

**MOBILE APPS IN THE WORKPLACE?
ADDO: A PROCESS AND OUTCOME EVALUATION**

by

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ABSTRACT

Numerous innovations in health information technology are empowering individuals to assume a more active role in monitoring and managing their health. The use of health-promoting Mobile Applications as a tool in workplaces is growing among employees who seek support to modify their lifestyles.

The aims of this study are to evaluate a mobile app, Addo, regarding its implementation and impact on promoting health behaviour changes in workplace settings in Nova Scotia. Treatment (n=51) and control groups (n=51) were assessed through a longitudinal design using the RE-AIM (Reach, Effectiveness, Adoption, Implementation, Maintenance) framework. Data were collected through surveys (pre-, post- and 3 months post-Addo mobile app challenge) and qualitative interviews.

Results from the treatment group indicated that the implementation of Addo was low. Using validated and standardized survey tools (General Self-Efficacy and RAND-SF-36), all participants scored 'excellent/very good' self-reported health at baseline (77%) and 3-months post Addo mobile app (79%): Addo had no impact. Interview feedback on the app was generally negative. The low levels of usage and implementation combined with the already healthy behaviours of participants may indicate a lack of need by these employees for Addo. The lack of impact and negative perceptions about the app may have influenced the developer to discontinue the availability of the app, which occurred near the end of the evaluation.

The results from this evaluation indicated little need for this app, low use, and no impact, however, in populations where need is greater or where apps are more motivating, a more positive outcome is possible. As the app market for health promotion

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continues to grow, it is important that evidence-based evaluation inform their development and use, and to assess their outcomes.

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List of Symbols, Nomenclature or Abbreviations

Mobile Application (mobile app)

Reach, Efficacy, Adoption, Implementation, and Maintenance (RE-AIM)

Workplace Wellness Program (WWP)

Chapter 1: Introduction

Canadians live in a society where electronic information is readily available and easily accessible. Easy access to search engines and smart phones can provide information almost instantaneously on a variety of important health care topics such as nutrition, disease prevention and maintenance, and stress reduction (Meyer, Coveney, & Ward, 2014; Richardson, Hamadani, & Gotay, 2013; Shegog et al., 2013). The amount of information available to the public is greater now than at any other point in history (Andrejeviic, 2013). According to Statistics Canada (2010), in 2005, 57.9% of the Canadian population reported using the Internet to search for medical or health related information. In 2009, that number grew to 69.9% of the population (Stats Can, 2010). High levels of Internet access may provide health promoters with the ability to present knowledge to a wide body of the population with a quick, easy, and cost effective form of delivery. Currently, there is little evidence (Edwards et. al., 2016) that public health practitioners and users participate in the design of health apps and most apps do not incorporate theoretically consistent behavior change strategies. In addition, while on one hand, this high availability of information may provide individuals the opportunity to manage and take control over their own health, on the other hand, it may provide the individual with too many choices or contradictory information which may lead them to resort to old and familiar habits (Meyer et al., 2014).

According to the American Heart Association, numerous innovations in health information technology are empowering individuals to assume a more active role in monitoring and managing their chronic conditions and therapeutic regimes, as well as their health and wellness (Burke et al. 2015). Over 100,000 health applications (mobile

apps) are available worldwide for smartphones with exercise, diet and weight management apps being the most popular download e.g., My Fitness Pal, Weight Watchers, Map My Run (Edwards et al., 2016). While there are successful health applications of gamification on Super Nintendo, Nintendo Wii and personal computers, gamification in mobile health is, perhaps surprisingly, a relatively new concept (Edwards et al., 2016). While mobile apps may have the potential for improving the health of the populace, the pace of science in evaluating these apps has not kept pace with business and industry sectors and consumer demands (Burke et al., 2015). Thus, evaluation and research in this area is a significant need as there are concerns that the health-promoting smartphone apps being developed fail to incorporate evidence-based content and that rigorous testing to provide efficacy data is trailing behind their adoption (Burke et al., 2015).

