead to assumption.

There are also several weaknesses of SCT. Bandura (2004) highlights personal efficacy as playing a central role in behaviour change. One must believe in his/her ability to change in order for change to occur. However, not every individual holds a strong (or strong enough) belief that they are capable of change. This innate capacity to believe one is strong enough or has enough will to make a change can be argued to be a personality trait that some individuals may possess more strongly than others. Social Cognitive Theory does not necessarily address those individuals who lack or have less belief in their self efficacy.

Finally, Bandura (2004) comments that the environmental factors that are found to influence behaviour are social support and barriers to behaviour adoption. Social support is

understood as how others will encourage or promote a person's participation in a specific behaviour. In addition, the number of barriers that must be changed is negatively correlated with the likelihood that a person will engage in the chosen behaviour (Ramirez, Kulinna & Cothran, 2012). For those individuals who lack the necessary social support (a supportive family or community), and are faced with multiple barriers (low income or low education), this theory would suggest an unlikely change in behaviour. SCT fails to address how to create or increase a likelihood of change within the population of those who lack social support.

<u>The Social Ecological Model</u>

The Social Ecological Model takes a broader approach to understanding the influencers of human behaviour. This model takes into account an individual's relationship with both his/her immediate environment such as their family, their more external environment such as their community, and the policies that govern that society (Giles-Corti et al, 2005). Story et al (2008) identifies four levels of influence on individual behaviour in relation to eating in childhood. The first level includes psychosocial and biological influences that exist at the intrapersonal level such as knowledge of healthy food. The second level involves interpersonal influences such as family. The third level is the organizational level and includes one's physical environment or community. And the fourth level consists of societal influences or the 'macrosystem' that one exists in. The Social Ecological Model has been suggested as useful for examining the obesity epidemic and low levels of physical activity in developed countries (Blanchard et al, 2005). This model has also been used in research that examined the relative influence of individual, environmental, social, and the physical environment on recreational physical activity in Western Australia (Giles-Corti & Donovan, 2002). The physical

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environment is secondary to individual and social environmental influencers, suggesting that strategies including those that aim to influence individual factors (knowledge, abilities) and social factors (peers, cultural values), along with the physical environment, are imperative to increasing physical activity (Giles-Corti & Donovan, 2002).

The Social Ecological Model has also been used to understand and intervene with the multiple factors that interact and contribute to youth obesity. One particular study by Kolmodin, Naar-King, Ellis and Brogan (2007) used this model to understand the factors affecting a severely overweight African American adolescent population and their caregivers. Individual child factors that were assessed were mental health, nutrition knowledge, and motivation to change health behaviours related to overweight and obesity. The study revealed that over 36% of the adolescents were clinically depressed; many (90%) of the adolescents demonstrated some understanding of what nutrition means (highlighted by the agreement that one should eat more fruits and vegetables and less sugary foods), however fewer than half of the adolescents said they were ready to make a change while less than a third said they were currently changing. The family factors that were assessed included the parent's weight and mental health status, supervision of their child(ren), and the motivation to promote weight loss in their child(ren). Over three quarters of the parents were considered obese, with 40% identified as clinically depressed. Many parents were aware of their teen's eating and exercise habits, but 88% never checked their child's weight. Few parents said they felt ready to supervise their teen's eating and exercise routine. The environmental factors assessed included available neighborhood resources such as parks used for physical activity and grocery stores with healthy food options. Close to 75% of the families said they shopped at a grocery store versus a convenience store,

and it was found that most did not use the community resources (such as nearby parks) for exercise.

One strength of the Social Ecological Model is how it takes a broader approach to understanding human behaviour influencers than the Social Cognitive Theory does. This model goes beyond the "person", "social networks", and the "environment", and incorporates the policies that govern the society that the individual exists in. This suggests and places an importance on the society's capability to influence an individual's behaviour. This capability can be found in the 1986 Ottawa Charter for Health Promotion that highlights health promotion action as including building healthy public policy. The Charter states that health promotion policy combines various approaches including organizational change, legislation, and fiscal measures. The Social Ecological Model highlights societal policies (whether they be written or inferred) as playing a role in not only how one behaves, but also how one may change his/her behaviour. This may suggest that those looking to influence healthy behaviour, may be able to create a stronger influence by changing social policies related to the desired behaviour (such as preventing smoking within a closed public environment).

The above strength (utilizing a wider approach to understanding human behaviour influencers) may also be argued as a weakness of the theory. To suggest that our behaviour is defined, dictated, or influenced by societal policies is also to suggest that human beings are not unique and creatively free individuals. This is to say, that a human being's behaviour is not internally creative. The Social Ecological Model does not discuss one's relationship with the "self". While the concept of possessing knowledge is addressed, creative will and ability is not. This theory may therefore suggest that spontaneous creative will in changing behaviour does not

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exist without external forces guiding the change. In turn, this may force us to consider both the role of individual will or the "self", and the role that society plays in creating change. The discussion on the individual versus society can be explained through the innate desire for "authenticity". Erickson (2011) suggests that authenticity is a pervasive component of our society, our institutions, and our own selves. We are committed to authentic self-values and identifying who we are as both a self (individual), and as a self within our community (society). Erickson may be suggesting we must consider both the authentic individual and society, whereby one cannot exist with the other. If we consider this in terms of behaviour change, then we may conclude that both the unique self and society together not only guide change, but may also be responsible for change (as would be in accordance with the Ottawa Charter for Health Promotion).

The Continuum Model

The continuum model places individuals on a range that reflects the likelihood of action for that person (Schwarzer, 2008). The goal is to move the individual along the continuum towards action. The premise is that if the individual has an intention to change, the focus of the intervention lies first in identifying barriers, vulnerabilities, and perceived self-efficacy (Schwarzer, 2008). A theory associated with the continuum model is the Theory of Planned Behaviour. This theory assumes that human behaviour is rational and is driven by motivational factors (Ceccato, Ferris, Manuel, & Grimshaw, 2007, The World Bank, 2010). The theory suggests that "intention" (willingness to act or behave) and "perceived behavioural control" (how much control one perceives they have over their behaviour) directly influences the targeted behaviour, while social norms and perceived behaviour control are influenced by behaviour and

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control beliefs. Therefore, according to the Theory of Planned Behaviour, one's personal beliefs about a behaviour, the social groups' perceptions of the behaviour, and the beliefs about being able to perform the behaviour form the foundation of any given behaviour change (Ceccato, Ferris, Manuel, & Grimshaw, 2007, The World Bank, 2010).

While there are many studies that utilize the Theory of Planned Behaviour to understand youth obesity, I shall discuss two here. The first considered parents as health promoters for their children. A study by Andrews, Silk, and Eneli (2010) was conducted with parents using the Theory of Planned Behaviour survey items as they relate to providing healthy foods and limiting unhealthy foods for their children. The results supported the theory's predictions and found that the degree to which parents viewed providing healthy food choices (and limiting unhealthy ones) as effective in preventing obesity (understood here as response efficacy) was predictive of a parent tracking their child's eating behaviour. The second study was a qualitative study by Rhoades, Al-Oballi Kridli, and Penprase (2011), which examined adolescents' personal beliefs on being overweight. The theory of planned behaviour was used to conduct semi-structured interviews of 10 overweight adolescents. This research found that this population had positive attitudes in dealing with their current weight status and that they valued their family's support in helping to control their weight. In addition, while friends were important to promote a regular exercise routine, it was families, and in particular mothers, who were shown to be crucial when addressing eating habits. This is important evidence as the TIME project is using the family as a whole to achieve the health behaviour change of increasing fruit and vegetable intake.

A strength of the continuum model is the placement of individuals on a range reflecting the likelihood of action. The person may move back and forth on this range before achieving the

desired goal (or not). The reason why I consider this to be a strength is because it appears to be a more realistic depiction of how behaviour change occurs in real life. Change is (generally) not a linear progression, and is fraught with both struggles of movement (forward and backward), and timeline reconstruction (spending varying amounts of time in different areas of the change continuum). Another strength of this model is how it, like Social Cognitive Theory, also addresses perceived self-efficacy, which has been found to be an important component in health behaviour change (Bandura, 2004). Recognizing that the will or drive to change a behaviour must (at least somewhat) come from within, is an important distinction from the Social Ecological Model, which does not address internal will.

The Theory of Planned Behaviour assumes that human behaviour is rational and driven by motivational factors. While it can be presumed that one behaves or chooses to change behaviour based on factors that one finds motivational, I feel it is somewhat inaccurate to say that all human behaviour is rational. There are many instances where a person can assess their own behaviour or examples from people they know, and say that the behaviour was indeed irrational. In addition, what about moments of insanity or mental illness? It is unrealistic to assume that human behaviour is not without some moments of irrationalism. In fact, it may be the exact irrational behaviour that leads to brilliant creativity. This argument draws a parallel between the Theory of Planned Behaviour and the Social Ecological Model again, as the Social Ecological Model does not address creative will/ability (which I link to irrationalism), and the Theory of Planned Behaviour assumes human behaviour is always rational (and arguably incapable of irrationalism and therefore creativity).

The Stage Model

The stage model suggests that there are qualitative stages that people go through while experiencing change. In addition, people may move back and forth between stages, and change does not necessarily begin with intention (Schwarzer, 2008). A popular stage model is the Transtheoretical Model of Behaviour Change (TTM). This model integrates both processes and change principles from major intervention theories and emerged from an analysis of various psychotherapy and behaviour change theories (Prochaska & DiClemente, 1984). TTM highlights five stages of health behaviour change that are defined in terms of goals (precontemplation, contemplation, preparation, action, and maintenance) (Schwarzer, 2008). This model also has ten processes of change that include the pros and cons of change, perceived self-efficacy, and temptation, wherein different factors are related to different stage transitions (Schwarzer, 2008).

One study by Horacek, White, Betts, and Hoerr, et al (2002) used the Stages of Change for fruit and vegetable intake in young men and women and examined whether psychosocial, weight satisfaction, and dietary pattern variables discriminated between the stages. While self-efficacy scores had the highest predictive value for determining the stage of change for meeting fruit and vegetable guidelines in both gender groups, it was also found that self-efficacy may function to discriminate men in the pre-action stages of fruit intake. The authors found that young men appear to require more confidence in their ability to include fruit consumption in their daily diet as they consider or commit to such a change. For both men and women, the perceived benefits of eating fruits and vegetables increased significantly as the participants committed to improving their intake of these foods. While some of these findings may appear as "common knowledge", it is important to note the gender difference in confidence in one's ability

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to increase fruit consumption for men. This is important for the TIME project and similar health behaviour change interventions where the population will include both males and females. These application driven interventions might benefit from considering a tailored approach to male users.

Another study by Walton, Hoerr, Heine, Frost, et al (1999) assessed a younger population of fifth and sixth graders (not unlike the population addressed in the TIME study), and their physical activity using the Stages of Change. The authors adapted the Stages of Change to assess readiness to be or stay physically active within this population. The students also completed the Past Year Leisure Time Physical Activity Questionnaire and the Modifiable Physical Activity Questionnaire for Adolescents (Aaron et al, 1993). The stages of precontemplation, contemplation, and preparation were grouped as "pre-action", while the action and maintenance stages were grouped as "post-action". The authors found nearly 40% were grouped into the pre-action stages, with the remaining 60% in the post-action stages. Twenty-two percent were found to be in the precontemplation or contemplation stages, with significantly fewer girls in the maintenance stage than boys. The girls were found to cluster more in the contemplation stage. These findings add to our understanding of fruit and vegetable intake for males and females. While boys appear to be in a maintenance stage when looking at physical activity, their older counterparts appear to show a need for confidence in increasing fruit and vegetable consumption. A study combining these findings would provide insight into how to best support both physical activity and proper nutrition across the young male stage of life (through to adulthood).

The stage model connects similarly to the continuum model. Both highlight a movement in change. In addition, the stage model highlights qualitative stages that may or may not begin

with intention. This is an important contribution to research on behaviour change as it suggests that not only are there specific stages that behaviour change programs can be designed around, but also that intention is not necessarily the first step in creating change. Therefore, other factors must be uncovered in facilitating the change process. This may in fact, be a detriment to health care providers as they are challenged to learn the "starting point" of change for each individual.

Health Behaviour Change Interventions - Factors and Tools that affect Change

While there are many different types of health behaviour change interventions aimed at reducing obesity in children, some programs and intervention techniques have been shown to be more effective than others. Stice, Shaw and Marti (2006) conducted a meta-analysis of 64 obesity prevention programs for children and adolescents and found that certain tools were more useful than others. The authors studied participant type, intervention, delivery, and design features associated with larger effects. The researchers found that the age of participants was important. Obesity prevention programs are most effective when delivered to middle school or high school students versus grade school students.

These programs are also considered more effective when the intervention involves the parents (Baranowski Cullen, Nicklas, Thompson, & Baranowski, 2002; Story, 1999, as cited in Stice, Shaw & Marti, 2006). It was hypothesized that school age children may be challenged in grasping the concepts or skills taught in the interventions and are less likely to influence the food purchasing choices made by the parents. This relates to the TIME research team's aim of including both children and parents in their participant group; thereby increasing the probability of a successful health behaviour intervention. The authors addressed risk status of participants and found that interventions are more effective when offered to high-risk participants (selected prevention programs) versus all individuals in a population (universal prevention programs).

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This is important for the TIME project as the targeted population is one that has recently been found to be at risk for making poor nutrition choices due to schedule time constraints (Chircop et al, under review).

The authors also looked at the duration of the program/intervention and those programs that either directly or indirectly made an improvement on dietary intake and physical activity levels. It was found that those programs that were longer in duration (greater than 16 weeks), had a direct impact on food type, food consumption, and participation in physical activity (making these behaviour changes mandatory versus suggestive changes) were more successful in reducing obesity. The TIME project had a six month intervention period; however, diet and physical activity changes were suggestive versus mandatory. The number of behaviour targets was also inversely related to the magnitude of intervention effects. In addition, how the intervention was delivered and the level of participant interaction were equally important. Those health behaviour change programs that were delivered by qualified health professionals (versus elementary teachers for example) were more successful. In addition, interventions that were interactive produced larger effects. The TIME study used an interactive smartphone health application as the health behaviour change intervention. This type of intervention is built on the premise of participant interaction. Due to the nature of any smartphone application, the user must interact with it to gain any knowledge or positive effects.

Finally, the authors of the Stice, Shaw and Marti study (2006) found that the use of both pilot studies and self-selected participants are important in a successful obesity reduction study. Pilot studies are considered more effective than non-pilot studies as interventionists are more passionate about a new prevention or harm reduction program and trials or pilot studies are generally more methodologically rigorous and are therefore more immune to confounding

variables. Using participants who are self-selected is recommended as this sample of participants are generally more motivated to achieve a change in behaviour and therefore engage more effectively in the program. These points are both related to the TIME project as the intervention is a pilot project and the participants are participating on a volunteer (versus mandatory) basis.

A more recent meta-analysis of 55 studies assessing child obesity prevention programs, published in 2011 by Waters et al, suggests there is strong evidence supporting the beneficial effects of these programs on Body Mass Index (BMI), particularly for those programs targeting children six to twelve years old. This is an interesting finding considering the Stice, Shaw and Marti (2006) study that highlights the success when targeting the middle school or high school population. Waters et al (2011) concluded that specific program components, strategies, and policies are promising when addressing child obesity prevention and are highlighted as follows: a school curriculum that includes:

- Healthy eating, physical activity, and body image education.
- Improvements in the nutritional quality of food supplied in schools.
- Increased time spent doing physical activity and the development of fundamental movement skills throughout the school week.
- Practices and an environment that supports children in both physical activity and consuming healthier foods, as well as support for those that are implementing these health promotion strategies (including teachers and school staff).
- And finally, support in the home environment; encouraging parents and home activities to be more active, eating healthier foods, and decreasing screen based activities (such as watching television or playing video games).

The above review is related to the TIME project in many ways. To begin, the population of interest in the TIME study is school aged children involved in recreational activities and their parents. Secondly, one of the main objectives of the TIME project is increasing fruit and vegetable consumption in the home environment through the use of a smartphone application. The application is also family-focused, providing both parents and children with a user-friendly application experience. Finally, while the TIME project will be addressing both the home and recreational facility environment, it can be argued that the strategies used in the school environment to achieve success in preventing child obesity may also be applied to the recreational facility environment where physical activity is already a focus. Through implementing changes in the food offered at these centres, it may be possible to further increase the success rate of obesity prevention strategies aimed at school aged children.

Diffusion of Innovations Theory

The TIME research team designed and built a smartphone health application to aid in healthy decision making surrounding fruit and vegetable intake. This smartphone health application will be used in the population of busy Nova Scotia families with children who participate in recreational activities as an intervention aimed at increasing fruit and vegetable intake. My research addressed how parents perceived smartphone health applications and whether they thought they were effective in achieving healthy behaviour change. These research questions targeted a deeper query around adoption of this technology. Understanding the target population's adoption of smartphone application technology may provide knowledge in developing health behaviour change interventions using this type of technology. In turn, this knowledge may aid in reducing the prevalence of obesity in Nova Scotia families using this application. I have chosen to use the Diffusion of Innovations Theory (Rogers, 2003) to define

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what the perceived characteristics of an innovation are, how this can affect adoption, and what characteristics might be important to focus on to improve chances of adoption success within the population of interest. This information may then add to the literature on the adoption of smartphone health applications by busy families in Nova Scotia.

Adoption of a technology, an idea, or a new behaviour for example, can best be understood through the Theory of the Diffusion of Innovations. Everett Rogers' (2003) Diffusion of Innovations Theory addresses how innovations are adopted within social groups and across social systems over time. Rogers identifies an innovation as anything that is considered new by the audience. This could be a new product, an idea, a methodology, etc. In the case of this current study, the innovation was smartphone application technology and specifically smartphone health applications. The Diffusion of Innovations Theory includes assumptions about what type of adopter a person is (innovator, early adopter, early majority, late majority, and laggard), and seeks to understand how the perceived characteristics of an innovation (relative advantage, compatibility, complexity, trialability, and observability) help to explain the differences in adoption (Rogers, 2003).

The Diffusion of Innovations Theory has been used across many disciplines over the course of many decades. Greenhalgh et al (2004) conducted an extensive systematic literature review of diffusion of public service innovations. The review focused primarily on health care and found thirteen research areas that provide evidence relevant to the diffusion of innovations in health care organizations. Some researchers advocate for the use of this theory in diffusing interventions in regards to five modifiable risk behaviours: alcohol consumption, tobacco use, overweight and obesity, low fruit and vegetable consumption, and physical activity (Sharma &

Kanekar, 2008). The Center for Disease Control and Prevention has also used this theory in dissemination of school guidelines to prevent tobacco use and addiction to education agencies and found that the diffusion process required planned change over time via several communication channels (Sharma & Kanekar, 2008). Glanz, Rimer, and Kiswanath (2008) highlight an extensive list of programs and initiatives that have made use of this theory in their planning, implementation, and dissemination stages. These programs include:

- In the physical activity field, SPARK (Sports, Play, and Active Recreation for Kids) and CATCH (Coordinated Approach to Child Health), programs for school-based physical education, making healthy food choices, and preventing tobacco use.
- In the cancer control field, the Pool Sun safety program.
- In nutrition, an intervention called Body and Soul which aided in increasing fruit and vegetable intake through the American Cancer Society, the Center for Disease Control and Prevention, and the National Cancer Institute.
- And finally, HIV/AIDS programs in developing countries.