While there is a growing body of literature on the efficacy and usability with such devices (Arhippainen & Tahti, 2003; Edwards., 2016; Harrison, Flood, & Duce, 2013), little evaluation has occurred in Nova Scotia to date. The overall aim of this research study is to evaluate the mobile app “Addo,” designed by Moses Robicheau, founder of a Nova Scotia-based start-up company, as a mobile app challenge designed to help individual employees make healthier lifestyle choices based on four concepts of wellness: physical fitness, nutrition, mental health, and social wellbeing. The specific research question is:

1.1. Research Question

- What is the reach, efficacy, adoption, implementation and maintenance of the Addo platform?

This chapter introduces Addo the mobile app, summarizes workplace interventions to improve health, and introduces the topic of health behavior change and the framework on which the research is based.

1.2. Introduction to Addo

Addo's platform is a gamified mobile app designed to provide positive reinforcement at an individual level to achieve healthy behavior change (M. Robicheau, personal communication, August 17, 2015). Users are encouraged to improve their health behavior choices in a competitive fashion by earning points for certain behaviors such as fruit and vegetable consumption, minutes of physical activity, meditation, or acts of kindness. Points are collected cumulatively over the course of the challenge and made visible to all users on a Leaderboard. The Leaderboard is designed to enable competition and allows users to gauge how they are doing amongst their peers.

Addo uses a 21-day challenge system to engage individuals and identifies a mandate to “promote simple and attainable goals, which users can set and achieve” (M. Robicheau, personal communication, August 17, 2015). During each 21-day mobile app challenge, a total of 16 challenges are presented on the platform and the individual user chooses which challenges to accept. Successful completion of a challenge enables users to earn points and compete with her or his colleagues. Addo users earn points by logging their specific healthy activities using the online platform. Points are awarded for each challenge based on difficulty of attainment. For example, the longer it takes to complete a challenge, the more points the individual is awarded (e.g. 30 minutes of cardiovascular activity compared to 10 minutes of meditation).

According to M. Robicheau (personal communication, August 17, 2015), Addo uses a system that analyses user data in an attempt to reinforce behavior with a rewards and notification system that is continuously refined and tailored to each user. Additionally, users receive notifications and incentives based on completion of past challenges. The Addo system was designed to be implemented at the individual level, requiring no assistance from an administrator. Users are required to complete an initial set-up to download the mobile app and create a user name but receive no additional information or communication external to the mobile app. Addo may also be adopted at an organizational level. In this instance, the organization such as the workplace, is responsible for rewarding employees based on scores or points earned and encouraging collegiality. The founder of Addo did not develop the mobile app to be specific to the workplace, but rather to a broader community context including the fitness and educational markets (M. Robicheau, personal communication, August 17, 2015).

It is important to note that at this time Addo was a relatively new start-up company. The platform had previously been used with positive response. Of these previous users, 77 completed a user feedback survey assessing overall usability of Addo. The student investigator received access to these results and they are described in greater detail in Chapter 3, Methodology. The student investigator was interested in health behaviors in a set population of working employees, in part due to her position as a personal trainer in three facilities in the Halifax Regional Municipality (see further details in Chapter 3 - Methodology). Addo was presented as an opportunity to influence the development and real-world application of a health and wellness mobile app. Following conversations with Addo's founder, a review of its mandate and a literature review search

on health behavior theories upon which the platform was based, the decision was made to conduct a process and outcome evaluation of Addo.

1.3. Workplace interventions to improve health

For the purpose of this study, the workplace environment can be described as a unique community culture for employees. The essence of community is that something is “shared,” in this context, the working environment. Culture has been defined in a number of ways, but most simply, as the learned and shared behavior of a community of interacting human beings (Useem & Useem, 1963). The aspect of community and interactions in the working environment is important to consider when delivering a health and wellness program due to the complexity of employee roles, the physical environment, job descriptions and flexibility of working hours.