In health service technology research, Diffusion of Innovations Theory has been used to understand the adoption rate and aid in strategy planning for the implementation of Information and Communication Technology initiatives (ICT) like electronic health records (Menzi, 2008). The larger the scale of the new technology within healthcare, the more important it becomes to understand innovation adoption. This understanding can be applied to the fast growing application of smartphone technology in the health promotion field. This theory is popular in the more specific field of telehealth, which is understood by the Centre for Connected Healthy Policy (2011) as the use of digital technologies to deliver healthcare and services to users in

separate locations. The Diffusion of Innovations Theory has been applied in various empirical studies to help in understanding ICT adoption among healthcare professionals across North America and Asia (Helitzer et al, 2003; Spaulding et al, 2005; Park & Chen, 2007; Wu et al, 2007 as cited in Menzi, 2008). The integration of ICT is not unlike the implementation of smartphone health applications. Both are systems that provide information and communicate with users. Considering that ICT initiatives are fraught with adoption resistance (Menzi, 2008), it is important to have some understanding of the factors that influence the adoption of smartphone health applications within the study population. In addition, the Diffusion of Innovations Theory views innovations being changed to fit the needs of the population, versus the people being fit into the framework of a particular innovation (Robinson, 2009). Health promoters and developers are looking to accomplish the following: design a smartphone health application that fits the understood needs of the user thereby leading to an effective, tailored intervention.

Rogers (2003) identifies an innovation as anything that is considered new by the audience. The innovation can be anything that is novel (including an idea or a process). A strength of the Diffusion of Innovations Theory is that it is all encompassing; if the innovation is considered new by the user, then the theory can be used to assess the adoption of the innovation, allowing it to be utilized across a vast array of research fields. However, it can be argued that the concept of an innovation according to Rogers is somewhat narrow. While an innovation must be novel to be considered an innovation to the user, what would one consider a new product that the user has knowledge about, but may have not used personally before? For example, in my research, many of the focus group participants have at least a basic understanding of smartphones and smartphone health applications, although not all may own one

or have used a health application before. Could we not argue that this type of health behaviour change intervention (the use of a smartphone health application to improve fruit and vegetable intake) may indeed not be a true innovation to any of the users? Considering the above, the Diffusions of Innovations Theory is used in my research with the understanding that the user of the innovation views the application (or the discussion on the use of the health application) as something that, while the user may have some basic knowledge, is considered an idea, concept, or method that is new to their daily life.

To understand why the TIME research team chose to use a smartphone application as the platform for their health behaviour change intervention, it is important to outline the evolution and types of behaviour change interventions (from print to web to mobile). Previous generations of behaviour change interventions have had limitations; and as such, current innovations are likely to have limitations as well. Each new generation has claimed to provide improvement over the last. With the most recent generation of health behaviour change interventions utilizing smartphone technology, the TIME research team is ensuring the use of the most up-to-date behaviour change intervention type available.

The Evolution of Health Behaviour Change Interventions
First Generation: Print-based Health Behaviour Change Interventions

Health behaviour change interventions can include educational materials, the use of communication networks and marketing, the development of health policy, and individual or group action aimed at improving one or a group's health status (Health Canada, 2002). Before the widespread adoption of the home computer and the daily use of the internet, education in health behaviour change interventions made use of print material. Leaflets, flyers, and

pamphlets were used to spread healthy messages about how to eat well, exercise properly and be screened regularly for common forms of cancer. While print interventions are still used today, this strategy has advanced through the use of tailoring and is generally used in conjunction with web applications and technology interfaces that not only allow for tailored messaging but also for interaction between the message and the user. Nutrition and exercise education have become customized to the needs of the user, thereby allowing the user to receive personalized information in a fast and easily digestible format.

While print materials can be targeted to specific populations through the use of design techniques, and appropriate wording, it is the use of "tailoring" that has been found to be more successful in achieving health initiative goals (Kreuter, Farrell, Olevitch & Brennan, 2000). Tailoring is understood as any combination of information and strategies intended to reach one specific individual, based on characteristics that are unique to that person, related to the outcome of interest, and derived from a personal assessment (Kreuter, Farrell, Olevitch & Brennan, 2000). An example of a tailored print health intervention focusing on improving one's ability to make healthy food choices may be a nutrition program that is tailored to the user, delivered via personal mail, created based on results of survey questions asked of the targeted person, and intended to aid in this target person's daily nutrition choices. Tailored interventions take targeted interventions one step further by being uniquely individualized to each person versus a segment of a population.

The advantages of print health behaviour interventions are many. A major advantage of using print material (over technological methods) is the number and geographic spread of people that are able to be reached. This is critical when trying to implement a population health

initiative or when targeting a sub-group that may not have access to a computer and/or the internet. Print interventions have been shown to have a further reach into groups with lower social economic status, with literacy however being an issue to contend with (Marcus, Owen, Forsyth, Cavill & Fridinger, 1998). In addition, print materials can be used to access populations in remote locations who may not be accessible via regular and reliable internet service. While web health behaviour change interventions may be faster in terms of delivering a message, it is not known if that message can be delivered reliably to those living in rural areas. Print methods have the ability to reach anyone who has a mailing address.

Tailored print information is also more likely to be read, remembered, and viewed as personally relevant by the user. Because it enables individualized feedback, it commands greater attention from the user; therefore, it is processed more intensively by the person and is perceived more positively by the health consumer (Lustria, Cortese, Noar & Glueckauf, 2009). In fact, some research has found that print material is more likely than electronic material to be kept for later use (Marshall, Bauman, Marcus & Owen, 2003). Tailored print messaging has also been found to outperform the less personalized targeted messages in affecting behaviour change (Noar, Benac & Harris, 2007; Marcus et al, 1998).

The most successful use of tailoring in print interventions has included initiatives that focus on preventative behaviours, like smoking cessation and dietary change, and screening behaviours such as mammography and pap tests. The most successful types of print materials have included tailored pamphlets, newsletters and magazines versus letters, manuals or booklets (Noar, Benac & Harris, 2007). It is understood that the more a media method is able to garner and retain the attention of users (utilizing graphics, pictures and intriguing layouts or interfaces),

the more likely this method will induce the intended outcome of the intervention. Bull, Holt, Kreuter, Clark and Scharff (2001) revealed evidence of this when the authors found that those participants who rated print health information materials to be attractive were significantly more apt to like them, understand what the health information was trying to convey, and pay attention to them.

A limitation of using print material is the unknown result in behaviour change in large populations. While print material allows health professionals to reach a wide array of people, their effectiveness in generating behaviour change is unclear (Marcus, Owen, Forsyth, Cavill & Fridinger, 1998). An example of this is mass media health campaigns (utilizing print media such as pamphlets, magazines and billboards). When these campaigns have been used in public health initiatives, there is evidence that the message reaches a large number of individuals (Marcus, Owen, Forsyth, Cavill & Fridinger, 1998). Across studies, message recall is quite high, indicating that mass media campaigns can successfully educate and reinforce awareness of the benefits of engaging in physical activity (Marcus, Owen, Forsyth, Cavill & Fridinger, 1998). When the initiatives are performed on a smaller scale these methods become more efficacious (Marcus, Owen, Forsyth, Cavill & Fridinger, 1998). By targeting subgroups, the public health impact is lessened (as a smaller proportion of the population is reached), but the overall change in behaviour is heightened (only within the targeted subgroups) (Marcus, Owen, Forsyth, Cavill & Fridinger, 1998). Another limitation of print material is that it is not possible to manipulate the health information once it is on paper. Health information can be lengthy in some types of media like manuals, which therefore deters the user from reading it in its entirety (Noar, Benac & Harris, 2007).

Second Generation: Web-based Health Behaviour Change Interventions (eHealth)

The World Health Organization (2013) defines eHealth as the use of information and communication technologies (ICT) for health. North Americans are becoming the most technologically savvy population; in 2007 over 55% of households that earned less than $30,000 a year used the internet, and 70% of households with incomes of less than $25,000 were using commercial game consoles (Pew Internet & American Life Project, 2007 as cited in Silk, Winn, Keesecker, Horodynski & Sayir, 2008). Many low-income individuals now have the ability to access and interact with web-based health behaviour change interventions. With technology becoming more advanced by the day, and therefore less expensive to use, build and modify, the use of tailored health behaviour change interventions delivered via the web have the potential to reach thousands of individuals, almost matching the reaching capacity of print material. In addition, these interventions are cost-effective (Noar, Benac & Harris, 2007) for the participants (as the cost of computers and internet has become more affordable), health professionals, and researchers to implement.

While the range of applications grows, including the use of online interventions to address obesity, deal with poor nutrition habits, and manage diabetes (Marshall, Bauman, Marcus & Owen, 2003), the literature on web-based health behaviour change interventions is in the early stages of development. The issue of efficacy of this type of intervention was addressed by Free et al (2013). The authors identified 75 controlled trials of mobile technology-based health interventions delivered to a health-care consumer. These trials addressed a range of health concerns including disease management (adherence to antiretroviral therapy in HIV positive individuals), smoking cessation, and improving diabetes control through physical

activity. The researchers found mixed results. While some trials improved adherence to health programs and regimens (including increased adherence to antiretroviral therapy, decreased smoking behaviour, and an increase in diabetes control), other trials found the interventions to have no effect on mortality of HIV individuals, and no effect on body weight for those studies addressing a reduction in body weight. The authors suggested that due to the infancy of this area of research and the evidence of this type of intervention working in some instances and not others, more trials are necessary to fully understand the efficacy of this type of technology based health intervention.

However, some research has provided early evidence that this method of health behaviour change intervention is effective for specific areas like controlling weight, (Breton, Bernard, Fuemmeler, Lorien & Abroms, 2011) and holds promise in changing health behaviour for a variety of reasons. To begin, web-based technology has contributed to the sophistication of tailoring of interventions, meaning they can be more personalized to the user or patient. Powerful systems can now automate the collection of data (input) which can then be used to provide individualized feedback (output) to the user (Lustria, Cortese, Noar & Glueckauf, 2009; Marshall, Bauman, Marcus & Owen, 2003). In fact, entire health programs can be designed based on this feedback loop system. Expert and advanced systems enable tailoring of interventions in such a way that a variety of factors that influence behaviour can be captured. In turn, these interventions are approaching a level of personalization that, at one point in time, was only ever achieved through face to face interactions between patient and clinician (Lustria, Cortese, Noar & Glueckauf, 2009; Cugelman, Thelwall & Dawes, 2011; Brug, Oenema & Campbell, 2003).

Online applications also have a high degree of flexibility. Beyond being able to deliver tailored messages and provide immediate personalized feedback, interactive technology gives users the ability to "toggle" (move back and forth) between interfaces and therefore intensifies understanding of the material (Lustria, Cortese, Noar & Glueckauf, 2009). In addition, access to a user's calendar is particularly helpful in delivery of reminders and messages. This interaction between an online intervention and a person's personal scheduler program can aid in timely delivery of prompts and ensure steady progress through a health program (Lustria, Cortese, Noar & Glueckauf, 2009). It has been found that many users simply prefer to receive their health information in online or email format versus print format (Marshall, Bauman, Marcus & Owen, 2003). Compared to the first generation of print-based tailored health behaviour change interventions, web-based programs are able to utilize a greater variety of options for assessing an individual, thereby creating a richer feedback system (Lustria, Cortese, Noar & Glueckauf, 2009). The online format allows health professionals and researchers to create and deliver customized health messages, equipping individuals with the necessary tools to not only make health behaviour changes, but also to maintain these changes and keep patients/users engaged in their own self-care (Lustria, Cortese, Noar & Glueckauf, 2009).

Another advantage of online health behaviour change interventions includes the variety of customizable tools that can be incorporated. These tools can be interactive and even built by the user (providing a form of customization that is beyond previous generations of health behaviour change intervention methods). These customizations can include goal setting activities, self-monitoring tools, email reminders, links to resources, and skill building activities (Lustria, Cortese, Noar & Glueckauf, 2009). Through automation, health behaviour change

interventions can quickly implement a tailored component and schedule and disseminate this component to the user to create an experience unique to the individual.

Web-based delivery also facilitates implementation of programs to wider audiences, essentially breaking geographical barriers and providing health professionals with the opportunity to collect data and provide care to people across the globe. Because of this now world-wide reach, the use of online media is being used to engage large populations in automated relationships that resemble the support offered by their physicians, fitness trainers, or smoking cessation counselors (Cugelman, Thelwall & Dawes, 2011). The major factor driving these online health promotion campaigns is the convenience and speed of today's internet. Presently, over 1.5 billion people use the internet (Cugelman, Thelwall & Dawes, 2011), suggesting that health behaviour change intervention campaigns via the web are able to access over 20% of the world's population. Another factor is the interactivity component and the use of multimedia, offering new ways to engage an ever diverse audience.

An obvious financial benefit to developing online health behaviour change interventions for mass targeted groups is the sheer cost-effectiveness of preventative medicine. Canadian spending on healthcare in 2010 ($191.6 billion) indicates that preventative health care is critical (Canadian Institute for Health Information, 2011). Ensuring this care is reaching the largest number of people quickly is important as rising health care costs are truly driving the search for affordable web-based health behaviour change interventions (Cugelman, Thelwall & Dawes, 2011). Online formats offer healthcare savings. This is evident in recent research that found large differences between the costs of various intervention programs. These programs included smoking cessation telecounseling interventions ($150 to $250 per smoker), tailored print

interventions ($5 to $40 per smoker), and tailored online smoking cessation interventions (less than $1 per smoker) (Strecher, Shiffman & West, 2005). In conclusion, the more people a print-based intervention reaches, the more it costs to deliver, while the cost of online health behaviour change interventions increase only marginally as more people are reached (Marshall, Bauman, Marcus & Owen, 2003).

The limitations of using web-based health interventions involve the necessity of both technology and the internet. Because this type of health behaviour change intervention is accessed via technology and the internet, both technology and internet access can be a challenge (whether this is the fault of the user or the provider is irrelevant). Marshall, Bauman, Marcus, and Owen (2003) investigated the difference between using print and web-based physical activity programs, and found that people who used the web to access information during their study had concerns around web page security (user name and password not working) and/or problems with connectivity (the server was slow or down). These problems are a reality for anyone who is using modern-day technology to access information. Another limitation of online interventions is mandatory versus voluntary participation. When participation is mandatory, such as following a care plan to live healthily with diabetes, the user is more likely to interact regularly with the intervention (Eysenbach, 2005). However, in longitudinal studies of interventions that are neither mandatory nor critical to the individual's health, significant attrition is found (Eysenbach, 2005). Finally, the issue of relying on self-report versus objective measures of behaviour is an important general research limitation. As health researchers, these are significant concerns when trying to develop health behaviour change interventions that will be implemented via the web.

Third Generation: Mobile Health Behaviour Change Interventions (mHealth)

Mobile health or mHealth is the use of mobile phone technology to deliver health care. Types of mHealth technologies include text messaging, smartphone application use, video messaging, voice calling, and the use of an internet connection via the mobile phone (Cole-Lewis & Kershaw, 2010). mHealth harnesses the mobility and timeliness of information communication technology (ICT) for the purposes of improving health and the delivery of health care between health service providers and patients (Lester et al, 2011).

Web-based health behaviour change interventions are limited in their success due to lack of adherence. There are essentially two types of adherence: intervention adherence, which is the proportion of participants who use an intervention over time; and study adherence, which is the proportion of participants who stay in a study over time. These two types are correlated and explained by a third variable, participant interest (Cugelman, Thelwall & Dawes, 2011). The level of participant interest influences other factors such as usability, personal connection, positive feedback, and peer-to-peer communication (Cugelman, Thelwall & Dawes, 2011). This understanding of adherence is closely related to the variables that are at play when a person adopts an intervention into their lives. It is important to understand and build on the relationship between adherence and participant interest in order to ensure that user interaction with the material will be sufficient to result in behaviour change. By further tailoring a health behaviour change intervention and asking the user to co-create or personalize the intervention, health professionals and developers are able to build an environment where the user is interested in the health program and is more likely to adhere to the intervention guidelines. This form of tailoring has been found in the next generation of health promotion, mobile health or mHealth.

It is evident that as health behaviour change intervention strategies have changed and adapted over the years, the need for tailoring has become greater and the opportunities to do so have become more prominent. With the use of smartphone technology, interactive health applications that can be jointly built by the provider and the user are now recognized as something that can be implemented at any time and "on the go". Users can interact with and access their health application at any location with wifi service, thereby allowing the health behaviour change intervention to literally be implemented anytime, anywhere. Considering this reality and the popularity of smartphones in today's world, interventions that use this modality may have a greater likelihood of being effective.

As of November 2011, there were 8 million smartphone users in Canada, an increase of 7% since March of 2011 (Ng, 2011). The United States has 70 million smartphone users with 7% of these 70 million using health applications monthly and 1.3 million using these applications every day (Conn, 2011). Smartphones are used by a large population now and are recognized as a promising method for helping people improve their health. Just as internet methods utilize tailoring to effect behaviour change, smartphone applications utilize this feature as well. The more tailored an intervention, the more likely a positive behaviour change will be induced. In addition, these devices include a level of self-monitoring and are portable. The ability to access a health intervention at any time and location has been shown to be relevant in behaviour change interventions (Breton, Bernard, Fuemmeler, Lorien & Abroms, 2011).

The number of smartphone application downloads is on the rise with figures increasing from 300 million downloads in 2009 to 5 billion in 2010 (Mobile Future, 2010 & Microsoft as cited in Kamel Boulos, Wheeler, Tavares, & Jones, 2011). Currently, smartphone health

applications can be downloaded for free or purchased at a price range of $0.99 to $49.99. While there are over 12,000 healthcare and fitness applications available (Cummisky, 2011), only a few hundred address weight loss and diet specifically (Breton, Bernard, Fuemmeler, Lorien & Abroms, 2011). Generally these weight loss applications have interactive tools built into them along with a food compositional database. These applications fall into three main types: those for assessing and tracking weight, those utilizing dietary journals, and those that combine both and include information and journaling capability for physical activity as well. These applications include tools such as food and exercise diaries, easily accessible recipes, nutritional databases, personalized weight graphs, and the ability to interact with the internet through the application (Breton, Bernard, Fuemmeler, Lorien & Abroms, 2011).

Examples of innovative applications include Fast Food Calories Hunter, which provides caloric information for common fast foods; and Food Scanner, an application that allows the user the ability to scan a barcode with the device and upload the nutritional information right into their food diary on the application (Breton, Bernard, Fuemmeler, Lorien & Abroms, 2011). Similar applications include Wellness Diary, UbiFit Garden, and Absolute Fitness which all support the management of dietary and exercise data as well as setting and tracking personal goals (Alagozi, Valdez, Wilkowska, Ziefle, Dorner & Holzinger, 2010). Other nutrition and physical activity applications include Lose It, Fat Secret, and MapMyRun (Cummiskey, 2011). Some applications are also linked with GPS technology to provide the user with information on where healthier food options are within a geographic radius.

In addition to the advantage of mobility (can be used anytime, anywhere), smartphone health applications have been shown to improve the health of people with type 1 diabetes,

hypertension, asthma, sexually transmitted infections, those suffering from alcohol and narcotic addictions, smokers interested in quitting (Abroms, Padmanabhan, Thaweethai, Phillips, 2011), and those interested in decreasing their weight, and increasing their physical activity (Patrick, William, Griswold, Raab & Intille, 2008). Beyond this, smartphones have been found to positively contribute to dietary management, help to increase fruit and fiber consumption and decrease saturated fat intake (Delichatsios et al, 2001), and are perceived by users as useful and effective in controlling weight (Lee, Chae, Kim, Ho & Choi, 2010).