The concept of the working environment is recognized as an important predictor of employee health and a reflection of the overarching environment, although its influence on the delivery and engagement in health promotion programs is not adequately understood (Zwetsloot & Leka, 2010). Workplaces are viewed as promising sites for health promotion due to the availability and access of the population (65%) aged 16 years and older (Deitz, Cook, Hersch, & Leaf, 2014). If Workplace Wellness Programs (WWPs) are done effectively, due to their nature, they can positively impact populations at risk for lifestyle behaviors linked to the prevalence and burden of obesity, stress, inactivity, and other unhealthy habits at an age when interventions can still change the long-term health trajectory of employees. This is meaningful from an organizational perspective because on average, health care costs increase with the age of employees, however, previous research found that health risk factors could have more effect on

health care costs than age alone (Pitt-Catsouphes, James & Matz-Costa, 2014). That is, the average person age 65-74 with low health risk factors typically has lower annual medical expenses compared with someone whose age is 45-54 with moderate health risks (Pitt-Catsouphes et. al. 2014). As the population of Canada continues to age, health intervention strategies must evolve and be designed to support workers at different points across the life span (Truxillo, Cadiz & Hammer, 2014). Employees in sedentary jobs can be considered an appropriate population to target for health and wellness programs because of the prevalence of lifestyle-related diseases, such as heart disease, diabetes, obesity, and certain types of cancer, that occur in part due to a lack of routine activity at their worksite.

It is appropriate that this research occurred in Nova Scotia due to the high rates of chronic illness in the province. An environmental scan from the Nova Scotia Health Research Foundation (2009) reports sixty-four percent of all deaths in Nova Scotia are attributed to one of four types of chronic diseases every year: cancer, cardiovascular disease, chronic respiratory disease and diabetes. Additionally, Nova Scotians report the third highest percentage of diabetes (NS: 6.8%, Canada: 5.8%) and the highest percentages of arthritis or rheumatism (NS: 23%, Canada: 12%) and asthma (NS: 10.8%, Canada: 8%) (Stats Can, 2009). From a primary care perspective, it is beneficial to improve the health of Nova Scotians. WWPs are a growing trend among many organizations throughout North America although implementation, effectiveness, and usability is still largely unknown, with very little information on outcomes from within the Atlantic Provinces (Medysis, 2008).

1.4. Computer interventions in workplaces

Addo was designed to reflect principles of behaviour change techniques, which are based on well-established theories of human behavior change: The Theory of Reasoned Action, Social Cognitive Theory, and The Health Belief Model. These theories and their link to Addo are introduced here and further described in Chapter 2, literature review. Skinner (1938) proposed that the frequency of a behavior is determined by its consequences or reinforcements (as cited in Schlinger & Normand, 2013). A behavior change technique is an observable, replicable and irreducible component of an intervention designed to alter or redirect causal processes that regulate behavior; that is, a technique is proposed to be an active ingredient (e.g., feedback, self-monitoring, reinforcement; Edwards et al., 2016). Previous research supports computer-tailored interventions designed to target specific health behaviors such as smoking, diet, and physical activity in their ability to motivate lifestyle changes (Spittaels, De Bourdeaudhuij, Brug, & Vandelanotte, 2007); however few published studies have evaluated the effects of such tailored interventions as part of a WWP (Edwards et al. 2016; McHugh & Suggs, 2012).

Web-based interventions may have the potential to affect behavior change theories, but the actual public health impact and perspectives of users and organizations remains unclear (Kohl, Crutzen, & de Vries, 2013). In addition, the actual reach and use of interventions (process evaluation) should be considered in any such evaluation, as even the most promising intervention will not have a public health impact if it does not reach employees or the intervention itself is not being utilized (Kohl et al., 2013). The limited literature on the usage, effectiveness, and behavior change outcomes resulting

from workplace wellness initiatives (especially those involving a mobile app) provided a starting point for this research.

While there is a body of literature describing computer-based interventions as effective in enhancing the learning and retention of health-related materials and promoting behavior change theories (Deitz et al., 2014; Edwards et al., 2016), when evaluated in health services research studies, outcomes often fail to translate into meaningful human behavior changes across multiple contexts. In fact, some estimates indicate that two-thirds of organizations' efforts to implement change fail (Damschroder, Aron, Keith, Kirsh, Alexander, & Lowery, 2009). Given the potential variability of results (Edwards et al., 2016), evaluation is a critical component in addressing facilitators and barriers of implementing change and should be of interest to employers or stakeholders investing in workplace wellness initiatives.