Within the medical field, mHealth is removing geography and time as barriers to care by establishing connectivity with remote locations and workers, and through the creation of new points of contact with patients. Some applications of smartphone technology in health care include home monitors to manage COPD, two way provider/patient video messaging, and mental health brainwave monitoring (Krohn, 2010). On an international scale, the use of smartphones in health behaviour change interventions is found globally with evidence of a diabetes awareness campaign that is using mobile phones to spread its message across India (PR Newswire U.S., 2011). mHealth interventions have also been applied in Kenya, where text messages have shown to improve adherence to antiretroviral therapy, thereby prolonging viral suppression in the HIV affected population (Thirumurthy & Lester, 2012).

In addition, gesture based technologies and the integration of Web 2.0, social networking, and gaming are starting to enter into the smartphone health application arena and are increasing the opportunity for social support which has been shown to aid users in sustaining weight loss efforts (Bernard, Fuemmeler, Lorien & Abroms, 2011; Alagozi, Valdez, Wilkowska, Ziefle, Dorner & Holzinger, 2010). Smartphone health applications appear to reduce the burden

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of planning and self-monitoring and increase the ability to tailor and customize the intervention to the user (Breton, Bernard, Fuemmeler, Lorien & Abroms, 2011). The more tailored an application is and the more efficient people become at self-monitoring behaviours, the more likely they are to adhere to weight loss goals (Breton, Bernard, Fuemmeler, Lorien & Abroms, 2011). Therefore, it can be argued that health behaviour change interventions that are advanced enough to include such features may be more effective in inducing positive behaviour change.

Despite the advantages of these applications, there are limitations. A limitation of using smartphone application interventions is the lack of available evidenced-based health applications, including those in the areas of nutrition, exercise, and smoking cessation (Breton, Bernard, Fuemmeler, Lorien & Abroms, 2011; Abroms, Padmanabhan, Thaweethai, Phillips, 2011). This may be due to a lack of standardization in this new area of health behaviour change. Another limitation of smartphone application interventions is the increase in screen time, which may be linked with a higher prevalence of obesity, and has been noted to be on the rise in the youth population (Cummiskey, 2011). Health behaviour change interventions must also be built for all types of individuals including those with low literacy, the disabled, and older adults. Smartphones can be highly sophisticated and complex, making use of complicated user interfaces that have steep learning curves.

Smartphones can also be costly (the new iPhone 5 can cost over $800) and this can prevent certain segments of the population from gaining access to a particular health behaviour change intervention if it is delivered via a smartphone application. Mobile phones are also exactly that, mobile. They can be shared, lost or stolen and therefore the confidentiality of the information can be at a higher security risk. Another limitation lies in the different platforms

available today including Blackberry, Apple, and Android by Google. Not every application can run on the various platforms and currently only SMS text messaging and voice are operation system-neutral (Patrick, William, Griswold, Raab & Intille, 2008). Finally, different carriers of smartphone devices will often compete with one another for market share. While currently, carriers do not compete on health related services outside the domain of wellness programs like tracking caloric intake for example, it can be argued that this may change. As health applications grow in number, this may present opportunity for some carriers to create a potential exclusivity of a particular application or associated device, thereby placing a barrier to access for those that do not utilize that carrier (Patrick, William, Griswold, Raab & Intille, 2008).

The Complexity and Challenges of Human-Computer Interactions and mHealth

Human-computer interaction (HCI) is the study of the interaction between individuals and computers (Huang, 2009). A major issue for practitioners in the field of HCI is the design of interactive computer systems for human use. The goal is to make computers as user-friendly as possible and minimize barriers. Huang (2009) explains that due to the multidisciplinary nature of human-computer interaction, designing a user interface for mobile devices specifically poses some unique challenges.

A major design challenge is creating a device that is both usable and affordable to a wide set of users. In addition, the concept of portability is at the core of the main requirement for mHealth devices – mobility. And due to this requirement, all hardware must be miniaturized. This in turn, creates another set of challenges. Small-sized display screens on a typical mobile device make it difficult to display large volumes of information (Huang, 2009). Designers are then forced to split the information into multiple small blocks, creating a less than seamless flow

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of readable information for the user. This is also a general complaint for navigating and browsing when using the smaller screen. Furthermore, images, drawings, and diagrams may have to be redesigned to accommodate the smaller screen. In addition, the design of smaller keyboards has also been an issue. Many individuals experience keyboarding errors due to small keys and large fingers. Two major keyboards, known as the stylus and the touch screen are good potential alternatives for the smaller keyboard problem (Huang, 2009).

Beyond the hardware and software complexities of mobile devices, other difficulties are presented in the differing languages, cultures, motives, and constraints of both producers and the end users of eHealth and mHealth systems and services (Pagliari, 2007). While many designers believe it is important to engage users in the design and testing of mobile health devices, the driving force of bringing a product to market can sometimes mean that development issues only emerge after rollout (Pagliari, 2007). Many examples of useful systems have been abandoned or failed all together due to technical, human, or organizational issues that were not foreseen in the beginning of development. In addition, design flaws that may at first appear minor, such as problems with usability or conceptual fit can prevent or slow implementation of otherwise soundly engineered technology (Pagliari, 2007). Finally, due to the youth of this field, there is little evidence as of yet to demonstrate measurable impacts of many mobile health devices and interventions. This in turn creates uncertainty and a reluctance of health practitioners and policy makers to implement these technologies (Pagliari, 2007).

mHealth Regulations

While there are many types of mobile health interventions and applications, all mHealth technologies can be categorized into two different types: one that is used strictly within the

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medical community, and one that is used within the general population and is viewed more as a general wellness application or intervention. The devices and interventions that are used within the medical community are regulated by the Food and Drug Administration (FDA). These regulations are explained within the FDA's Mobile Medical App (MMA) guidance document. While many health professionals and wellness application developers alike have found the regulations challenging to understand, I will attempt to explain the differences between these two uses of mHealth and shed light on what some health professionals feel is a policy gap between the medical application of mHealth technologies, and the wellness application of mHealth technologies.

The FDA has regulated mobile applications since medical applications were first developed. This governing body has been regulating software for medical purposes since at least 1976 (Thompson, 2013). Over this period, mHealth has blossomed, and both the medical community and the wellness community have developed applications and interventions to address health care needs. Recently, at the Wireless Convergence Summit 2013, the FDA attempted to provide some clarification around what types of mHealth interventions it regulates. The general consensus of the FDA is that if the application was not created specifically with a medical purpose in mind, then the FDA has no desire to regulate it (Wiltz, 2013). An example is a generic smartphone with no medical purpose. The smartphone is not a medical device and therefore, the FDA will not regulate it. What the FDA does intend to do is focus on a small subset of applications that include patient self-management applications, simple tracking applications or trending applications that are not intended for treating or adjusting medication. The FDA is also interested in regulating those applications that transform a mobile device into a regulated medical device (Wiltz, 2013). The challenge for the FDA (and therefore the confusion

for many in the mHealth field) is trying to clarify which application's marketing claims are general health and wellness and which are claims to improve a disease or condition (Wiltz, 2013). For example, some applications claim to help a user lose 50 pounds, while others claim to diagnose a particular disease. The latter would be one that would be a concentration for regulation. Some of these applications, while providing valuable health information and serving an important role in healthcare delivery, may present healthcare risks to patients (FDA, 2011) and this is why regulation is critical.

The FDA (2011) outlines that what is important in terms of regulation is the intended use of the application. If the intended use is for the diagnosis of a disease or cure, mitigation, or treatment or prevention of a disease, than that meets the definition of a medical device and therefore, the mobile application would be deemed a medical device and regulated as such. An example would be an application that controls blood pressure at the bedside of a hospital patient. However, those mHealth applications that are electronic copies of textbooks, or those that are used to log or track decisions or suggestions relating to maintaining general health and wellness (as the TIME application would be considered), or those that are more generic aids that assist users but are not identified for a specific medical use, are not regulated (FDA, 2011). In addition, those entities that distribute mobile applications such as iTunes, Android Market, or BlackBerry App World are not regulated by the FDA as these distributing bodies do not actually engage in the manufacturing functions of the applications themselves. Mobile medical applications are also classified under three classes by the FDA. Class I only requires general controls, Class II requires general and specific controls, and Class III requires premarket approval (FDA, 2013). The issue for many developers and health care practitioners that are making use of these applications, is understanding what applications are regulated and how the

medical applications are regulated. It certainly is a vague area in terms of health policy, and one that the FDA appears to be continuing to update through the guidelines on mHealth applications just as technology allows us to develop more sophisticated methods of delivering health care and general wellness through mobile technology.

The policy of "intended use" (how the device is intended to be used to decide on how it will be regulated) was introduced for traditional health care practice where the medical device has always been used by the health care provider. However, now individuals are becoming advocates in managing their health and the same device has the potential to support both medical-oriented uses and wellness-oriented uses (Eysenbach et al, 2013). The difference between wellness and medical use include the type of environment, the user, and the purpose for using the device. Many of the wellness devices and applications currently on the market fall into the definition of medical device with another group in a gray area (Eysenbach et al, 2013). The lines between wellness and medical device can be argued as vague. An example is a blood pressure meter designed for in home use. While considered a regulated medical device, the operator is not a clinician, health data is not sent to a service provider, and the environment is not clinical. In addition, there are hardware and software associated with the device that must be considered. Applying the same regulation policy to this device may present an increased cost that in turn, does not justify the benefit the device can bring to the user (Eysenbach et al, 2013). This example challenges the regulating bodies, and puts forth a warranted discussion on the policy gap in the field of mHealth.

The Policy Gap within mHealth

Developing and implementing mobile health interoperability standards is critical to growing the field of mHealth and providing a quality of care through mobile technologies. However, device regulation, current policy, and the market reality (a push to get devices and interventions to market as fast as possible), have placed barriers on the adoption of technical standards in the industry (Eysenbach et al, 2013). These barriers in turn have deterred device vendors who want to enter the mobile health device market. Eysenbach et al (2013) argues the current regulatory policy is in need of updating to reflect the demand of the consumer health industry; therein lying the policy gap.

To achieve the goal of better managing health through the use of mobile technologies (both from a wellness and medical perspective), it is imperative that a global health industry is created for the technology providers, the users, and the operators alike (Eysenbach et al, 2013). And due to the multidisciplinary nature of the industry, developing a set of mobile health device interoperability standards to ensure cooperation between all stakeholders becomes paramount. However, due to the lack of synchronization between the technology stakeholders and the development of regulation and policy, there has been a significant delay in the market adoption of mobile health device standards (Eysenbach et al, 2013). Inappropriate technical decisions had lead to either insufficient regulation or over-regulation towards mobile health devices, both of which hinder the forward movement of the industry. This in turn has become a recognized global issue with policy makers and vendors in multiple countries working on decreasing this policy gap, however with little success (Eysenbach et al, 2013).

Conclusion

This chapter discussed the literature on the current health status of Nova Scotians, the rising cost of health care, health behaviour change, and the popular models and theories of health behaviour change. The theories discussed included Social Cognitive Theory, the Social Ecological Model, the Continuum Model, and the Stage Model. In addition, two reviews of obesity prevention programs over the past seven years were examined. The Diffusion of Innovations Theory was introduced, providing an understanding of how the results of this study will be framed. And finally, the evolution of health behaviour change interventions was discussed, highlighting the movement from print-based interventions, to web-based (eHealth), to mobile-based (mHealth), including some of the challenges that this type of health behaviour change intervention is currently facing. The next chapter will outline the research methodology used in my thesis. The objective and design of the study will be explained in addition to how the social constructionist view that I hold of the world is considered in regards to data collection and analysis. Finally, the implications of this research will be discussed followed by the method used for selecting participants, collecting the data, and the stages of analysis.

CHAPTER 3

RESEARCH METHODOLOGY

Study Purpose

The objective of this study was to gain an in-depth understanding of the perceptions of busy Nova Scotia parents whose children are involved in recreational activities on the use of smartphone health applications in improving family nutrition and physical activity habits. An additional objective was to understand what, if any, barriers exist in adopting this method of health behaviour change intervention.

Research Design

This thesis research was part of a mixed methods study where the collected qualitative focus group data informed later quantitative research (the later phases of the TIME study). The choice to conduct focus groups was based on the number and variety of questions that the TIME research team had surrounding the development of the health application (and associated features), and logistics of the intervention itself. The research team and I were interested in the ideas that could be generated from the focus groups and what this population thought about using a smartphone health application to improve nutrition and physical activity behaviour (positive or negative). The nature of a focus group is collaborative and therefore lends itself to the generation and debate of ideas.

Follow-up interviews, focusing on the three specific questions of interest pertaining to this thesis, were conducted with one randomly selected participant from each focus group (four total interviews) to ensure data saturation. The follow-up interviewees were chosen by selecting

their name from a bowl of fellow focus group names. The results were built into a model to aid in illustrating the findings. The Diffusion of Innovations Theory (Rogers, 2003) was used to understand the one negative case found, to help understand the prominent ideas presented by the focus group participants, and to aid in presenting recommendations for future research and similar behaviour change interventions. The application of the Diffusion of Innovations Theory highlighted key aspects of adoption for this population. The data collected was applicable to both this Masters thesis and used as information to aid the later phases of the TIME research project as the smartphone health application was developed.

Mixed Methods

This Masters research was a component of a wider mixed methods study and therefore, I feel it is important to discuss the mixed methods approach to conducting research. The choice to conduct my research using more qualitative methods was made to allow the results from this research study to inform later phases of the TIME research project that would include both quantitative and qualitative components. Health services research is a diverse and constantly evolving field that demands advancing and inclusive methods. The two original research methods of quantitative and qualitative can be distinguished by the philosophical underpinnings of the study (inductive versus deductive), the research strategy employed (case study versus experiment), and the specific methods used in the study (observation versus structured survey) (Creswell, 2008). Mixed methods research utilizes the strengths of both quantitative and qualitative methodologies, allowing researchers to increase the depth of understanding on a given topic (Johnson, Onwuegbuzie, & Turner, 2007). Mixed methods can be a better approach than purely qualitative or quantitative research when one type of data is not sufficient to provide

breadth of information on a topic (Creswell & Plano Clark, 2011). Mixed methods can also be appropriate when results need to be followed up on, or generalized, or when the research objectives are complex enough that multiple phases and multiple types of data must be used (Creswell & Plano Clark, 2011). This was the case with the TIME project. The TIME project was a multi-year project that included several phases. The first phase was the collection of focus group data on busy Nova Scotia parents' perceptions of smartphone health applications, in addition to other queries related to the design and implementation of the application health behaviour change intervention.

Wisdom, Cavaleri, Onwuegbuzie, and Green (2012) suggest that a mixed methods approach can be used for varying purposes to achieve a more comprehensive picture of health services than either qualitative or quantitative methods alone. The authors suggest that the following are scenarios when it is appropriate to use a mixed methods approach:

- When researchers would like to converge methods or use one to corroborate findings from another about a single phenomenon (triangulation).

- When researchers would like to use one method to elaborate, enhance, or further clarify the results from one method (complementary).

- When researchers would like to use results from one method to inform another (development).

- When researchers would like to use one method to discover contradictions in findings from another method, and in turn reframe a research question (initiation).

- And finally, when researchers seek to expand the depth of the study using different methods for different research components (expansion).

It is evident that my research was used as "development" for the later phases of the TIME project. Without these data, the development of the health behaviour change intervention would not have been as tailored for the population of interest, and arguably, may lead to decreased success in achieving the research goal of increasing fruit and vegetable intake in busy Nova Scotia families.

Wisom, et al (2012) also performed a study to assess the popularity of mixed methods research in the field of Health Services Research. The researchers found that from 2003 to 2007, only 2.85% of empirical studies used mixed methods; 6.18% of empirical studies were qualitative based, and 90.98% were quantitative. The mixed methods articles were categorized into five areas which were organizational and individual decision making processes (18 studies), outcomes of effects of policies or initiatives (16 articles), measurement development (13 articles), experiences and perceptions (8 articles), and mixed methods or multimethod (5 articles). The authors found that while the amount of mixed method research being published across this time period was consistent, the amount was minimal considering the complexity of the field.

<div align="center">An argument for focus groups</div>

The choice to conduct focus groups as a method of data collection was made because the data that was of interest to the TIME research team was best collected through the brainstorming environment that is provided through focus groups; and also, the questions asked were not of a sensitive nature and therefore did not demand personal interviews. In addition, Rabiee (2004) found that the topic of nutrition and lifestyle behaviours is well understood through the use of focus groups. This finding may be due to the ease of discussing a shared common interest like nutrition or a particular lifestyle behaviour like enjoying physical activity. One could argue that

it is easy to share in a group setting like a focus group when you are discussing a topic that many have in common (nutrition and activity), and that is not considered sensitive in nature such as experiencing the close death of a family member. Focus groups can also aid in the planning and presentation of health education for targeted populations (Basch, 1987). Considering the above, I felt that focus groups would allow me to gather more design and intervention ideas and considerations for the TIME research team, and would provide me with an environment where participants would feel comfortable sharing their thoughts on the topic. Allowing participants to engage with others and consider their ideas, I felt would foster a richer conversation and could possibly bring forth new thoughts that would have otherwise not been revealed through the strict use of personal interviews.

Cullen (2000) suggests that focus groups are useful in qualitative nutrition research because they easily provide the researcher with feedback on the future acceptability (or adoption) of nutrition programs. Consistent with my beliefs on how health behaviour change interventions should be designed, Cullen believes that effective nutrition programs should meet the self-perceived content and delivery needs of the target population. Cullen finds that through the identification of opinions, attitudes, beliefs and perceptions about certain behaviours, and factors that influence those behaviours, programs, ideas, and intervention strategies can be fine-tuned prior to program implementation. This in turn may lead to a more successful health behaviour change intervention program. Cullen suggests that nutrition professionals (and health researchers) should add focus group research to each stage of program development, and in doing so, facilitate the adaptation of the proposed program to better fit the needs of the target group.

Focus groups have been used to understand a variety of health research topics including the use of health services, health education (Basch, 1987), and to aid in creating disease-specific health programs. Gettleman and Winkleby (2000) used this method of data collection to develop a heart disease prevention program in a population of low-income, ethnically-diverse women. The authors stated that this particular population experience higher rates of cardiovascular disease (CVD), with many living in environments that tend to support or promote CVD behaviours. Gettleman and Winkleby reported that while this sub-group constitutes one of the largest groups at high risk for this disease, very few CVD prevention programs effectively target and reach this group. The authors chose focus groups as a method of gaining insight and generating ideas on how to best design and implement future CVD interventions for this population. This study found that low-income, ethically-diverse women prefer heart disease prevention programs that address multiple CVD risk factors, emphasize the concept of "staying healthy for themselves", teach specific skills to adopt heart healthy behaviours, and offer choices in affecting these behaviour changes. A program that provides a visual over written format and aids in developing knowledge on how to separate health myths and facts was also found to be important.

Focus groups have also been used to identify factors affecting healthy weight maintenance in college men. Walsh, White, and Greaney (2009) used this method of data collection to explore how men view weight maintenance in the context of factors that affect eating and physical activity. The researchers found that motivators such as sports performance, self-esteem, attractiveness, and long-term health were similar for both being active and eating well. However, there were more motivators to being physically active than eating healthfully. The authors found that barriers to healthful eating included dietary fat, the taste of fruits and

vegetables, and food spoilage. The barriers to being physically active were found to be lack of time or time management, other obligations, girlfriends, or being lazy. This research, like mine, is important to understanding the barriers to participating in a health behaviour change intervention or encouraging a healthy behaviour change in a specific population. If we are to design interventions for target groups, we must understand what their needs are and the barriers that exist to performing the intended healthy behaviour.

Another population that has been targeted using focus groups to understand nutrition practices and health beliefs is that of the urban Caribbean Latino population with diabetes. Quatromoni et al (1994) state that people of Caribbean Latino extraction are two to three times more likely than people of non-Hispanic extraction to develop diabetes. The authors chose this method of data collection to understand the cultural influences on nutrition and health beliefs and stated that they found it to be a very useful method as participants were more apt to share their thoughts/feelings when among others from the same culture. In addition, the information collected would aid in planning innovative intervention programs targeting this population.

The researchers found that participants felt socially isolated and had little understanding of what the long-term consequences of the disease were. In addition, this population highlighted multiple barriers to nutrition and physical activity interventions, skepticism surrounding the value of preventative health behaviours, and a need for culturally sensitive health-care services. This finding highlights again the importance of understanding the special needs of certain populations if health providers are to design interventions that will ensure success with these target groups.

In terms of understanding adoption rates, focus groups have been used to understand the barriers to adoption of health information technology in elderly populations that live in community-based affordable housing. Tran et al (2009) found that while there may be challenges to adopting the technology amongst minority populations such as this one, senior residents will adopt if they understand the benefits of using the technology in improving their health and remaining independent, and if the technology does in fact have a perceived direct benefit on their health and independence.

An argument for the Diffusion of Innovations Theory

The use of the Diffusion of Innovations Theory to help frame the results of this study was chosen for its wide application in health research and because understanding how the population of interest perceives the characteristics of smartphone health applications will provide valuable information for both the overall TIME research project and their development team. In addition, the health and technology world at large who are interested in developing health solutions for this population will benefit from understanding this population's perceptions of the topic. In turn, these interventions will hopefully be adopted by the population of interest and be successful in achieving positive health behaviour change.

Researcher's Perspective

I carry a social constructionist perspective of the world and applied this to my facilitation of the focus groups. Social constructionism is understood as the view or theory that creating knowledge and truth is not a singular act, but rather that meaning is created through social interaction, and that there are multiple realities of a singular event just as every person in the world holds their own personal perspective on an issue (Burr, 2003). My background in

professional coaching added to the application of a social constructionist perspective and therefore appeared to fit naturally into the context of this study. One critical component of coaching is "co-creating" the coaching relationship. This entails establishing trust and intimacy with a client, being fully present in all conversations, and employing a style that is open and flexible (International Coach Federation, 2011).

Study Implications

Results for this research project will provide insight into the perceptions of busy Nova Scotia parents on the use of smartphone health applications to improve family nutrition and physical activity habits. Having this information may be important for health professionals and developers of health applications who are working to improve the nutrition and physical activity environment within the family home using this type of intervention. Parents are the main purchasers of food within the home and are the role models for their children when it comes to eating and being physically active (Stice, Shaw & Marti, 2006). Through understanding parents' perspectives on this new method of health behaviour change intervention, a unique opportunity exists to gain better access to the entire family in terms of their perceived needs and barriers to adopting such an intervention and ultimately, changing their behaviour. Research has shown improved health and behaviour change among users of smartphone health applications in decreasing weight and increasing physical activity (Patrick, William, Griswold, Raab & Intille, 2008). These applications have also helped to increase fruit and fibre consumption and decrease saturated fat in the diet (Delichatsios et al, 2001).

Informed by the results of this study, smartphone health application developers may be equipped with the information needed to design an application that will truly fit the needs of

busy Nova Scotia families and in turn, aid in reducing the obesity epidemic in this province.

Finally, as the target population of busy Nova Scotia families struggle to find time to eat

healthily and exercise, smartphone health applications provide a fast and easy access modality

which in turn can be tailored to fit the fast-paced needs of the Nova Scotia family.

Understanding how parents in these families view this method of health behaviour change is the

first step in achieving success with this technology, within this population.

Protection of Human Subjects

Human subjects were involved in this research study and therefore this project was

designed to minimize all potential risk or discomfort to the participants. Participation in the

study was voluntary and participants were able to withdraw from the study at any time and

without consequence. Please see Appendix A for a copy of the consent form. This project was

conducted in accordance with ethical guidelines outlined by the Canadian Tri-Council

Guidelines for the Involvement of Human Subjects in Research and was approved by the Office

of Research Ethics at Dalhousie University in July 2011.

Research Method

The collection of focus group data took place at four different locations throughout the

Halifax Regional Municipality (HRM). The locations were two large multi-use sports facilities

(listed as 1 and 2), a professional building in downtown Halifax, and a suburban coffee shop.

All focus groups lasted no more than 1 hour and were audio recorded. I was the only moderator

for every focus group.

All participants were provided with information on the study and were asked to complete

a consent form prior to participating in the focus group. Please see Appendix B and A for a

copy of these documents. In addition, each participant was compensated with a $15 honorarium for their time and signed a receipt of this transaction. Please see Appendix C for a copy of the participant study honorarium receipt. The following questions were asked in addition to other questions relating to the TIME study such as the use and design of a smartphone health application and comfort level with smartphone enabled GPS tracking.

Focus Group Questions:

- Do you believe that a healthy eating and physical activity application could help support healthy nutrition and physical activity habits in your family?

- How could a healthy eating and physical activity application help your family eat healthier and achieve physical activity goals?

- What might be the barriers to using such an application?

A total of four focus groups and four follow-up interviews were conducted. Further data collection was necessary to reach data saturation, and was a suggestion by my committee members. The number of focus groups conducted was a suggestion by Krueger (2009), who recommends three to four focus groups should be conducted with each group of interest and if the research question/study is simple. As this research study was only interested in one particular group and the research objective was not complicated in nature, data was collected from four focus groups and supplemented with follow-up interview data. Please see the results and discussion chapter for a breakdown of focus group demographics.

Sample Selection

Sampling of the population was purposeful. The participants were sought on the understanding that they all shared some commonalities (see below) and were viewed as subject experts relating to the inclusion criteria below. Participants were recruited through recreational facilities and through convenient sampling techniques. Those participants that were recruited at recreational facilities were recruited through a flyer. Please see Appendix D for a copy of this flyer. All participants had to meet the following requirements:

- Live in the Halifax Regional Municipality.

- Have a child between the ages of 5 and 12 who is involved in recreational activities (represents the population of interest for the later phases of the TIME project).

- Be able to read and speak English.

- Be able to participate fully in a focus group discussing mobile health applications.

There are two schools of thought when coordinating focus group participants. The first is that the richness of data can only be generated if the individuals are able to fully engage in the discussion and therefore a homogenous group is best (Krueger, 1994 as cited in Rabiee, 2004). The second school of thought highlights that participants should not know one another to encourage more honest and spontaneous views and responses, and prevent pre-existing relationships to show up in patterns of dominance in the group (Thomas et al, 1995 as cited in Rabiee, 2004). Therefore, I ensured that some focus groups included those that knew one another, while others consisted of strangers who had no pre-existing relationship.

The sample size varied from group to group with a range of 3 to 7. Krueger (2009) suggests that noncommercial focus groups should be in the 5 to 8 range. Efforts were made to

keep to this recommendation as much as possible. If the focus group is too small there is not enough information generated through discussion, and if the focus group is too large it can become difficult to facilitate and control (Krueger, 2009).

All participants experienced the administration of the same questions, in the same order. The questionnaire was built through the combined efforts of myself and qualitative research experts on the TIME research team. Please refer to Appendix E for a copy of the focus group questionnaire (including both questions related to my thesis and the TIME study). Efforts were made to keep the style of moderation similar across all groups. The use of a journal after each focus group provided reflection for me to ensure I was consistent. In addition, I attempted to make every focus group environment as quiet as possible to ensure clear audio recording, however, not every data collection environment was optimal (focus group four was conducted in a busy coffee shop for example).

Stages of Analysis

Transcription of focus group audio data began after the second focus group (due to my schedule at the time). Data was transcribed into a word document. I was the sole transcriber. Fade and Swift (2010) suggest that transcribing one's own data provides a major advantage to the researcher as it allows for development of familiarity with the data which is essential for analysis. Every speaker started with a new line, including the moderator. An effort was made to transcribe all voices, however, if several voices were speaking at once, or there was a muffling of sounds, three dots (…) were used to signify this. Laughter was also transcribed using the word "laughter" in brackets (laughter). Krueger (2009) suggests that what is most critical in data analysis is data reduction and to place one's attention on the parts of the group discussion

where the most relevant conversation is being held. Therefore, during transcription less concentration was placed on those comments that were not related to the focus group topic.

Krueger's Analytic Framework method (2009) was used to conduct the focus groups (using certain moderating techniques) and analyze the data. Krueger's framework was chosen because it has been claimed that this approach is easily understood by both researchers and students and is a useful (methodical) way to analyze focus group interviews (Rabiee, 2004). In addition, framework analysis helps in minimizing potential bias by providing a systematic method by which to adhere to, and allows for themes to develop from within the data (Rabiee, 2004). This method includes the following five stages (Rabiee, 2004):

- Familiarization (listening to the audio recordings and reading the transcripts thoroughly).
- Identifying a thematic framework (writing memos in the margin of the transcript in the form of phrases or concepts that arise from the text).
- Indexing (highlighting and sorting through quotes and making comparisons both within and between cases).
- Charting (lifting the quotes from their original location within the transcript and rearranging them under newly developed themes).
- Mapping and interpretation (making sense of the quotes through the use of a framework).

Familiarization & Identifying a Thematic Framework

Through listening and transcribing the data, I familiarized myself with the data. After an initial reading of the transcripts, some basic analysis (including writing concepts or phrases in the margins of the transcripts that appeared to me while reading), and discussions with my

committee members, it became apparent that follow-up interviews would be required to achieve data saturation. I randomly chose one person from each focus group (a total of 4 people) to participate in a follow-up interview by drawing the interviewee's name from a bowl of fellow focus group names. This sample consisted of 2 men and 2 women. All appeared to be familiar with smartphone application technology (as evidenced through our discussions on the topic). The follow-up interviews were conducted over the phone (speaker phone), at a mutually agreed upon time, took no more than 10 minutes, and were audio recorded using an iPad application called "Voice Recorder". The three questions that were asked of the participants were the same as during the focus group (refer to Appendix E). While the follow-up interviews were arguably short in duration, few questions were asked, and the main focus was to inquire about their thoughts on the proposed intervention method, and what they felt the barriers to adopting this method might be. These questions were not sensitive in nature, nor linked to an emotional experience, and therefore the responses were direct and brief. Whenever I needed clarification on meaning, I asked, and the interviewee would provide a brief example:

> Me: *"Ok and can you tell me what you mean, more about the word awareness? What does that mean to you?"*
>
> Interviewee: *"Just um, so when you, you know have fruit loops for breakfast and you put it in that's what you've eaten, than you know ok, that's too many calories for breakfast or, I know that that's not a healthy choice, you want to make a healthy choice for your snack."*
>
> Me: *"Ok, so be more conscious I guess of everything. More aware, like you said."*
>
> Interviewee: *"Exactly."* – Follow-up interview 2 participant

The follow-up interviews all took place during the week of March 19th, 2012. After each

interview, I familiarized myself with the data through listening to the audio recording,

transcribing the data, and making memos in the margin of the word document, just as I had done

with the focus group data. After each interview the data continued to support the same major

ideas that arose from the focus groups. No new information was revealed. At this time, I

concluded that data saturation had been reached and decided to move forward onto the next

stage of analysis.

Indexing & Charting

During the time between scheduling and conducting the follow-up interviews, the focus

group data was put into an excel document. Every time someone shared a thought, these data

were allotted a line. Each line was numbered. Each focus group was given a separate excel

sheet within the excel document and was color coded to differentiate between the different focus

groups. Next, the quotes were charted by lifting each quote from their original excel sheet into a

master sheet under the categories that were found during the familiarization and indexing stage

(the concepts and phrases written within the margins of the transcripts). In addition, the number

of quotes that were found to be related to these categories was noted. This provided me with a

sense of how important the category may be in relation to how frequently it was mentioned

during data collection. Once all follow-up interviews were conducted, this data was added in the

same manner to the master sheet. Please refer to the results and discussion chapter for this

original list of categories.

After this initial analysis, I went through every category and corresponding quote again.

I assessed each quote both as a stand-alone datum, in relation to other quotes within the

category, and across categories that appeared similar in nature. It became apparent that certain categories could be collapsed into larger categories as the overall "idea" was the same (while the wording used to express the idea may have been somewhat different). Please see the results and discussion chapter for the list of larger categories.

Mapping & Interpretation

After the second analysis of the data, I looked at each category in relation to the overarching research question: "What are the perceptions of parents whose children are involved in recreational activities on the use of smartphone health applications in improving family nutrition and physical activity habits and, what if any barriers exist in adopting this method of health behaviour intervention?" At this point, I felt that a model would help to organize and share my findings. Coinciding with Krueger's mapping and interpretation stage of analysis, I mapped the categories into a model that I developed based on how the categories were related to each other. At the top of the model was the major finding and under this finding, each large category fell under two major categories. Under these major categories fell subsequent sub categories, and further sub categories. The major categories were found to be generally related. However, the quotes were organized under these major categories separately, as the context of *how* these thoughts were expressed in the focus groups and interviews were either in one context or another. Please see the results and discussion chapter for the model.

Study Rigour

Trustworthiness was ensured through the use of member checks and negative case analysis. All participants received the transcripts by mail or email. This provided the participants with an opportunity to confirm the responses made during the focus group. All participants had an opportunity to discuss the transcripts if they chose to by contacting me. No participants chose to comment on the data collected. Only raw data and not analyzed data were sent to the participants. Sandelowski (2002) suggests that research participants are not always the best judge of valid research. In addition, due to the small scale of this research, and the neutral nature of the topic, I did not believe it was necessary to provide the participants with analyzed transcripts for confirmation or refutation. A negative case analysis was conducted on the one negative case that was found using the Diffusion of Innovations Theory to provide insight into why this participant held a different view from the rest of the sample. I found this theory to be the most appropriate to both frame my findings and provide an explanation of the one negative case found in my research. Please see the results and discussion chapter for full analysis of this negative case.

To provide dependability, I attempted to collect thick, descriptive data. To ensure this, I allowed for creative discovery within the focus groups; meaning, that each group had ample opportunity to discuss their perspectives with one another. In addition, I utilized interview/coaching techniques such as probing and reflection. I kept a personal free form journal of my focus group experiences to provide a credible interpretation of the data, allowing me to refer to exactly what I was experiencing at the time of the focus group when I was analyzing the data. I did this to ensure no loss in memory of my focus group experience due to

time between conducting the focus groups and data analysis. Finally, an audit trail was kept of all data, starting with the audio of the focus groups, followed by the transcription of these interviews, and all analysis of the data.

Conclusion

This chapter discussed the methods used in this research study. The purpose of the study and the overall objective were stated as understanding the perceptions of busy Nova Scotia parents on the use of smartphone health applications in improving family nutrition and physical activity habits; and in addition, what barriers might exist for this population in adopting such a method of behaviour change. I stated my view of the world as social constructionist, and this epistemological leaning along with my background in professional coaching, provided a foundation for me to conduct the focus groups and follow-up interviews. How and where the participants were recruited was discussed, along with how the focus groups were designed using suggestions from Krueger (2009), and Rabiee (2004). The various stages of analysis were explained in detail including how the data was transcribed and organized using Krueger's Analytic Framework (2009). The concept of trustworthiness was covered using member checks and the Diffusion of Innovations Theory to provide a negative case analysis. Finally, to show dependability, my use of interview/coaching techniques was highlighted, along with a personal journal, and an audit trail of all data. The next chapter will discuss the results of the research study, consider next steps in this area, and study limitations and strengths encountered. The results and discussion chapter will include a breakdown of the three stages of analysis, the compilation of the categories in every stage, and a model illustrating the major findings of the research and the relative categories. The Diffusion of Innovations Theory will be used to both

frame the ideas brought forth by the study participants, help explain the only negative case

found, and make recommendations based on the findings.

CHAPTER 4

RESULTS AND DISCUSSION

This chapter will cover the results of the research project and discuss the findings. Basic information pertaining to each focus group will be highlighted in table format, including demographics of the participants, as noted by the researcher. The study findings will then be discussed using a model developed through the stages of analysis. The Diffusion of Innovations Theory will be used to frame the ideas expressed by the study participants and to help explain the only negative case found in the research. This theory will also be used to make recommendations based on the findings. The strengths and limitations of this study will also be considered. As this research was qualitative in nature, much of the results are discussed while being presented in this chapter. Therefore, it felt natural to present both the results and the discussion of these findings within the same chapter.

Participant Demographic Information

Focus group and follow-up interview information is highlighted in the table below. Two of the four focus groups included a mix of both males and females with the other two being all female. Almost all were familiar and comfortable with smartphone application technology (as evidenced through the focus group discussions).

Table 1 - Participant Information Table:

Focus Group	Date/Time	Location	Number of participants	Length of focus group	Demographics noted by researcher
Group 1	September 20th, 2011/Evening	Large multi-use sports facility 1	3	1.5 hours	- All female - 2 of the 3 were very familiar with smartphone technology
Group 2	September 22nd, 2011/Lunch hour	Large multi-use sports facility 2	7	1 Hour	- Gender mix - All were familiar with smartphone technology except one
Group 3	November 3rd, 2011/Lunch hour	Professional business building, Halifax	6	1 Hour	- Gender mix - All participants were familiar with smartphone technology
Group 4	November 10th, 2011/Later morning	Suburban coffee shop, Tantallon	4	1.5 hours	- All female - All were familiar with smartphone technology, with 1 being very familiar
Follow-up interview 1	March 19th, 2012	Phone	1	10 minutes	-Male -Familiar with smartphone technology
Follow-up interview 2	March 20th, 2012	Phone	1	10 minutes	-Female -Familiar with smartphone technology
Follow-up interview 3	March 23rd, 2012	Phone	1	10 minutes	-Male -Familiar with smartphone technology
Follow-up interview 4	March 23rd, 2012	Phone	1	10 minutes	-Female -Very familiar with smartphone technology

Research findings indicate one major finding, two major categories, and ten sub categories related to how busy parents in the Halifax Regional Municipality view smartphone health applications. The major finding was revealed through three stages of analysis. The first analysis of the data yielded the following categories:

First Analysis Categories:

- Failure of interoperability
- Fitting into lifestyle
- Cost
- Motivation/self-discipline
- Convenience/time convenience
- Tracking and storing data
- Family/kid inclusive
- Feedback on inputted nutrition/physical activity data
- Food information/options/choices/ substitutions
- Physical activity information/options/choices/ ideas
- Cost savings/incentives/coupons
- Linked to local recreational places/restaurants/food suppliers/geographic location
- Menu/meal planning
- Meal timing/time frame
- Simple to use/not complicated/easy to navigate/intuitive
- Kid friendly/interactive
- User not technologically savvy
- Motivational support/feedback/challenge
- Reminders/notifications
- Additional research/articles on nutrition/physical activity
- Decision making
- Quickness of application

- Picture references

- User customizable

- Invasive

- Tailored information (to person and lifestyle)

- Effectiveness of application/method of health behaviour change

- Time/effort commitment

- In conjunction with/based on known health behaviour change program

- Interesting to user/hold attention of user

- Too specialized/specific/not generalized/inclusive enough

- Balancing nutrition with physical activity

The second phase was conducted by collapsing certain categories from the above list into larger categories. The collapsing of categories was directed through the similarity of some of the categories. While the wording used to express the ideas may have been different, the meaning or idea was the same.