Although WWP are prevalent in organizations, both large and small, there is a well-recognized gap between what is seen in research and the implementation of these strategies in real-life settings (Lane, Murphy, & Bauman, 2013; McGinnis & Foege, 2000). Previous research suggests that clarifying the factors that impact behavior modifications may contribute to successful implementation of future interventions (Butterfoss, 2006).

1.5. Process and Outcome Evaluation

Evaluation is defined as a systematic examination and assessment of the features of an initiative and its effects, in order to produce information that can be used by those who have an interest in its improvement or effectiveness (World Health Organization [WHO], 1998). Process evaluation is used to monitor and document program implementation and can aid in understanding the relationship between specific program

elements and program outcomes (Saunders, Evans, & Joshi, 2005). Process evaluations ask about the reach of a program, program activities and when and where they occurred, and barriers and facilitators of implementation (CDC, 2014). Additionally, process evaluation can have a vital role in understanding the feasibility of the intervention and provides greater confidence in conclusions about effectiveness by assessing the quantity and quality of what was delivered, and assessing the generalizability of its effectiveness by understanding the role of context (Moore et. al. 2015).

In the case of Addo and in accordance with the RE-AIM framework (details below), the evaluation assessed who used Addo (reach), how frequently (dose), and how users actually used Addo (fidelity to intended use). Determining who used the program and how provides administrators with knowledge of the extent to which the intervention was implemented as planned. Dose exposure identifies which participants actively engage with, interact with, are receptive to, and use the program platform. The dose satisfaction and reach is intended to measure the proportion of the audience that uses the mobile app in comparison with the intentions established by the Addo founder.

Outcome evaluations measure the progress of program participants in meeting the desired goals and objectives of a program (CDC, 2014). Addo was designed to have a positive influence on the health behaviors of individuals, hence the use of health outcome measures for this research. The outcome measures determine the motivation and ability of the individuals to gain access to, understand, and use information in ways that promote and maintain good health and are needed to assess and interpret the casual link between the intervention and intended or actual performed behavior (Engbers, 2008).

1.6. Research framework for the evaluation: RE-AIM

The evaluation process of this research was designed following the framework of: Reach, Efficacy, Adoption, Implementation, and Maintenance (RE-AIM), a widely used framework developed to enhance the impact of health promotion interventions using the dimensions considered most relevant to real-world implementation (King, Glasgow, & Leeman-Castillo, 2010). The RE-AIM model was used to describe the process and outcome variables of the intervention (mobile app) in terms of five dimensions: the reach or how many individuals participated in the intervention (mobile app), whether or not they adopted the mobile app into their everyday routine, the effectiveness of the program to impact human behavior change, the implementation or whether or not the program was used as intended, and maintenance, i.e., whether they continued with their health improvements over time. A detailed description of each section of the RE-AIM model in relation to the specific components of the Addo implementation process can be found in Chapter 3.

1.7. Potential Significance

As previously mentioned, there is room for improvement for the current health status of Nova Scotians. With 64% of all deaths in Nova Scotia attributed to chronic diseases every year (NSHRF, 2009), innovative avenues for improving overall health and wellness have the potential to impact future outcomes. Additionally, consumers are keen to access health information on their mobile devices and over 500 million people globally currently use mobile health applications (Edwards et al., 2016). This shift in technology may provide smart phone users with the motivation and tools to improve their health behaviors and in theory, reduce their risk of chronic diseases. Healthcare costs in Canada

are on the rise and initiatives that can prevent chronic diseases are receiving greater attention. In Nova Scotia, the largest departmental expense is health and wellness, which accounts for approximately 40% of total expenses in 2015-16 (Nova Scotia Health Authority, 2016). Additionally, 80% of employees in the province have at least one modifiable risk factor such as blood pressure, smoking, diabetes, stress, obesity, or sedentary behavior. The workplace intervention or use of the mobile app in this research provides the starting blocks of opportunity for organizations in Nova Scotia to support lifestyle changes and reduce the prevalence of disease among employees (Makrides et al., 2011). This research has the potential to add to the existing body of knowledge on the delivery process, use, and efficacy associated with using a mobile app to improve health.

This chapter provided background information on workplace health promotion, online intervention tools and outlined the research evaluation process for the mobile app, Addo. Chapter 2 will examine the literature on workplace wellness and health behavior change theories. Chapter 3 provides details on the use of the RE-AIM framework and the research methodology, Chapter 4 presents the results of the research, Chapter 5 the discussion and Chapter 6 conclusions.