This secondary analysis yielded the following list of larger categories (corresponding numbers represent the number of quotes per category):

Second Analysis Larger Categories:

- Failure of interoperability (9)

- Lifestyle (19)

- Cost (4)

- Motivation/self discipline/awareness (9)

- Tracking and storing data (7)

- Family/kids inclusive (14)

- Feedback on inputted nutrition/physical activity data (13)

- Decision making (4)

- Health information (36)

- Cost savings/incentives/coupons (9)

- Linked to local recreation places/restaurants/food suppliers/geographical location (9)

- Meals/menus (35)

- Simple to use/not complicated/easy to navigate/intuitive (23)

- User not technology savvy (4)

- Reminders/notifications (10)

- Time/effort commitment (18)

- Quickness of application (16)

- Picture references (11)

- User customizable (14)

- Invasive (11)

- Tailored (13)

- Effectiveness of application/method of health behaviour change (4)

- In conjunction with/based on known health behaviour change program (5)

- Balancing nutrition with physical activity (14)

The third phase of analysis produced the model on page 75 based on how the categories were related to each other. At the top of the model is the major finding which was found to be: Busy parents from the Halifax Regional Municipality feel that smartphone health applications can improve family nutrition and physical activity as long as barriers are minimized and requirements for adoption are met.

Figure 1 – Major Finding:

Major Finding:
Smartphone health applications can improve family nutrition and physical activity as long as barriers are minimized and requirements for adoption are met. The removal of many barriers are also requirements for adoption.
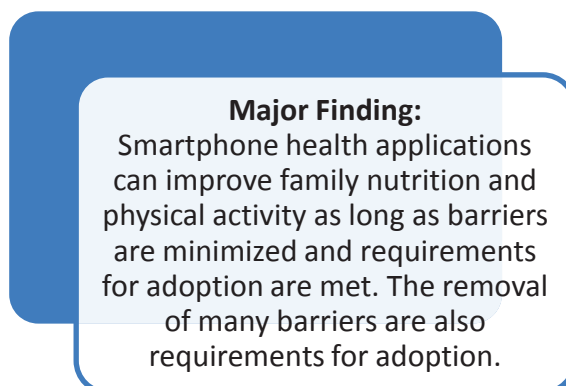
Under the major finding, each large category fell under two major categories, with subsequent

sub categories. The major categories falling under the major finding were as follows:

Figure 2 – Major Finding & Major Categories:

Major Finding:
Smartphone health applications can improve family nutrition and physical activity as long as barriers are minimized and requirements for adoption are met. The removal of many barriers are also requirements for adoption.

Barriers to using the application/the intervention being successful

Requirements to adopt the intervention
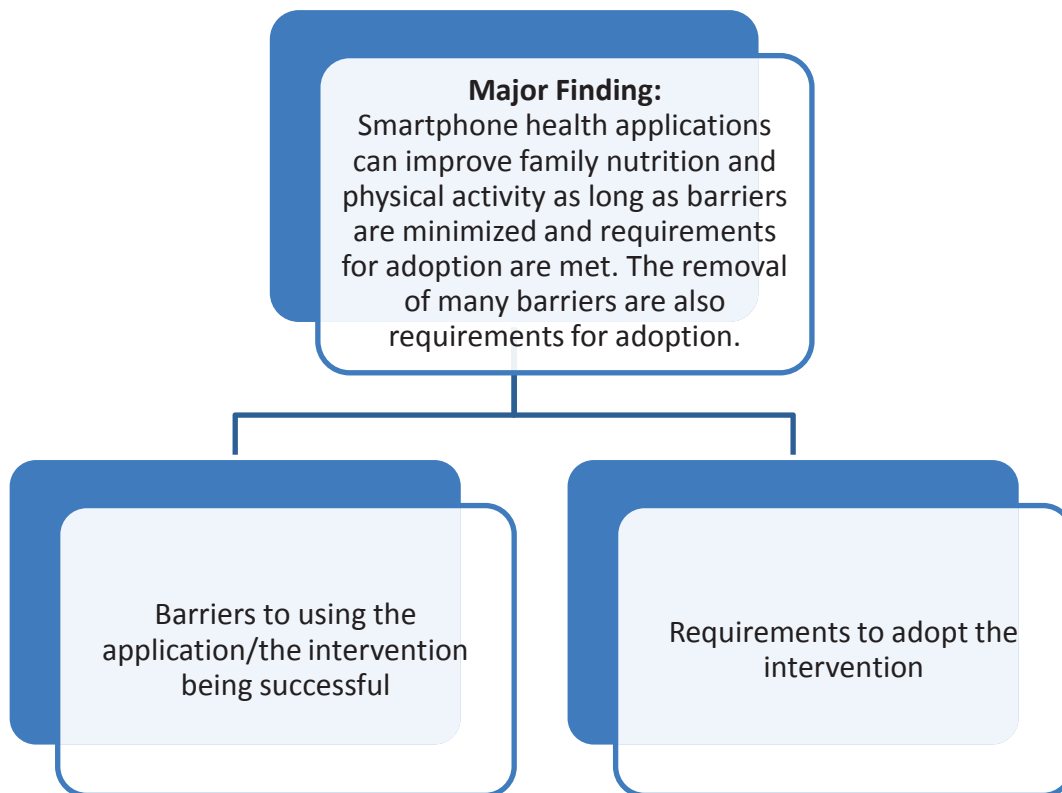
These major categories were found to be generally interrelated, meaning what was a barrier to

use the technology, could also be seen as a requirement for adoption. However, the quotes were

organized under these major categories separately, as the context of *how* these thoughts were

expressed in the focus groups and follow-up interviews were either in a context related to

barriers or requirements for adoption. Under these major categories, subcategories and further

subcategories emerged relating to technology specifically. The complete model is shown on

page 75.

Figure 3 - Model of Busy Parents' Perceptions on Smartphone Health Applications:
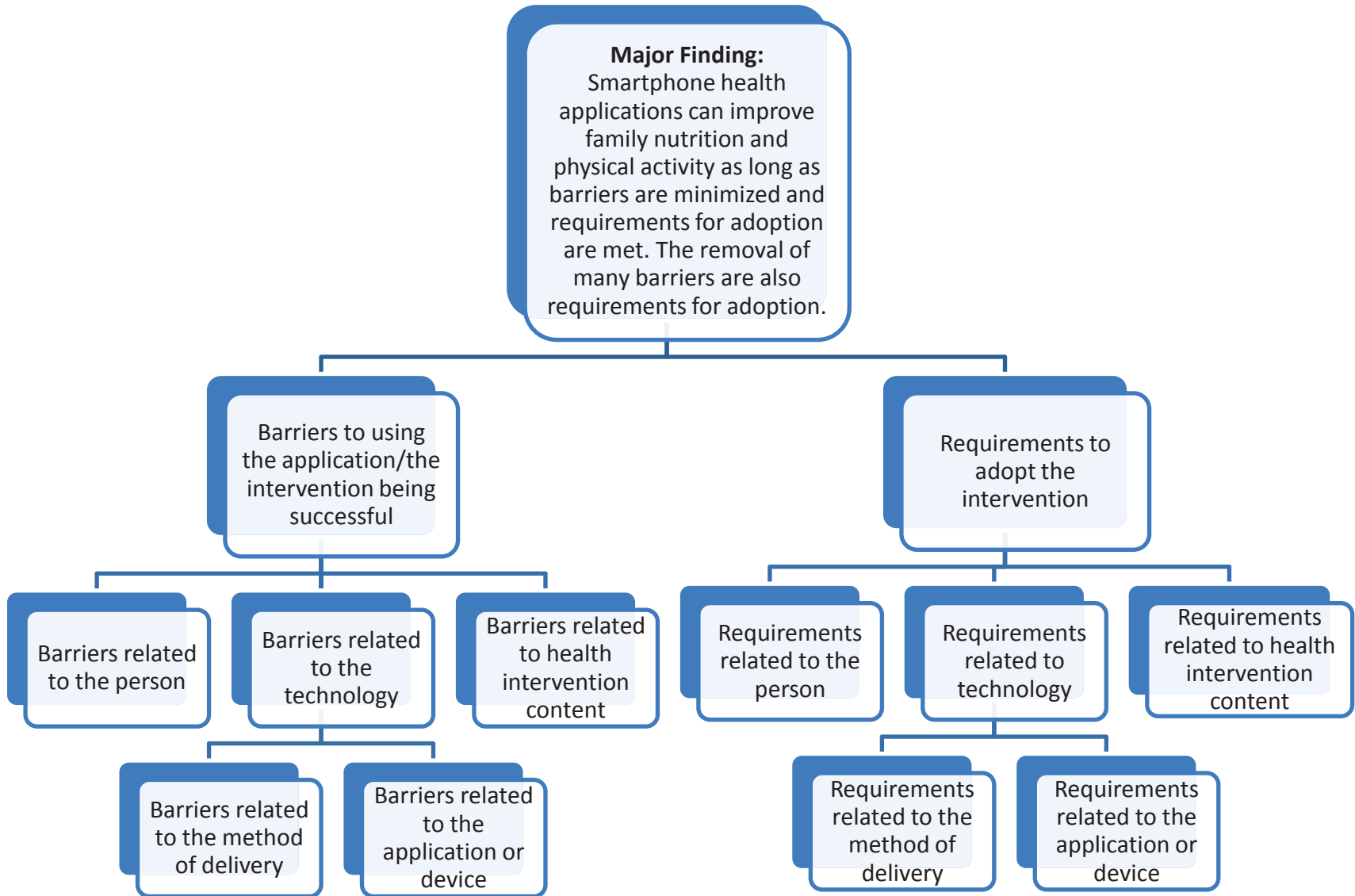
Diffusion of Innovations

The Diffusion of Innovations Theory addresses how innovations are adopted within social groups and across social systems over time (Rogers, 2003). An innovation is identified as anything that is considered new by an audience, and could be a product, idea, or methodology. In this research, the new innovation is a smartphone health application aimed at improving nutrition and physical activity habits in families. This theory seeks to understand how perceived characteristics of an innovation (relative advantage, compatibility, complexity, trialability, and observability) help to explain the difference in adoption (Rogers, 2003). As with all applications of theory, the assumptions put forward by the Diffusion of Innovation are merely ideas that are being used to explain and generalize research findings. While this theory is adequate in illustrating the major finding in this study, it is unable to explain all the complexities of this research. The first three perceived characteristics of an innovation that the theory highlights (relative advantage, compatibility, and complexity), are useful in understanding why the focus group participants identified certain barriers to using smartphone health applications, and what requirements they have to adopt the technology. The last two perceived characteristics of an innovation, understood as trialability and observability, may only be used to help explain later phases of the TIME study as the smartphone health application is used within the population of interest.

Relative Advantage

The first perceived characteristic of an innovation that affects adoption is relative advantage. Relative advantage describes the extent to which an individual perceives an innovation to improve upon the idea or product it supersedes (Rogers, 2003). This relative advantage can be measured in economic terms but typically, social prestige, satisfaction, and

convenience, are considered major factors. What is most important is that the person deems the innovation to be advantageous to him/herself (Rogers, 2003). In regards to the economic factor, the initial cost of an innovation is found to affect the rate of adoption (Rogers, 2003). The more cost effective an innovation is, the more likely it is to be adopted. This was found to be true in the findings of this study. Participants spoke about the cost of using such an intervention, revealing a barrier to adoption in the first quote, and a requirement for adoption in the second quote:

"Free is the only time I use an app" – Focus Group 1 participant; and the opportunity for cost savings within the intervention itself: *"Yeah like 10% off an item or something"* – Focus Group 2 participant.

This idea of cost savings can also be understood as what Rogers (2003) calls "The Effects of Incentives" on adoption. In this scenario, the potential adopter is given an incentive that may be of monetary value (an example would be a 10% discount as was suggested by one of the focus group participants), or is an object desired by the potential adopter. The concept of cost was categorized as both a barrier relating to the person and a requirement related to the health intervention content within the application itself.

While the participants did not frequently mention the idea of satisfaction as being something related to an advantage of adopting this method of health intervention, they did speak more about the concept of convenience. This idea of convenience was one of the highest discussed categories (as measured by how many quotes were linked to this category). The terms that were mentioned to define this category included "Simple to use", "Not complicated", "Easy to navigate", and "Intuitive". Some of the quotes that were included in this category were:

"...It would have to be really easy..." – Focus Group 4 participant*; "Yeah...it needs to be intuitive and simple"* – Focus Group 4 participant*; "Because it can't be confusing, it has to be OK, where is it"* – Focus Group 3 participant*; "It would have to be simple, fast, and easy"* – Focus Group 3 participant*; "Just don't make it too complicated"* – Focus Group 1 participant.

This category was viewed as both a barrier related to the application/device and a requirement for adoption related to the application/device.

Compatibility

The second perceived characteristic of an innovation that affects adoption is compatibility. Compatibility relates to the degree to which an innovation is understood by potential adopters as consistent with their existing values, past experiences, and current needs (Rogers, 2003). The more compatible an innovation is with a potential adopter's lifestyle, the less foreign the innovation will appear, and the more likely the person is to adopt the innovation. The innovation can be compatible or incompatible with sociocultural values and beliefs, previously introduced ideas, and a potential adopter's current needs. One of the most prominent ideas highlighted in every focus group and follow-up interview was the concept of tailoring the application to fit the needs of the user, and fitting the health intervention into one's current lifestyle. In fact, these ideas that became categories were very similar to other categories that related to having the application be family/kid inclusive (revealing a need for the application to be tailored to both their family as a unit, and individually for their children), and the invasiveness (too many notifications) of similar applications (and therefore not being viewed as something that is compatible with one's lifestyle). Some quotes that spoke to the idea of compatibility included:

"I would be open to receive it but depending on whether I interfaced it or intertwined it with my family routine, discern that on a piece of information by piece of information bit…then make a decision whether I want to incorporate it into a type of family routine or not" – Focus Group 2 participant*; "It would have to support what we do already…kinda fit into the day"* – Focus Group 3 participant*; "My daughters…well I would like to keep my kid healthy, on a healthy diet"* – Focus Group 1 participant*; "I would find things for kids the most helpful…"*– Focus Group 4 participant*; "I don't know. I mean that's why we don't have a smartphone. We want to try to be as much away from that kind of technology as possible…"*– Focus Group 2 participant*; "See my family is so busy, active right now, giving us extra suggestions to do anything would just be blown to the waist. I mean we don't have time to add in"* – Focus Group 2 participant*; "If you're going to send out email updates or anything like that, they have to be relevant. I wouldn't just want to see an email with a whole bunch of information that doesn't pertain to me. You know tailored updates…"*– Focus Group 4 participant.

Again, these categories were viewed as both barriers to adoption (barriers related to the person and barriers related to the method of delivery) and requirements for adoption (requirements related to the person, requirements related to the method of delivery, and requirements related to the health intervention content).

Complexity

The third perceived characteristic of an innovation that affects adoption is complexity. Complexity relates to how difficult an innovation is perceived to be and to use (Rogers, 2003). Any new idea can be classified on a continuum from simple to complex and while some innovations may appear clear in their meaning to potential adopters, others are not (Rogers,

2003). The Diffusion of Innovations Theory would suggest that the complexity of an innovation

is negatively related to its rate of adoption (Rogers, 2003). In addition, while the perceived

characteristic of complexity is not considered as important as relative advantage or compatibility

for many innovations, it is considered a very important barrier to adoption. This was evident in

the findings of this study. Many of the barriers that were mentioned by the population of interest

involved the concept of complexity. The ideas that were discussed in the focus groups and

follow-up interviews relating to this concept included "User not being technology savvy",

"Simple to use/not complicated/easy to navigate/intuitive", and "Too specialized/specific/not

generalized/inclusive enough". The barrier of complexity, and paradoxically, simplicity, was

one of the most frequently mentioned topics during data collection. Quotes relating to the

concept of complexity included:

"Because it can't be confusing" – Focus Group 4 participant*; "The whole simple, fast,*

and easy thing is the overriding them right" – Focus Group 3 participant*; "It can't be too*

technical. It has to be straight forward. I'm not savvy" – Focus Group 3 participant*; "Some of*

us are less technologically savvy than others" – Focus Group 4 participant*; "Limit the*

complication…make it simple to use" – Focus Group 1 participant*; "What I found was that none*

of them did everything and that was the biggest problem…there was an app to do that [keep

track of calories] but it was too excessive, and it wasn't easy to do it…it was too cumbersome" –

Focus Group 4 participant.

All of the quotes relating to complexity were viewed as a barrier to adoption (barriers

related to the person, barriers related to the application or device, and barriers related to the

health intervention content).

Trialability & Observability

The fourth and fifth perceived characteristics that affect adoption are trialability and observability. Trialability is the degree to which a person can experiment with an innovation on a limited basis (Rogers, 2003). Generally, when a new idea can be tried by a potential adopter, the innovation is more likely to be adopted. Through the experimentation with the innovation, the potential adopter can give meaning to the innovation, can dispel uncertainty, and can understand how the innovation works in relation to their own personal environment and condition (Rogers, 2003). Observability relates to the degree to which the results of an innovation are visible to others, including the adopter (Rogers, 2003). The observability of an innovation, as perceived by members of a social system, is positively related to the adoption rate of the innovation (Rogers, 2003). However, this can occasionally prove difficult as some innovations are challenging to observe. An example of this challenge can be found in the TIME study. While some health behaviour changes may be obvious to some, such as an average decrease in body mass index for a participating family, other health behaviour changes may be less obvious, such as the increase in motivation to perform healthy physical activity behaviours.

This particular research study is part of the much larger TIME study. At this point in the TIME study project time line, researchers and developers are developing the application that will be used to aid in improving fruit and vegetable intake within the busy Nova Scotia family home. The final two perceived characteristics that affect adoption according to the Diffusion of Innovations Theory can truly only be applied to the later phases of the TIME project when the participants begin to use the application (trialability), and the results are measured (observability), and therefore, are not within the scope of this particular research study.

Negative Case Analysis

While all participants agreed with the major finding, one participant from the second focus group did not. This person is considered to be the only negative case in the research and provided the following perspective:

"…that's why we don't have a smartphone. We want to try to be as much away from that kind of technology as possible. Our mobile phones are for emergency purposes only…we don't want to be 100% accessible to everyone all the time so we don't, it's not for us…you look at all of the education that is available, even without having an app on your phone. You know with school and teachers and you have nutritionists that you can go to and you have libraries and you have internet and all that so you have a multitude of avenues of looking at information for it, I don't see why adding it onto a phone would make people change their lifestyles and make a change for themselves. I mean if the information is already there, easy to access, why would having a phone make it, I don't see it making a big difference. It creates more laziness." – Focus Group 2 participant.

To help explain this negative case, I turned again to the Diffusion of Innovations Theory. In addition to understanding how perceived characteristics of an innovation help to explain the difference in adoption, the Diffusion of Innovations Theory also places adopters into five categories based on their eagerness/willingness to adopt. The first is Innovators. This group makes up roughly 2.5% of the population, takes an average of 0.4 years to make a decision on whether to adopt an innovation, is considered venturesome, is generally in control of substantial financial resources, and is able to cope with high degrees of uncertainty (Rogers, p. 281; p. 215; p. 282). The second are the Early Adopters. This group makes up 13.5% of the population, takes on average 0.55 years to adopt an innovation, is considered more integrated into the larger

social system than innovators, has the highest degree of opinion leadership in most social systems, and is understood to help trigger the critical mass when adopting an innovation (Rogers, p. 281; p. 215; p. 283).

The third are the Early Majority. This group makes up 34% of the population and takes roughly 1.14 years to adopt an innovation (Rogers, p. 281; p. 215). The Early Majority will adopt an idea/product before the average member of a social system will; however, they seldom hold positions of opinion leadership (Rogers, p. 283). They are considered an important link in the diffusion process as they provide interconnectedness in the system and are one of the largest adopter categories (Rogers, p.284). The fourth are the Late Majority. This group also makes up a large section of the population at 34% (Rogers, p. 281). The Late Majority will take more than double the amount of time to adopt an innovation than the Early Majority with an average of 2.34 years (Rogers, p. 215). In addition, this group is categorized as skeptical, and will generally adopt due to economic or peer pressure (Rogers, p. 284). The final group is called Laggards. This group is relatively small, although larger than the Innovator group at 16% (Rogers, p. 281). Laggards take a longer period of time to adopt with an average of 4.65 years, and are considered traditional with no opinion leadership within their social system (Rogers, p. 215; p. 284). Many Laggards are considered isolates and tend to be very suspicious of innovations and change agents (Rogers, p. 284).

According to the Diffusion of Innovations Theory, the negative case in this research could be considered a Laggard. This participant appears to be suspicious of smartphone application technology:

"We want to try to be as much away from that kind of technology as possible".

In addition, this participant was the only participant of all four focus groups and subsequent follow-up interviews to have this opinion on smartphone application technology, making her an isolate in this population. Finally, considering that smartphones have been commercially available for many years, this would suggest that this negative case participant is within the average time span for a Laggard's adoption rate of 4.65 years. This finding would suggest that the majority of the target population are not considered Laggards and would have a faster adoption rate than 4.65 years.

Increasing Rate of Adoption in the population of Busy Nova Scotia Families

The results of this study provide insight into the perceptions of busy Nova Scotia parents on the use of smartphone health applications in improving family nutrition and physical activity practices. The main finding would suggest that this population believes that smartphone health applications can improve family nutrition and physical activity as long as barriers are minimized and requirements for adoption are met. Using the Diffusion of Innovations Theory to analyze this finding, revealed certain categories that are viewed by the population of interest to be more important when considering adoption of a smartphone health application. This connection was made through the number of comments during the focus groups and subsequent follow-up interviews that were related to these categories. Upon further review, recommendations can be made for future steps in implementing a smartphone based health behaviour change initiative in this population using this connection.

As discussed, the Diffusion of Innovations Theory highlights five perceived characteristics of an innovation, three of which are pertinent to framing the findings from this study: relative advantage, compatibility, and complexity. These three characteristics were used

to categorize the data from this study. Certain categories held more data than others, meaning these topics were discussed more frequently (had a higher number of associated comments). Specifically, the following subcategories were found to be mentioned most often:

- Lifestyle (29 comments) – included both the intervention fitting into one's current lifestyle and the invasiveness of the intervention in one's lifestyle.

- Tailoring (27 comments) – which included tailoring for both family and children.

- Convenience – more convenient than previous applications used (19 comments).

- Complexity/Simplicity (23 comments) – which included comments around the need for the application to be simple to use and not be too complex.

These subcategories were related to the Diffusion of Innovation's first three perceived characteristics in the following way (with associated comment count suggesting where to focus adoption efforts first):

Relative Advantage: Convenience – 19 comments

Compatibility: Lifestyle and Tailoring – 56 comments

Complexity: Complexity/Simplicity – 23 comments

Considering this relationship, recommendations can be made on where to focus adoption efforts when attempting to implement this type of health behaviour change intervention in this population. These findings would suggest that the first barrier/requirement in adoption to consider is that of compatibility; more specifically, how the intervention will be tailored to fit the needs of the population of interest, and how the intervention will fit into the lifestyle of this population. It is evident that busy Nova Scotia parents are primarily concerned with how such

an intervention will fit into their already overscheduled life and how it can be tailored to suit their specific needs. The second barrier/requirement to consider is that of complexity. The findings of this study would suggest that this population is more likely to adopt such a health behaviour change intervention if the application is simple to use, or put another way, the level of complexity is low. The third barrier/requirement to consider would be relative advantage; more specifically, the level of convenience for the user. The findings suggest that this population is more willing to adopt the intervention if the application is convenient to use. In conclusion, health application developers and those involved in health behaviour change interventions using this technology may find more success in achieving adoption and health behaviour change if the above barriers/requirements for adoption are addressed.

Rogers (2003, p. 221) reports that anywhere from 49% to 87% of the variance in the rate of adoption of an innovation can be explained by the five perceived characteristics of an innovation. Therefore, it is important for those who are interested in changing the health behaviour of busy Nova Scotia families through the use of smartphone health applications, to seriously consider those innovation characteristics that have been found to be of importance to this population. While Rogers suggests that the characteristic of relative advantage is the strongest predictor of innovation adoption, I would suggest, based on my findings, that compatibility be addressed first, followed by complexity, and then relative advantage. It is apparent based on my results, that the population of interest are mostly concerned with compatibility (as evidenced by the amount of quotes [56] relating to this characteristic). And finally, I would suggest that that research on adoption of this particular innovation within this population not stop here, but continue throughout the course of the TIME health behaviour change intervention. Future focus group and interview data can help researchers and behaviour

change interventionists to make necessary changes to the application to increase the rate of adoption. As the rate of adoption increases, a reduction of obesity rates in Nova Scotia's youth may occur and better nutrition and physical activity habits in the population of interest may improve. This type of action, where research is continued throughout intervention implementation, is understood as formative research and has been used in multiple behaviour change initiatives including the Stanford Heart and Disease Prevention Program aimed at reducing the risk of heart disease in California communities in the 1970's and 80's (Rogers, 2003, p. 235-236).

Social Cognitive Theory

While I have chosen to frame my findings using the Diffusion of Innovations Theory, it is important to briefly discuss how my findings relate to the other major health behaviour change theories explored earlier in this thesis. To begin, Social Cognitive Theory identifies personal, environmental and behavioural factors that influence one's behaviour (Bandura, 1986). Personal factors would include personal knowledge, perceived self-efficacy, and the expected outcome related to the adopted behaviour (Ramirez, Kulinna & Cothran, 2012). Social Cognitive Theory places an emphasis on perceived self-efficacy playing an important role in behaviour change (Bandura, 2004). My findings suggest that this population do feel that smartphone health applications can improve family nutrition and physical activity habits if requirements for adoption are met and barriers are minimized. The population has a perceived self-efficacy surrounding their adoption behaviour, and an expected outcome, assuming the above requirements. Social Cognitive Theory highlights self-efficacy as playing a crucial role in health behaviour change – an individual must believe in their ability to change. The population of busy Nova Scotia parents do believe they would adopt this type of health behaviour change

intervention and that it would achieve a health change in nutrition and physical activity within their family unit. Social Cognitive Theory also highlights making and keeping short-term attainable goals and social support as influencing behaviour adoption (Bandura, 2004). My findings would suggest that the TIME application specifically may be more likely to succeed at achieving the goal of improving fruit and vegetable intake within the Nova Scotia busy family unit as the intervention makes use of both short-term goal making and social support, as it is a family tailored device.

<div align="center">Social Ecological Model</div>

The Social Ecological Model looks at various influencers of human behaviour including the relationship one has with his/her immediate environment (such as their family), the community they live in, and the policies that govern that community (Giles-Corti et al, 2005). This model also highlights four levels of influence in relationship to childhood eating, which is important considering the TIME application is designed specifically to improve nutrition within the family unit. These four levels include psychosocial and biological influences at the intrapersonal level such as knowledge of healthy food, interpersonal influences such as family, organizational influences such as one's physical environment or community, and societal influences or the 'macrosystem' that one exists in. The TIME smartphone health application is only addressing the family unit, and is not really engaging the society that the user is living in. However, the application does incorporate a nutrition knowledge component as it provides information on healthy nutrition choices to the user. The application is also designed to incorporate all family members (which was a finding of great importance to the target population), and will include a GPS system so that the user may interact with the physical

environment through information provided via the application on healthy food choices within a relative proximity to the user.

Continuum Model

A popular theory associated with the continuum model is the Theory of Planned Behaviour, which assumes that human behaviour is rational and is driven by motivational factors (Ceccato, Ferris, Manuel, & Grimshaw, 2007, The World Bank, 2010). The Theory of Planned Behaviour suggests one's personal beliefs about a behaviour, the social groups' perceptions of the behaviour, and the beliefs about being able to perform the behaviour, form the foundation of any given behaviour change (Ceccato, Ferris, Manuel, & Grimshaw, 2007, The World Bank, 2010). My findings would suggest, in the context of this theory, that the TIME smartphone health application may be successful at achieving the targeted health behaviour change within this population, as the focus group participants felt that they would be able to adopt the smartphone application into their lifestyle and that this particular type of health behaviour change intervention would be successful assuming requirements for adoption were meant and barriers were minimized. In addition, all focus groups were in agreement (a social group perception) that making healthy nutrition and physical activity choices for one's family is important.

Stage Model

A popular stage model is the Transtheoretical Model of Behaviour Change (TTM). TTM highlights five stages of health behaviour change that are defined in terms of goals: (precontemplation, contemplation, preparation, action, and maintenance) (Schwarzer, 2008). In terms of my findings, the stage model may suggest that many of the study participants are in the

precontemplation and contemplation stages, with some being in the preparation stage, and a small percentage in the action stage. The reasoning behind this is the level of current adoption of smartphone health applications within the targeted population. Many of the study participants were very familiar with smartphone health applications, with some already utilizing health applications to improve their personal nutrition and physical activity levels. As this study addressed the perceptions on smartphone health applications, and not actual behaviour change, the application of this theory can only be related most strongly to the discussion of the precontemplation and contemplation stages of health behaviour change.

Study Limitations and Strengths

This study has provided valuable insight into the perceptions of busy Nova Scotia parents on the use of smartphone health applications in improving family nutrition and physical activity habits. This research was part of a much larger study addressing the food environments in both the family home and participating recreational centers. Therefore, in addition to questions aimed at answering the research question, other questions were asked of the participants including those on application design and comfort level with GPS tracking. A more focused study where questions only pertaining to the research topic are asked may yield richer data and perhaps more concrete findings on the adoption of smartphone health applications in this population. In addition, the current study did not consider actual behaviour change. The focus of the research was on perceived adoption of technology and the technology's ability to bring about behaviour change. It is only through the later phases of the TIME study that actual behaviour change will be measured.

In terms of methodology and study logistics, multiple factors may have affected the quality of the data. Strengths and weaknesses with the methodology are as follows. The choice

to use focus groups did provide me with a rich data set for the TIME research team however, it also prevented me from being able to dig deeper into what some participants thought on the topic. The data appeared to scratch the surface of the topic, and while follow-up interviews presented the same ideas, other data collection methods should be considered in future research attempts in this area. For example, no demographic data was collected (except for basic information that was observed by me). A demographic questionnaire would allow for a deeper query into relationships between certain variables and the findings, such as the relationship between the barrier of complexity and gender, or income, or geographic location. Another data collection method to consider for future research would be strictly one-on-one interviews. Using this methodology would have allowed the possibility of further exploration of the thought process behind why participants felt and thought the way they did. More time could therefore be allotted to understanding the "why" behind the reasoning and in an environment where personal experiences or deep thoughts can be shared (a private environment with only me present versus a room of strangers).

Another limitation was being the sole moderator. It is advisable where possible to have at least two moderators participating in the collection of focus group data (Kruger, 2009). Having more than one moderator may help in collecting more data and the nuances of the conversation, such as the tone in a participant's voice, a long pause, or nervous laughter. These pieces of data may then be linked back to the transcripts, allowing the moderator to investigate further in follow-up interviews. In addition, two or more moderators can aid in handling paperwork (such as informed consent forms), and managing any food and drink provided, or dealing with interruptions from outside people (a knock at the door for example). At the same time, being the sole moderator allowed me to develop a report with the focus group participants.

Building a trusting, communication relationship with the participants allows for a deeper discussion (International Coach Federation, 2011). While all data was audio recorded, I found it challenging as the sole moderator, to capture every nuance of the focus group discussions. In addition to this challenge, not all focus group locations were ideal. Many were fraught with noise pollution, as became evident in the audio playback. Some focus groups were too large, while others were too small. Using Krueger's (2009) suggestion of 5 to 8, attempts were made to stay within this range. However, some focus groups contained only 3 people, while another contained 7. I found both of these focus groups to present unique challenges in gathering information (too much talking and socializing, creating groups within the group, or not enough people to promote discussion).

While some focus groups included a mix of friends and strangers, most included people who knew one another either through their professional or personal life; this lead to two outcomes: conversation being steered away from the topic, with much work on my part to refocus the group; and deeper conversations between friends who felt comfortable sharing in front of each other. I feel that this both hindered and helped my study by spending too much time on side conversations (non study related conversation), and at the same time, allowing people to share their thoughts more readily with others. The balanced gender mix was also something I hoped to achieve, however half of the focus groups were all female. This fact may present biased data that is not fully representative of how the entire population of busy Nova Scotia parents view smartphone health applications for improving family nutrition and physical activity habits. And therefore, this research may apply more directly to mothers versus fathers in the Halifax Regional Municipality. It may be important in future research to ensure all gender group dynamics are represented (male/female, female/female, and male/male). This may be

possible by collecting demographic data prior to the focus group and grouping the participants based on gender; randomly selecting for the mixed gender group. A final limitation during the data collection phase included some participants simply not wanting to participate as fully as others. Attempts to include them in the conversation were generally unsuccessful and their participation was short lived. While this may have impacted my results by not furthering conversations due to a lack of participation, I suggest that any future research could include both focus groups and in-depth interviews (versus just follow-up interviews) to ensure all participant opinions are heard.

A challenge faced during data analysis was deciphering and selecting the data that were relevant to the specific research questions. Much of the focus group conversation was dedicated to the questions that were of interest to the TIME research project and therefore, answers to these questions and those pertaining to this Masters thesis, were dispersed throughout the focus group data. Ideas and concepts that were related to this study were found across the board of questions asked and were also provided by participants during moments of brainstorming around other questions. This challenge may have been limited if the focus group questions only addressed my thesis specific research questions.

Another point of influence on this study is my personal epistemology and how this may have affected the moderation of the group and the analysis of the data. I took a social constructionist view on the data collection process whereby I encouraged the participants to brainstorm, debate ideas and perspectives, and therein create meaning as a group. The results are therefore viewed as a collective view on the topic versus individual opinions. Other researchers may take a different approach and view the data in a different light, such as a collection of individual ideas/thoughts on the topic (suggesting a more individual approach), or grouping the

participants by a particular demographic and viewing the data by demographic grouping. This in turn, would affect how the data is analyzed and the results presented. However, my collective approach may be argued as a strength of the study as more ideas were shared during the collective brainstorming and debate moments of the focus groups. Other techniques or influences may create a different set of data and results.

The Diffusion of Innovations Theory is not without limitations, and certainly within this thesis, has not been utilized to its fullest capacity. While I have chosen to use only particular aspects of the theory to frame, discuss, and analyze my study findings, there are multiple parts to the Diffusion of Innovations Theory that help in explaining the diffusion of an innovation. Future research may be undertaken incorporating these other theoretical elements to reveal a deeper evaluation of the perspectives of busy Nova Scotia parents on the topic of smartphone health applications in improving family nutrition and physical activity habits. The other aspects of this theory that were not included in my research, and therefore have shaped my findings, are highlighted by Rogers (2003) as four main elements in the diffusion of an innovation. These elements are the innovation itself, the channels of communication that are used to share information with others about the innovation (such as media and interpersonal communication), time (how long it takes to diffuse an innovation and the length of time it takes to adopt an innovation), and the social system (how a social structure and system affects a person's adoption rate). In addition, Rogers (2003) also highlights the innovation-decision process which includes five steps along a continuum to adoption (drawing a parallel to the continuum model). These steps are: knowledge, persuasion, decision, implementation, and confirmation. It is during the persuasion period where a person will address the perceived characteristics of the innovation in helping him/her to make a decision regarding adoption. These perceived characteristics (relative

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advantage, compatibility, complexity, trialability, and observability), are what I used to explain the findings of this study. In conclusion, it must be considered a strength of the study and an appropriate application of the Diffusion of Innovations Theory's perceived characteristics of an innovation to frame the research findings since the TIME study was at the stage of assessing the population's attitudes about the health behaviour change intervention, and therefore was not yet at a stage to measure implementation.

A limitation of the Diffusion of Innovations Theory that should be considered in relation to health behaviour change is that diffusion occurs more slowly when the innovation to be adopted is preventive in nature (Sharma & Kanekar, 2008). For example, a smoker would have to quit smoking today to prevent development of lung cancer in twenty years. Similarly, a parent would have to adopt the proposed smartphone health application to implement healthy family eating and physical activity habits today to prevent nutrient deficiencies and adolescent obesity in the next decade. The theory also holds what Rogers (2003) calls pro-innovation bias. This refers to the connotation that an innovation must be adopted by all members quickly, without rejection or reinvention (Sharma & Kanekar, 2008). However, this is generally not feasible, as it is unrealistic to think everyone will adopt an innovation completely without question. To combat this, Rogers (2003) suggests conducting research while the innovation is still being adopted; thereby better understanding the multiple complexities of the process and making adjustments accordingly. This speaks to a strength in my research that attempts to understand what the views are on the adoption of this innovation by the population of interest prior to implementation and my recommendation to continue to study their needs throughout the intervention, making changes as necessary to improve the chances of a successful health behaviour change program.

Conclusion

This chapter discussed in detail the results of the research study. The demographic information for each focus group was highlighted and an analysis of the focus group and follow-up interview data was reviewed. All data were categorized and the major finding of the research was found to be that busy parents from the Halifax Regional Municipality feel that smartphone health applications can improve family nutrition and physical activity as long as barriers are minimized and requirements for adoption are met. The findings were organized into a model that aided in illustrating how the categories were analyzed. The Diffusion of Innovations Theory was used to illustrate the findings of the study and showcase how the next stages of the TIME study can be assessed using this theory. The only negative case was analyzed using the same theory and was determined to fall into the adopter category of Laggards. In addition, the Diffusion of Innovations Theory was used to make recommendations for next steps in regards to the design and implementation of health behaviour change interventions using smartphone application technology in this population. The limitations of this study were also considered.

CHAPTER 5

CONCLUSION

The current study examined the perceptions of busy Nova Scotia parents, whose children are involved in recreational activities, on the use of smartphone health applications for improving both nutrition and physical activity levels within the family unit. This thesis was part of the much larger TIME research project. The purpose of the TIME project was to improve the food environments in both the family home and recreational facilities within the Halifax Regional Municipality. Four focus groups were conducted across the Halifax Regional Municipality. The data was organized and analyzed using Krueger's Analytic Framework method (2009). The results of the study were then discussed using a model developed through the stages of analysis. These findings were then framed and recommendations were made for next steps using the Diffusion of Innovations Theory. This chapter will discuss the findings of this study in relation to the thesis research question, the TIME project smartphone application and similar smartphone health applications, the health of busy Nova Scotia families, and health services research as a practice.