Chapter 2: Literature Review

Workplace wellness dates back to the 1970s when the concept of workplace occupational health and safety initiatives began to emerge (Morrison & MacKinnon, 2008), but attention to WWP has increased in recent years. In 2002, a survey assessing the number one work priority of Canadians was career advancement; in 2012 it was work-life balance. In fact, nearly 40 percent of Canadian employees say they would leave a job for work-life balance reasons (Government of Canada, 2012). WWPs are designed to improve the health and wellbeing of employees and their dependents. The rationale is that participation in a WWP will lead to improved health, more engaged and happier employees, and improved workforce performance, all of which impact the organization's bottom line (Goetzel et al., 2015) and improve the overall health of employees.

Computer-based interventions are a recent addition to WWP programs. A few published studies support the effectiveness of computer-based tailored interventions to target specific health behaviors such as smoking, diet, and physical activity to induce lifestyle changes (McHugh & Suggs, 2012; Spittaels et al., 2007). In general, however, there is very limited research on the implementation process and effectiveness of WWPs in Canada, and even less research from the Atlantic Provinces. This is an important factor in the development and evaluation of mobile apps, because regardless of the strength of the finished product, if the app is not implemented sufficiently, the user experience will suffer. In addition, the extent to which mobile apps are shown to be efficacious at facilitating behavior change is unclear. At the same time, with over 100,000 health-

related apps available for download (Edwards et al., 2016), the potential for technology-based health interventions to impact populations is more possible than ever before (Payne et al., 2015).

This chapter summarizes literature related to the key components of this research: (1) workplace wellness, online interventions, mobile apps, and their impact on health improvements for employees, and (2) the impact of self-efficacy on health-related behavior change, and the predictors of success in maintaining health-related behavior change. The specific mobile app, Addo, was designed with self-efficacy and health-related behavior change theories in mind, therefore it is important to understand the context of these theories for the purpose of this evaluation.

The literature was searched using the following search engines; PubMed, Google Scholar, and the University of New Brunswick Library, PsycInfo, EMBASE and Web of Science. Keywords include

- “Workplace wellness OR Corporate wellness program AND Mobile app”
- “Canadian index of wellbeing AND Online health interventions workplace”
- “Health behavior self-efficacy OR Behavior change theory AND Workplace environment”
- “Mobile app OR Workplace wellness program AND Corporate culture”
- “Process evaluation OR Evaluation AND computer-based interventions OR Workplace wellness program”
- “Work culture AND Health behaviors”

2.1. What is known about workplace wellness, online interventions, mobile apps, and the impact of health improvements for employees?

Based on a systematic review of 13 relevant articles, workplace wellness programs still lack clarity and consensus as to what defines or constitutes a workplace wellness program, although based on the results of this review one definition emerged as: workplace-based programs that incorporate health promotion and disease prevention activities with the goal of improving the health of employees (Hind & Rouse, 2014). In general terms, additionally, workplace wellness can be described as addressing modifiable health risks through comprehensive individual and environmental efforts to promote the health of employees (Makrides et al., 2011). However, because WWP definitions, titles, target population, implementation, and execution vary greatly, defining and measuring WWPs can be complicated.

Many work sites engage in some sort of health promotion programming designed to improve worker health and reduce health care costs. In addition, workplace wellness has the advantage of access to employees at an age when interventions can still change their long-term health trajectory. This can be achieved through small changes in behavior in individuals, which may improve long-term health. With the current population trend of aging employees (Truxillo et al., 2014), it becomes even more essential to maintain healthy working environments to ensure productivity (for example, fewer doctor visits or hospitalizations). The graying of the Baby Boomer generation, combined with a decrease of birth rates, has resulted in a dramatic shift in worldwide demographics (Lavalliere et al., 2016). The aging of the workforce and a higher percentage of workers who will work

past traditional retirement age present significant challenges and opportunities for employers (Lavalliere et al., 2016).