Addressing the Study Objective

The overarching research question that this study answered was "what are the perceptions of busy Nova Scotia parents on the use of smartphone health applications for improving family nutrition and physical activity habits?" And more specifically, "what if any barriers exist to adopting this method of health behaviour change intervention?"

The main finding of this study would suggest that busy Nova Scotia parents perceive smartphone health applications to be capable of helping families to improve their nutrition and

physical activity habits as long as requirements for adoption are met and barriers are minimized. The finding that barriers must be minimized indicates that barriers do exist for this population in adopting this type of health behaviour change intervention.

How the focus group participants conveyed their thoughts suggested that there are barriers to adoption and there are also requirements for adoption, many of which are similar. The categorization of these ideas depended on the context in which the thought was expressed (the context of the conversation at the time the idea was expressed). The findings would suggest there to be specific barriers and requirements for adoption that should be met in order for this population to successfully adopt this type of behaviour change intervention. The greatest (had the most associated comments) barriers/requirements for adoption were found to be:

- Lifestyle (the application must fit into one's current lifestyle)
- Tailoring (the application must be tailored to fit the individual's uniqueness)
- Convenience (the application must add a convenience to one's current regimen or method of maintaining a healthy lifestyle)
- And complexity/simplicity (the application cannot be complicated to use, or must supersede in simplicity any previous methods used in maintaining a healthy lifestyle)

These thoughts expressed by this population were also found to be important factors for adoption and successful application of health behaviour change interventions within the literature. In terms of fitting an intervention into one's lifestyle, Rogers (2003) found that the more compatible an innovation is with a potential adopter's lifestyle, and therefore the less foreign the innovation will appear, the more likely the person is to adopt that innovation. The innovation must be compatible with one's values and beliefs, and most importantly, their needs.

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This point relates to tailoring, and the importance of designing the application to fit the needs of each individual. It is evident that the most successful health behaviour change interventions are those that are tailored (Breton, Bernard, Fuemmeler, Lorien & Abroms, 2011). The more tailored an innovation is, the higher the participant interest will be (Cugelman, Thelwall & Dawes, 2011), which in turn influences the user's perceptions around usability (understood as convenience and complexity).

The finding that convenience and simplicity (or lack of complexity) is important when adopting this type of intervention is evident in the literature as well. The use of smartphone health applications appears to reduce the burden of self-monitoring by the user (Breton, Bernard, Fuemmeler, Lorien & Abroms, 2011), and can therefore be argued to be a more attractive method of receiving a health behaviour change intervention. In addition, North Americans are becoming a highly technology driven population (Pew Internet & American Life Project, 2007 as cited in Silk, Winn, Keesecker, Horodynski & Sayir, 2008) with many people using smartphones as their communication method of choice. With so many individuals regularly using smartphones, the concept of using a health application on your smartphone appears to be a health behaviour change intervention that fits well into one's daily routine, while ensuring the learning curve is not too steep.

Another finding in the literature is the relevance of portability in health behaviour change interventions (Breton, Bernard, Fuemmeler, Lorien & Abroms, 2011). Portability can be viewed as a convenience to the population of interest. The most frequently mentioned requirements for adoption were found to be lifestyle and tailoring; these concepts were discussed in the focus groups from both an individual standpoint, and a family standpoint. It was apparent that designing the application to be family/child-friendly was important. This finding is also

highlighted in the literature; the most effective type of health program is one that is behaviour family-based (Epstein, Valoski, Wing, & McCurley, 1990; Flodmark, Ohlsson, Ryden, & Sveger, 1993, as cited in Stice, Shaw & Marti, 2006).

Implications for the TIME Project and similar Smartphone Health Applications

The findings of this study are important for the larger TIME project. One of the objectives of conducting the focus groups, beyond the thesis specific research question, was to gather information on how the application should be designed, behave, and interact with the user to ensure a successful intervention. Through conducting this research, the TIME research team was able to harness critical qualitative information that was used to design the interface of the application, make decisions on the application content, tailor the application to fit into the user's lifestyle, and administer a pilot intervention that logistically catered to the target population. Through the later phases of the TIME project, quantitative data may confirm previous behavioural research findings that smartphone health applications help increase consumption of fruit (Delichatsios et al, 2001).

A finding that is important for both the TIME project and similar health application developers is that the population of interest is mostly concerned with a) how the application fits into their current lifestyle and b) that the intervention is tailored to fit the individual and family's needs. By focusing an intervention's marketing or project roll-out strategy first on the concept of compatibility, second on the concept of simplicity/complexity, and third on the concept of convenience, the findings of this study suggest that adoption of this health behaviour change intervention will be more likely to occur within this population. Conversely, this strategic

direction is not recommended in the literature by Rogers (2003), who highlights that convenience is the strongest predictor of innovation adoption.

Implications for the Health of Busy Nova Scotia Families

As discussed, Nova Scotia has one of the highest rates of obesity in Canada (Tjepkema, 2006) with a particularly high youth obesity rate (Shields, 2006). Atlantic Canadian children are exhibiting the highest rate of increase in obesity in the country (Kuhle et al, 2011), and only a small proportion of youth are meeting Canada Food Guide recommendations (Campagna et al, 2005). Beyond this, the research tells us that lack of time is a major constraint for Nova Scotia families in making healthy nutrition choices (Chircop et al, under review). In addition, those families whose children are participating in recreational activities experience stress due to organizing these activities, leading to a limited perceived feasibility of healthy meal planning. Considering the above, the findings from this thesis research are especially critical for the population of busy Nova Scotia parents. By understanding this population's requirements for adoption and the barriers that exist for them, future health behaviour change interventions can be designed, tailored and implemented with their needs in mind. In turn, their rate of adoption and adherence may increase and at the same time, the current rates of youth obesity in Atlantic Canada may decrease. This may reveal an inverse relationship between adoption of tailored smartphone health applications within this population and rates of youth obesity.

Implications for Health Services Research

AcademyHealth (2012) defines the field of health services research as multidisciplinary, investigating how social factors, organizational structures and processes, financial systems, personal behaviours, and health technologies affect the access, quality, cost of health care, and

the overall health of a population. The goal of health services research is to identify what is the most effective way to organize, finance, manage, and deliver quality care. Outlined by AcademyHealth, that we as health service researchers are always pursuing the answers to are: What works? For whom? At what cost? And, under what circumstances?

This research provided information on how mobile health technology (smartphone health applications) can improve the health status of a particular population, to gather information around what aspects of this particular type of health behaviour change intervention are required for adoption, and therefore, to understand the circumstances that will increase the likelihood of success. This study was able to fill a gap on this topic for this population, as previously there was little known about the needs of busy Nova Scotia families in terms of adopting a smartphone health behaviour change intervention. Through the collection of focus group data, this research was able to provide insight into the discipline on delivering this type of health behaviour change intervention to this population, and as the larger TIME project unfolds, at what cost. The study of intervention cost versus value-add is an important one and should be undertaken considering the ever increasing concern of rising health care costs (Canadian Institute for Health Information, 2011).

The findings of this study suggest that when delivering a health behaviour change intervention to this population, the intervention should be tailored, convenient, simple to use, and supersede the previous health behaviour change intervention (in that order). Knowing this information, health and behaviour researchers will be able to further examine and fine-tune the complexities of implementing a smartphone health behaviour change intervention within this population and populations with similar needs and characteristics. Health behaviour change involves varying combinations of social, emotional, and cognitive factors (Schwarzer, 2008), and

therefore, it is important as a discipline, to strive to, and continue to, research, indentify, and test, the varying combinations of these factors. As technology continues to develop and more individuals turn to smartphone based health applications to provide health information, it will be important for the field of health services research to continue to understand the needs of the technology's users. Understanding the adoption of such application can provide valuable information to those in the health professions who are responsible for designing and providing this type and level of health care.

REFERENCES

Aaron, D. J., Kriska, A. M., Dearwater, S. R., et al (1993). The epidemiology of leisure physical activity in an adolescent population. *Medical Science Sports Exercise, 25,* 847-853.

Abroms, L. C., Padmanabhan, N., Thaweethai, L., & Phillips, T. iPhone apps for smoking cessation: a content analysis. *American Journal of Preventative Medicine,40(3)*, 279-285.

AcademyHealth. (2012). *What is HSR.* Retrieved from http://www.academyhealth.org/about/content.cfm?itemnumber=831&navitemnumber=514.

Alagoz, F., Valdex, A. C., Wilkowska, W., Ziefle, M., Dorner, S., & Holzinger, A. (2010). From Cloud Computing to Mobile Internet, From User Focus to Culture and Hedonism. The Crucible of Mobile Health Care and Wellness Applications. *2010 5th International Conference on Pervasive Computing and Applications,* 38-45.

Andrews, K. R., Silk, K. S., & Eneli, I, U. (2010). Parents as Health Promoters: A Theory of Planned Behaviour Perspective on the Prevention of Childhood Obesity. *Journal of Health Communications: International Perspectives, 15(1),* 95-107.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood, NJ: Prentice-Hall.

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education & Behaviour, 31,* 143-164.

Basch, C. E. (1987). Focus group interview: An underutilized research technique for improving theory and practice in health education. *Health Education Quarterly, 14(4),* 411-448. doi: 10.1177/109019818701400404.

Blanchard, C. M., McGannon, K. R., Spence, J. C., Rhodes, R. E., Nehl, E., Baker, F., & Bostwick, J. (2005). Social ecological correlates of physical activity in normal weight, overweight, and obese individuals. *International Journal of Obesity, 29,* 720-726. doi: 10.1038/sj.ijo.0802927.

Breton, E. R. Fuemmeler, B. F., & Abroms, L. C. (2011). Weight loss – there is an app for that! But does it adhere to evidence-informed practices? *Translational Behavioural Medicine.* doi: 10.1007/s13142-011-0076-5.

Brug, J, Oenema, A., & Campbell, M. (2003). Past, present, and future of computer-tailored nutrition education. *American Journal of Clinical Nutrition, 77*, 28-34.

Bull, F. C., Holt, C. L., Kreuter, M. W., Clark, E. M., & Scharff, D. (2001). Understanding the effects of printed health education materials: Which features lead to which outcomes? *Journal of Health Communication, 6,*265–279.

Burr, V. (2003). *Social Constructionism* (2nd ed.). New York, NY: Routeledge.

Campagna, P. et al (2005). PACY 2005: Physical activity levels and dietary intake of children and youth in the province of Nova Scotia. *Nova Scotia Department of Health Promotion and Protection and Department of Education.*

Canadian Institute for Health Information. (2012). *National Health Expenditure Trends, 1975 to 2012* . Retrieved from

https://secure.cihi.ca/free_products/NHEXTrendsReport2012EN.pdf.

Ceccato, N. E., Ferris, L. E., Manuel, D., & Grimshaw, J. M. (2007). Adopting Health Behaviour Change Theory Throughout the Clinical Practice Guideline Process. *Journal of Continuing Education in the Health Professions, 27(4)*, 201-207. doi: 10.1002Ochp.138.

Centre for Connected Health Policy. (2011). *What is Telehealth.* Retrieved from http://www.cchpca.org/what-is-telehealth.

Chircop A, Shearer C, Flannery M, Kirk S, Pitter R, Rehman L, Grant J, Lyons R. Sacrificing healthy eating for physical activity: Decision making among adolescents and their families. Canadian Journal of Public Health (manuscript under review, submitted January 2012).

Cole-Lewis, H. & Kershaw, T. (2010). Text Messaging as a Tool for Behavior Change in Disease Prevention and Management. *Epidemiologic Reviews, 32(1),* 56-69. doi: 1093/epirev/mxq004.

Conn, J. (2011). There's an app for that. *Modern Healthcare*, *41(17),* 30-33. Retrieved from EBSCO*host*.

Cresswell, J. (2008). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches.* Thousand Oaks, CA: Sage.

Cresswell, J. & Plan Clark, V. (2011). *Designing and Conducting Mixed Methods Research* (2nd ed.). Thousand Oaks, CA: Sage.

Croll, J. K., Neumark-Sztainer, D., & Story, M. (2001). Healthy eating: what does it mean to adolescents? *Journal of Nutrition Education, 33(4),* 193-198.

Cugelman, B, Thelwall, M., & Dawes, P. (2011). Online Interventions for Social Marketing Health Behaviour Change Campaigns: A Meta-Analysis of Psychological Architectures and Adherence Factors. *Journal of Medical Internet Research, 13(1)*, 17. doi:10.2196/jmir.1367.

Cullen, K. (2000). Market research for nutrition professionals: focus group discussions. *Journal of American Dietetic Association, 100(12).* Retrieved from http://www.dannon-institute.org/pdf/how_f00b.pdf.

Cummiskey, M. (2011). There's An App for That. Smartphone Use in Health and Physical Education. *Journal of Physical Education, Recreation & Dance, 82(8)*, 24-30.

Delichatsios et al (2001). Randomized trial of a 'talking computer' to improve adults' eating habits. *American Journal of Health Promotion 15*, 215-224.

Devine, C. M., Jastran, M., Jabs, J., Wethington, E. et al (2006). "A lot of sacrifices": Work-family spillover and the food choice coping strategies of low-wage employed parents. *Social Sciences & Medicine, 1 November.*

Erickson, R. J. (2011). The Importance of Authenticity for Self and Society. *Symbolic Interaction, 18(2),* 121-144. doi:10.1525/si.1995.18.2.121.

Eysenbach, G. (2005). The Law of Attrition. *Journal of Medical Internet Research, 7(1)*, 11. doi:10.2196/jmir.7.1.e11.

Eysenbach, G., Brooke, J., Zhong, D., Kirwan, M. J., & Duan, X. (2013). Viewpoint Regulatory

 Barriers Blocking Standardization of Interoperability. *JMIR Mhealth & Uhealth.* doi:

 vli2e13 10,2196/mhealth.2654.

Fade, S. A., & Swift, J. A. (2010). Qualitative research in nutrition and dietetics: data analysis

 issues. *Journal of Human Nutrition and Dietetics, 24*, 106-114.

FDA (Food and Drug Administration), (2011). *Public Workshop - Mobile Medical Applications

 Draft Guidance, Transcript for September 12, 2011.* Retrieved from

 http://www.fda.gov/MedicalDevices/NewsEvents/WorkshopsConferences/ucm275908.ht

 m.

Free C, Phillips G, Galli L, Watson L, Felix L, et al (2013). The Effectiveness of Mobile-Health

 Technology-Based Health Behaviour Change or Disease Management Interventions for

 Health Care Consumers: A Systematic Review. PLoS Med 10(1): e1001362.

 doi:10.1371/journal.pmed.1001362.

Garel, E. (2011). The Challenge of Behaviour Change Interventions. *Benefits Canada.* Retrieved

 from http://www.benefitscanada.com/benefits/disability-management/the-challenge-of-

 behaviour-change-interventions-17171.

Gettleman, L. & Winkleby, M. A. (2000). Using Focus Groups to develop a Heart Disease

 Prevention Program for Ethnically Diverse, Low-income Women. *Journal of Community

 Health, 25(6).*

Giles-Corti, B. & Donovan, R. J. (2002). The relative influence of individual, social and physical

 environment determinants of physical activity. *Social Science & Medicine, 54,* 1793-

 1812.

Giles-Corti, B., Timperio, A., Bull, F., & Pikora, T. (2005). Understanding physical activity

    environmental correlates: Increased specificity for ecological models. *Exercise & Sport*

    Sciences Reviews, 33, 175-181.

Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). (2008). *Health Behaviour and Health*

    Education. Theory, Research, and Practice (4th ed.). San Francisco, CA: Jossey-Bass.

    Retrieved from http://www.ihepsa.com/files/h1.pdf#page=351.

Greenhalgh, T., Robert G., Macfarlane F., Bate, P., & Kyriakidou, O. (2004). Diffusion of

    innovations in service organisations: systematic literature review and recommendations

    for future research. *Millbank Q, 82*, 581-629.

Harris, J. E. & Murray, L. (1997). The relationship between social cognitive model variables and

    fruits and vegetable consumption. *American Journal of Health Studies, 13(3),* 133-141.

Health Canada. (2002). Health Promotion – Does It Work? *Health Policy Research, 1(3)*, 1-39.

Heitzler, D., Martina, S. L., Dukeb, J., & Huhmana, M. (2006). Correlates of physical activity in

    a national sample of children aged 9-13 years. *Preventative Medicine, 42,* 254-260.

Horacek, T. M, White, A., Betts, N. M. Hoerr, S., et al (2002). Self-efficacy, perceived benefits,

    and weight satisfaction discriminate among stages of change for fruit and vegetable

    intakes for young men and women. *Journal of the American Dietetic Association, 102,*

    10, 1466-1470.

Huang, K. (2009). Challenges in Human-Computer Interaction. *Proceedings of the World*

    Congress on Engineering and Computer Science, Vol I. San Francisco, USA.

International Coach Federation. (2011). *Core Competencies.* Retrieved from

http://www.coachfederation.org/icfcredentials/core-competencies/.

Jabs, J., Devine, C. M., Bisogni, C. A., Farrell, T. J., Jastran, M., & Wethington, E. (2007). Trying to Find the Quickest Way: Employed Mother's Constructions of Time for Food. *Journal of Nutrition Education and Behavior, 39(3),* 170.Johnson, R. B., Onwuegbuzie A. J., & Turner, L. A. (2007). Toward a Definition of Mixed Methods Research. *Journal of Mixed Methods Research, 2,* 112-133.

Kamel Boulos, M. N., Wheeler, S., Tavares, C. & Jones, R. (2011). How smartphones are changing the face of mobile and participatory healthcare: an overview, with example from eCAALYX. *Engineering OnLine, 10*, 24.

Kolmodin, K. Naar-King, S., Ellis, D. A., & Brogan, K. (2007). A Social Ecological Model of Obesity in Overweight African American Adolescents. *Diabetes, 56,* 473.

Krueger, R., & Casey, M. (2009). Focus Groups. *A Practical Guide for Applied Research* (4th ed.). Thousand Oaks, CA: SAGE Publications, Inc.

Krukowski, R. A., Tilford, J. M., Harvey-Berino, J., & West, D. S. (2011). Comparing behavioral weight loss modalities: incremental cost-effectiveness of an internet-based versus an in-person condition. *Obesity, August 19(8),* 1629-1635. doi:10.38/oby.2010.341.

Kreuter, M. W., Farrell, D., Olevitch, L., & Brennan, L. (2000). *Tailoring health messages: Customizing communication with computer technology.* Mahwah, NJ: Erlbaum.

Kuhle, S., Kirk, S., Ohinmaa, A., Yasui, Y., Allen, A. C., & Veugelers, P. J. (2011). Use and cost of health services among overweight and obese Canadian children. *International Journal of Pediatric Obesity, 6,* 142-148.

Lee, W. Chae, Y. M., Kim, S., Ho, S. H., & Choi, I. (2010). Evaluation of a mobile phone-based diet game for weight control. *Journal of Telemedicine and Telecare, 16.*

Lester, R. T., van der Kop, M, Taylor, D, Alasaly, K, Coleman, J., & Marra, F. (2011). M-health: Connecting patients to improve population and public health. *British Columbia Medical Journal, 53(5),* 218.

Lustria, M. A., Cortese, J., Noar, S. M., & Glueckauf, R. L. (2009). Computer-tailored health behaviour change interventions delivered over the web: Review and analysis of key components. *Patient Education and Counseling, 74*, 156-173.

Marcus, B. H., Own, N., Forsyth, L. H. Cavill, N. A., & Cavill, N. A., & Fridinger, F. (1998). Physical Activity Interventions Using Mass Media, Print Media, and Information Technology. *American Journal of Preventative Medicine, 15(4)*, 362-378. doi:10.1016/S0749-3797(98)00079-8.

Marshall, A. L., Bauman, A. E., Marcus, B. H., & Owen, N. (2003). Print versus website physical activity programs: A randomized trial. *American Journal of Preventative Medicine, 25(2)*, 88-94. doi: 10.1016/S0749-3797(03)00111-9.

Mezni, H. (2008). Adoption of Telehealth by Healthcare Professionals: An Overview of Theoretical Models and Their Application. *MCIS 2008 Proceedings, Paper 38.* Retrieved from http://aisel.aisnet.org/mcis2008/38.

Mokdad, A. H. et al (2003). Prevalence of Obesity, Diabetes, and Obesity-Related Health Risk

      Factors. *Journal of the American Medical Association, 289(1),* 76-79. doi:

      10.1001/jama.289.1.76.

Noar, S. M., Benac, C. N., & Harris, M. S. (2007). Does Tailoring Matter? Meta-Analytic

      Review of Tailored Print Health Behaviour Change Interventions. *Psychological Bulletin,*

      133(4), 673-693. doi: 10.1037/0033-2909.133.4.673.

Ng, G. (2011). comScore: Canada Has 8 Million Smartphone Users Led By RIM, Apple and

      Google. Retrieved from http://www.iphoneincanada.ca/iphone-news/comscore-canada-

      has-8-million-smartphone-users-led-by-rim-apple-and-google/.

Pagliari, C. (2007). Design and Evaluation in eHealth: Challenged and Implications for an

      Interdisciplinary Field. *Journal of Medical Internet Research, 9(2),* 15. doi:

      10.2196/jmir.9.2.e15.

Patrick, K., Griswold, W. G., Raab, F., & Intille, S. S. (2008). Health and the Mobile Phone.

      American Journal of Preventative Medicine, 35(2), 177-181.

      doi:10.1016/j.amepre.2008.05.001.

PR Newswire (U.S.). (2011). *Arogya World Launches New Diabetes Prevention mHealth*

      Program in India with Nokia Life Tools. Retrieved from

      http://global.factiva.com.ezproxy.library.dal.ca/ga/default.aspx.

Prochaska, J. O. & DiClemente, C. C. (1984). *The transtheoretical approach : Crossing the*

      traditional boundaries of therapy. Melbourne, FL: Krieger Publishing Company.

Public Health Agency of Canada and Canadian Institute for Health Information. (2011). *Obesity in Canada. A joint report from the Public Health Agency of Canada and the Canadian Institute for Health Information.* Retrieved from http://www.phac-aspc.gc.ca/hp-ps/hl-mvs/oic-oac/assets/pdf/oic-oac-eng.pdf.

Quatromoni, P. A., Milbauer, M., Posner, B. M., Parkhurt Carballeira, N., Brunt, M., & Chipkin, St. R. (1994). Use of Focus Groups to Explore Nutrition Practices and Health Beliefs of Urban Caribbean Latinos with Diabetes. *Diabetes Care, 17(8),* 869-873.

Rabiee, F. (2004). Focus-group interview and data analysis. *Proceedings of the Nutrition Society, 63*, 655-660.

Ramirez, E., Kulinna, P. H., & Cothran, D. (2012). Constructs of physical activity behaviour in children: The usefulness of Social Cognitive Theory. *Psychology of Sport and Exercise, 13(3),* 303-310.

Rhoades, D. R., Al-Oballi Kridli, S., & Penprase, B. (2011). Understanding overweight adolescents' beliefs using the theory of planned behaviour. *International Journal of Nursing Practice, 17,* 562-570.

Rick, K. (2010). There's An App for That – mHealth Takes Center Stage. *Journal of Healthcare Information Management, 24(3)*, 9-10.

Robinson, L. (2009). *A summary of Diffusion of Innovations.* Retrieved from http://www.enablingchange.com.au/Summary_Diffusion_Theory.pdf.

Rogers, E. M. (2003). *Diffusion of Innovations*. New York, NY: Free Press.

Sandelowski, M. (2002). Reembodying Qualitative Inquiry. *Qualitative Health Research, 12(1)*, 104-115.

Schwarzer, R. (2008). Modeling Health Behaviour Change: How to Predict and Modify the Adoption and Maintenance of Health Behaviours. *Applied Psychology, 57(1)*, 1-29. doi: 10.1111/j.1464-0597.2007.00325.x.

Sharma, M., & Kanekar, A. (2008). Diffusion of innovations theory for alcohol, tobacco, and drugs. *Journal of Alcohol and Drug Education*. Retrieved from http://www.thefreelibrary.com/_/print/PrintArticle.aspx?id=179277678.

Shields, M. (2006). Measured obesity: Overweight Canadian children and adolescents. Nutrition: Findings from the Canadian Community Health Survey, Issue 1. Statistics Canada Cat. no. 82-620-MWE.

Shumaker, S. A, Ockene, J. K., & Riekert, K. A. (Eds.). (2009). *The Handbook of Health Behaviour Change* (3rd ed.). New York, NY: Springer Publishing Company.

Silk, K. J, Winn, B, Keesecker, N, Horodynski, M. A., & Sayir, A. (2008). Increasing Nutrition Literacy: Testing the Effectiveness of Print, Web site, and Game Modalities. *Journal of Nutrition Education and Behaviour, 40(1)*, 3-10. doi: 10.1016/j.jneb.2007.08.012.

Slater, J., Sevenhuysen, G., Edginton, B., & O'Neil, J. (2012). Trying to make it all come together: structuration and employed mothers' experience of family food provisioning in Canada. *Health Promotion International, 27(3),* 405-415.

Stice, E., Shaw, H., & Marti, C. N. (2006). A Meta-Analytic Review of Obesity Prevention

Programs for Children and Adolescents: The Skinny on Interventions that Work.

Psychological Bulletin, 132(5), 667-691.

Story, M., Kaphingst, K. M., robinson-O'Brien, R., & Glanz, K. (2008). Creating Healthy Food

and Eating Environments: Policy and Environmental Approaches. *Annual Review Public*

Health, 29, 253-272.

Strecher, V. J., Shiffman, S. & West, R. (2005). Randomized controlled trial of a web-based

computer-tailored smoking cessation program as a supplement to nicotine patch therapy.

Addiction, 100(5), 682-688.

The World Bank. (2010). *Theories of Behaviour Change*. Retrieved from

http://siteresources.worldbank.org/EXTGOVACC/Resources/BehaviourChangeweb.pdf

Thirumurthy, H. & Lester, R. T. (2012). M-health for health behaviour change in resource-

limited settings: applications in HIV care and beyond. *Bulletin of the World Health*

Organization, 90, 390-392. doi: 10.2471/BLT.11.099317.

Thompson, B. M. (2013). Set the mobile medical app guidance free! *Mobi health news.*

Retrieved from http://mobihealthnews.com/25040/set-the-fda-mobile-medical-app-

guidance-free/

Tjepkema, M. (2006). Measured obesity: Adult obesity in Canada: Measured height and

weight. Nutrition: Findings from the Canadian Community Health Survey, Issue 1.

Statistics Canada.

Tran, B. Q., Buckley, K. M., Bertera, E. M., & Gonzales. P. L. (2009). Benefits & Barriers to

    Adoption of Health IT in an Elderly Low-Income, Minority Community-Based

    Environment (31st Annual International Conference of the IEEE EMBS). Minneapolis,

    Minnesota, USA.

Walsh, J. R., White, A. A., & Greaney, M. L. (2009). Using focus groups to identify factors

    affecting healthy weight maintenance in college men. *Nutrition Research, 29(6),* 371-378.

Waters, E., de Silva-Sanigorski, A., Hall, B. J., Brown, T., Campbell, K. J., Gao, Y., &

    Summerbell. C. D. (2011). Interventions for preventing obesity in children. *The*

    Cochrane Collaboration. doi: 10.1002/14651858.CD001871.pub3

Whitehead, D. (2001). A social cognitive model for health education/health promotion practice.

    Journal of Advanced Nursing, 36(3), 417-425.

Willms J.D., Tremblay, M.S. & Katzmarzik, P.T. (2003). Geographic and demographic variation

    in the prevalence of overweight Canadian children. *Obesity Research, 11(5)*, 668-73.

Wiltz, C. (2013). FDA's Regulation of Mobile Medical Apps Will Probably Confuse You.

    Medical Device and Diagnostic Industry. Retrieved from

    http://www.mddionline.com/blog/devicetalk/fdas-regulation-mobile-medical-apps-will-

    probably-confuse-you.

Wisdom, J. P., Cavaleri, M. A., Onwuegbuzie, A., J., & Green, C. A. (2012). Methodological

    Reporting in Qualitative, Quantitative, and Mixed Methods Health Services Research

    Articles. *Health Services Research,47(2),* 721-745. doi: 10.1111/j.1475-

    6773.2011.01344.x

World Health Organization. (2013). *eHealth at WHO.* Retrieved from

http://www.who.int/ehealth/en/.

World Health Organization. (2013). *Media centre. Obesity and overweight.* Retrieved from

http://www.who.int/mediacentre/factsheets/fs311/en/.

World Health Organization. (1986). *Ottawa Charter for Health Promotion.* Retrieved from

http://www.euro.who.int/__data/assets/pdf_file/0004/129532/Ottawa_Charter.pdf.

DALHOUSIE
U N I V E R S I T Y
Inspiring Minds

Focus Group Pilot Study - Informed Consent Form

Title: TIME (Tools, Information, Motivation, Environment) for health: A multi-level intervention to promote healthy eating in children and their families. Phase I: Focus group pilot study

I have read the information describing the research study, and I agree to participate in the study. I understand that this focus group will be audio taped. I also understand that my participation is voluntary, and that I may withdraw from the study at any time for any reason. I agree to keep confidential the things that are discussed in the focus group. I understand that my name will not be attached to any focus group questions and that my answers will be combined with those of other participants in the study.

_____   _____

Name of participant   **Signature of participant**

I understand that quotes may be used in the final report and that my name will not be attached to these quotes. My signature below indicates that I agree to the use of quotations.

_____

Signature of participant

I agree to review the transcript of the focus group. I recognize that I have no obligation to review the transcript of the focus group.

_____

Signature of participant

Contact information of participant for receipt of transcript:

_____

_____

I, _____, have received a copy of this form for my records.

   Name of participant

_____

Date

☐   Please check this box and provide your email address if you would like to receive results from this study

Email: _____

_____   _____
Name of person obtaining consent   **Signature of person obtaining consent**

DALHOUSIE
UNIVERSITY
Inspiring Minds

Focus group pilot study - Project Information

Project Title

TIME (Tools, Information, Motivation, Environment) for health: A multi-level intervention to promote healthy eating in children and their families. Phase I: Focus group pilot study.

Introduction

You have been invited to take part in a research study at Dalhousie University. Taking part in this study is voluntary and you may choose to stop at any time. The study is described below. This description tells you about the expected time you will need to participate and possible discomforts you may experience. Participating in this study will provide insight into the preferences on using GPS (global positioning system) enabled smart phones as a way to deliver information to support healthy eating and physical activity in families.

What is the purpose of this study?

The purpose of the study is to better understand people's preferences, needs, wants, and barriers to using a GPS enabled smart phone application to support healthy eating. Knowledge gained from this study will inform decisions in later phases of a 3 year long, federally funded project that addresses the food environment both within the family unit and within recreational facilities in the Halifax Regional Municipality.

Study Design (**What you will be asked to do**)

If you agree to participate, you will be asked several questions about your preference for different smart phones and related technologies, your wants, needs and barriers to using such an application, and your comfort level with using a GPS (global positioning system) enabled smart phone that will provide real time individualized text messages about healthy eating in relation to your geographic location. All conversations that take place during the focus group will be audio taped. The total amount of time to participate in this study is 1 to 2 hours.

Who can participate?

You can participate if you have children aged between 5-12 years that participate in physical activity at a recreational facility in the Halifax area, live in Halifax Regional Municipality, are able to read and speak English, and are able to commit to taking part in a focus group. This focus group will ask about your preference and thoughts on using GPS enabled smart phones to deliver support relating to healthy eating and physical activity.

Who will be conducting the research?

Dr. Sara Kirk (494-8440, sara.kirk@dal.ca) and Dr. Cindy Shearer (PhDs) (494-2604, cindy.shearer@dal.ca) are in charge of the study. A Masters level research assistant, Katie Andrien (494-1590, katie.andrien@dal.ca) is also participating and will be collecting data. All are available to answer any questions you may have regarding this research.

Possible risks and discomforts

The discomforts associated with this study are minimal. It is possible that you may feel uncomfortable discussing your preferences and thoughts on this topic in a group setting. However, the research assistant will make every effort to ensure you are comfortable. If you would prefer, you can meet with the research assistant on your own rather than in a group. Just let her know your preference.

Possible benefits

You may not receive any direct benefit from your participation in this research. However, your participation may provide knowledge that will help to inform the later phases of this project.

Compensation

If you agree to participate in the study, you will receive $15 dollars in recognition of your time commitment to this project.

Confidentiality and anonymity

Every effort will be made to keep focus group data confidential. However, we cannot guarantee your anonymity as other people in the focus group will know who you are. We will ask all focus group participants to keep confidential the information discussed. Only the researchers involved in this study will have access to the data from the focus group. No data or direct quotes will be reported, presented, or published unless you give us permission. Your name will not be attached to the focus group questions. You will be identified only by a number. No individual results will be reported. The only exception to maintaining confidentiality is our obligation to abide by the duty to report suspected abuse and neglect legislated by the Nova Scotia Youth and Family Services Act.

The data from this study will be kept at Dalhousie University for a period of 5 years after publication, when it will be destroyed.

Who can I contact for information about this study?

Principal Investigators:

Dr. Sara Kirk, 494-8440 (sara.kirk@dal.ca)
Dr. Daniel Rainham, 494-1286 (Daniel.rainham@dal.ca)

Research Staff:

Dr. Cindy Shearer, Project Coordinator, 494-2604 (cindy.shearer@dal.ca)
Katie Andrien, Research Assistant, 494-1590 (katie.andrien@dal.ca)

Or, in the event that you have any difficulties with, or wish to voice concern about, any aspect of your participation in this study, you may contact:

Catherine Connors,
Director of Dalhousie University's
Office of Human Research Ethics Administration
e-mail: Catherine.Connors@dal.ca
phone: 494-1462

AHPRC
Atlantic **Health Promotion** Research Centre

September, 2011

Thank you for agreeing to participate in the TIME focus group, discussing the use of smartphone application technology and healthy eating and physical activity habits. The information from this focus group will be used to inform the later phases of the TIME study being conducted by Dalhousie University (Atlantic Health Promotion Research Centre) and led by Dr. Sara Kirk, Faculty of Health Professions.

We are happy to provide you with a $15 honorarium to thank you for participating in the focus group on _____. We would ask that you sign below to indicate that you have received your honorarium.

I _____ hereby confirm that I have received a sum of $15 cash from Katie Andrien, Research Assistant as an honorarium payment for participating in the focus group for the TIME project.

I understand this honorarium is taxable income and it is my responsibility to claim it on my income tax as Dalhousie University is not required to issue a T4A for this payment.

_____   _____
Signature Focus Group Participant   Katie Andrien, Research Assistant

Dalhousie University and the Atlantic Health Promotion Research Centre are looking for focus group participants.
Compensation provided for 1 hour of your time!

Date: To be determined

Time: To be determined

Place: Atlantic Health Promotion
Research Centre
Suite 209, City Centre Atlantic
1535 Dresden Row, Halifax, NS
OR   (Name of Recreational Facility)

If you answer YES to all of the questions below, call or email us!

- Do you have one or more children aged 5-12 years that participate in physical activity at a recreational facility within the Halifax Regional Municipality?
- Do you live in the Halifax Regional Municipality?
- Can you speak and read English?
- Will you be available to participate fully in a focus group which will explore your preferences on the use of smart phone application technology?

Contact person: Katie Andrien
katie.andrien@dal.ca
902 494 1590

TIME for health
Tools, Information, Motivation, Environment

APPENDIX E   FOCUS GROUP QUESTIONNAIRE

Focus Group Interview Guide

Introduction: My name is Katie Andrien. I am a Masters of Health Service Research student at Dalhousie University. I am involved with a study that is interested in improving the food environment within the Halifax family unit. This study was born out of findings from a previous research project that found that those Halifax families who have children involved in recreational activities ironically, found it challenging to eat healthily due to pressures on their time.

As part of the study we are developing a smartphone application that will help families to choose quick and easy healthy meals and snacks, with a view to improving their nutrition and activity habits. As we enter into the design phase of this application, we are hoping to answer some questions around how families will use such an application and how something like this could fit into their lives.

Can I answer any upfront questions at this time?

SECTION 1: Logistics/Pragmatics

- Do you currently own and use a mobile phone?
   - If so, do you own a smart phone?
      - What kind of smart phone do you own?
      - What do you like about it?
      - What do you dislike about it?
- What is your contract with this device? Is it a pay as you go, monthly, or multi-year contract?
- What are your thoughts on participating in a 6 month study where you would be required to interact with a smartphone application about nutrition and activity?
- If you were to participate in a study like that, would you prefer to have a smartphone provided to you or use your own smartphone and be compensated for this?
- How would you like that compensation to be provided?
- How would interacting with a study-provided smart phone fit into your lifestyle?

SECTION 2: Use of application

- If you own a smart phone, what do you use it for?
- How likely are you to use a smartphone for seeking information on healthy eating?
- What features of a smartphone (like quick access to the internet, your email, or different applications) would be most helpful to you with your lifestyle?
- If you own a smartphone, what kind of apps do you currently use or would like to use?
- What do you think about healthy eating and physical activity applications?
   - Do they work?
- If you were to use an application for healthy eating and physical activity, what components of this application would be really important and useful for you?

SECTION 3: Perceptions on how smartphone healthy eating and physical activity applications can support healthy nutrition and physical activity habits in busy families

- Do you believe that a healthy eating and physical activity application could help support healthy nutrition and activity habits in your family?
    a. Tell me more about your thoughts on this…
- How could a healthy eating and physical activity application help your family eat healthier and achieve physical activity goals?
- What might be the barriers to using such an application?

SECTION 4: Application Design

If you were to use an application to encourage healthy eating and physical activity:

- What exercise or sport suggestions would be most helpful? (If it helps, think about what types of physical activity you enjoy participating in)
    o What exercise or sport suggestions would be most appropriate for the rest of your family or your children?
- What fruits and vegetable suggestions would you like to see in the application? (It if helps, think about what fruits and vegetables your family consumes regularly)
- What type of measurement for the food would be most appropriate for you and your family? Example would be cups, milliliters, ounces, etc.
- Would you like picture references of what a serving of a particular food is? Example would be a picture of how much a serving of chicken is relative to a deck of cards.
- At what time of day would a smartphone reminder be most helpful?

SECTION 5: Comfort level with GPS tracking

GPS or global positioning system is a system of satellites and receivers that allow people and devices to pinpoint their precise location on the earth. This feature on a phone can be turned on or off by the user at any time.

- How comfortable are you with the use of GPS technology in smart phones to provide you with information related to your location? An example of this would be when you are lost downtown. GPS on a smartphone can tell you exactly where you are.
- How comfortable are you with the use of GPS to deliver targeted messages to a user based on their geographic location?
- How likely would you be to utilize this feature?

This concludes our focus group. Thanks so much for participating. Are there any questions that I can answer at this time?