Organizations cite a number of reasons for implementing WWP. A study conducted in 2008 by Medisys Health Group surveyed decision makers from a list of Canada's top 100 employers on their motivations for investing in health and wellness related programs. The top three reasons are to: (1) increase employee satisfaction and engagement (95%); (2) increase productivity (76%); and (3) improve corporate reputation (75%; Medisys, 2008). One quarter of the organizations reported that they do not measure the impact of their programs. Those that conducted evaluations reported that their programs exceeded expectations in regards to employee engagement and satisfaction, attracting talent, reducing employee turnover, decreasing disability and drug costs, and reducing absenteeism. Results from the Medisys Health Group (2008) study also indicated that employers who implement WWPs expect, and are satisfied, with less than half of their employees participating in their proposed initiatives. It is important to align corporate expectations with intervention goals and objectives.

Return on investment for WWPs is an ongoing research topic. Baicker et al. (2010) compiled a meta-analysis consisting of 32 original publications to assess the question of cost and savings associated with employer-based wellness promotion policies in the United States based on three criteria: (1) a well-defined treatment and comparison group; (2) a well-defined intervention; and (3) a representative analysis of a distinct new intervention. These characteristics were catalogued and a separate analysis was compiled of health care costs and absenteeism. Results from absenteeism were converted into

dollar cost units using a uniform wage rate to construct comparable estimates of return on investment. The average sample size of intervention groups exceeded 3,000 employees, and the size of comparison groups averaged about 4,500 employees. Although the studies examined programs for three years on average, most wellness programs continued beyond the study duration.

Based on the Baicker et al. (2010) analysis, a large positive return on investment was found, which suggests that wider adoption of WWPs could prove beneficial for corporate budgets as well as health. On average, the interventions produced \$358 in savings through reduced health costs per employee per year, while costing the employer \$144 per employee per year (Baicker et al., 2010). While this study provides supportive evidence for WWPs, the research did not address all aspects of WWPs. For example, 90% of the wellness programs were implemented in large firms of 1,000 or more employees. Little is known about employee wellness in smaller sized firms and whether smaller firms participate in workplace wellness programs and the quality of their employees' work life experience and health outcomes. Second, 80% of organizations in this study used the health risk assessment, which obtains self-reported baseline health data from the employee and is used by the employer to tailor subsequent interventions. This raises the question as to the transferability of these types of interventions from workplaces with many employees to those with fewer employees and the potential impact of these interventions. Understanding the needs of the employee and their workplace setting is critical as it enables the development of programs designed to best suit the population of the organization.

It is notable that WWPs are voluntary. The average participant tends to have a previously established general awareness of her or his health and the majority of these participants tend to be healthier from the outset. As such, WWPs may tend to not attract employees who are less health-conscious or who need extra motivation to improve their level of health. Lastly, program participation is often sporadic, lacking completeness of follow-up. Those who drop out are generally different than others in the sample, making longitudinal analysis difficult to complete. Even though positive benefits can be attributed to wellness programs, more research is needed in order to address barriers and enablers to successful interventions. More organizations of various sizes need to evaluate their WWPs, document their interventions and monitor participation rates and responses by employees. More research is needed to determine how to best address the needs of employees with the most severe health needs.

A systematic review with a final sample of 24 articles with the purpose of evaluating the potential of mobile apps to efficaciously disseminate health behaviour interventions shows mixed reviews (Payne et al., 2015). The results from the study are consistent with the previously mentioned Edwards et al. (2016) systematic review which indicates very few health and wellness mobile apps have been tested in intervention settings, and of those, the types of published, peer-reviewed mobile app studies that were available were predominantly small sample pilot or feasibility studies, instead of more rigorous randomized controlled trials with adequately powered samples (Payne et al., 2015).

The literature does illustrate high user acceptability of smartphone apps for health interventions. Specifically, many of the studies found that users want apps that are fast and easy to use and that allow for discrete interaction in public, with many users reporting being socially conscious of writing down or reporting personal data in public (Payne et al., 2015). In addition, many studies utilized such apps as part of a comprehensive intervention strategy, that is, the interventions were not specifically designed only for a smartphone, and the apps were used as part of a multicomponent strategy (Payne et al., 2015). This is noteworthy, as the chosen mobile app, Addo, is designed as a stand-alone challenge and not to be a part of a comprehensive intervention strategy. To what extent the population uses and adopts the mobile app Addo, impacts the overall evaluation, which in turn may hold future implications for the structure of the app.

According to Spittaels et al. (2007), online programs have contributed to significant changes in smoking, diet and physical activity; have the potential to provide individualized behavior change information at low cost; and have the advantage of reaching a wide variety of people at once, with the flexibility of any time and location. Working adults in the United States accessing a recent online program, HeartHealthy, showed significant improvement in the amount of overall physical activity they engaged in on a weekly basis, with particularly strong progress shown in the frequency of strenuous exercise (Deitz et al., 2014). These improvements were accompanied by significant improvements in exercise self-efficacy (Deitz et al., 2014).

Another web-based Behaviour Change Theory tool (ExecuPrev) showed a similar pattern of findings and showed that participants who used the online program made

significant changes over a control group in eating practices, diet-change self-efficacy, planning healthy eating, overall exercise, mild exercise and exercise self-efficacy (Deitz et al., 2014). In the HeartHealthy program, participants who showed an increase of self-efficacy at seven months also had increased levels of physical activity at 16 months (Deitz et al., 2014).

In contrast, a randomized trial of print versus website-based workplace physical activity programs showed no significant increase in physical activity in either group, although the website-based group showed a significant decrease in time reported sitting (Marshall, Leslie, Bauman, Marcus, & Owen, 2003). In addition, a similar study conducted by Spittaels et al. (2007) found minutes of sitting on both weekdays and weekend days significantly decreased for participants at a 6-month follow up.

A WWP influenced by primary-care prevention was created and implemented in the Department of Justice within the Nova Scotia Public Service of the Government of Nova Scotia and evaluated over a four-year period. The pilot study aimed to address: (1) concerns of modifiable risk factors such as hypertension, tobacco use, overweight, diabetes, or inactivity in employees in the workplace because of their high prevalence (up to 80% of Canadians aged 20-59); (2) the contribution of such risk factors to health-related outcomes and ill-health; and, (3) their association to rising health care costs (Makrides, 2011). The focus of the study aimed to improve strategies in the workplace that reduce high-risk factors and improve low risk maintenance in order to reduce employer cost and improve cost-savings. A total of 733 participants (approximately 60%

of eligible employees) participated in a baseline survey (the health risk assessment survey) at 12 sites.

The workplace wellness intervention (Makrides, 2011) consisted of programs and policies to support employees to make lifestyle changes to improve their health based on the following: annual health risk assessment, competitions to motivate employees (weight loss and healthy nutrition, pedometer walking contests); incentive programs, a variety of educational materials; and, one-on-one counselling via telephone and computer-based support across lifestyle risk factors. The pilot study reported on baseline and final screenings of 402 of the initial 733 employees through immediate post-intervention surveys for modifiable health risk prevalence, program outcome measures, and clinical and economic indicators.

Results of Makrides (2011) study vary due to a high non-compliance rate and additionally, did not factor in the extent of participation (sporadic participation compared to continuous participation). This indicates that there were no significant differences with respect to sex, age, cholesterol, nutrition score, fat score, fibre score, alcohol score, and fitness score between pre- and post-intervention. Statistically different results were found in the wellness score, blood pressure score, BMI, waist circumference, and average number of risk factors, with those completing only baseline measures and no participation in the intervention having less favourable scores. Sporadic participation or the lack of continued participation may act as a guide to influence the design of future WWP in their adoption and reach of employees and the effectiveness of the overall program. If the actual usage of a WWP is low or inconsistent, regardless of the quality of

information or tools provided, there will be limited knowledge translation or improved health outcomes. Social desirability bias and memory errors, such as forgetting to enter data, may have also led to over or underreporting of health behaviors (Makrides, 2011).

Understanding current trends in WWP's has the potential to influence future WWP's. The connection between an organization's health promotion program and overall business results is predicated on high employee awareness of and engagement in a WWP. A concern in some of the previous studies was a lack of participation and follow through. Employee turnover or retention could have an impact on program outcomes and poses challenges to long-term change. A further assumption is that participation in the workplace program will lead to improved health, more engaged and happier employees, and to improved workforce performance, all of which impact the organization's bottom line (Goetzel et al., 2015). Literature to date indicates that more information is needed: to understand why employees are not participating in WWP's and how to improve engagement strategies, and to identify potential alternate avenues to target modifiable risk factors (Groetzel et al., 2015; Makrides, 2011; Payne et al., 2015).

2.2. What is the impact of self-efficacy on health-related behavior change and what are the predictors of success in maintaining such changes?

Based on the goal of Addo, which is to encourage people to lead healthier lifestyles, and considering that the design of Addo was based on behaviour-change principles, it is important to acknowledge the role of self-efficacy on health-related behavior change. To help define behavior change and maintenance, Strecher, DeVellis, Becker, and Rosenstock (1986) describe two functions: (1) expectations about the

outcomes that will result from engaging in a behavior; and, (2) expectations about the ability to engage in or execute the behavior. This is reflective of a person's belief about how capable he or she is about performing the behavior. It is important to understand that the concept of self-efficacy relates to beliefs about capabilities of performing specific behaviors in particular situations; self-efficacy does not refer to a personality characteristic or a global trait that operates independently of contextual factors (Stretcher et al., 1986). This means that an individual's efficacy expectations will vary greatly depending on the particular task and context of the task. It is inappropriate to characterize a person as having high or low self-efficacy without reference to the specific behavior and circumstance with which the efficacy judgment is associated. For the purpose of this research, self-efficacy is specific to the context of general health behaviors.

Empirical evidence supports the link between self-efficacy as a predictor of health behaviors. Extensive reviews (Holloway & Watson, 2002) of the literature have identified specific research studies that have discovered significant relationships between self-efficacy and a variety of health-related behaviors. Self-efficacy affects people's choices of behavioral settings, the amount of effort they will expend on a task, and the length of time they will persist in the face of obstacles (Holloway & Watson, 2002). When an individual faces a challenging behavior but has experienced successful performance in the past, his or her personal experience is the most potent source of efficacy expectations (Stretcher et al., 1986). Assessments of one's self-efficacy help determine the amount of effort an individual will expend and the length of time that such

effort will endure in response to problems and adverse encounters (Holloway & Watson, 2002).

The stronger the perceived self-efficacy, the more robust and resolute their efforts will be. Conversely, those who have a lower level of perceived self-efficacy will expend less effort and will be more inclined to abandon their attempts (Holloway & Watson, 2002). Therefore, if an individual has completed a challenging task previously, he or she will likely feel more confident in his or her abilities to complete the task again. In relation to the health behavior changes specific to the Addo platform, it is important to note that successful maintenance of behavior change interventions have been linked to individuals with high self-efficacy, as individuals are more likely to make a decision to embrace the intervention and exhibit committed use even in the face of obstacles (Damschroder et al., 2009). Based on this knowledge, it is reasonable to predict that individuals who have higher levels of self-efficacy related to health behaviors will be more likely to use and continue to use the mobile app, Addo.

There are numerous studies (Gillison et al., 2015; Teixeira et al., 2015) on the predictors of success in changing behaviors such as diabetes or obesity. However, Blissmer et al. (2010), indicate that there needs to be further examination of commonalities between factors related to successful maintenance across behaviors as tools for understanding how to build more effective multiple behavior interventions. The current research study on the evaluation of Addo looked specifically at the maintenance of multiple behavior changes in individuals based on four major pillars of wellness: exercise, mental health, nutrition, and social supports and community.

As previously mentioned, Addo was designed with the following behaviour change theories in mind: Social Cognitive Theory, the Theory of Reasoned Action, and the Health Belief Model. These models share the following dimensions in changing behavior: intentions to behave, environmental constraints impeding the behavior, skills, outcome expectancies, norms for the behavior, self-standards, and affect and self-confidence with respect to the behavior (Elder, Ayala, & Harris, 1999). In order for a behavior to change successfully, the individual must (1) have a strong positive intention or predisposition to perform a behavior; (2) face a minimum of information processing and physical, logistical and social environmental barriers to performing the behavior; (3) perceive her/himself as having the requisite skills for the behavior; (4) believe that material, social or other reinforcement will follow the behavior; (5) believe that there is normative pressure to perform and none sanctioning of the behavior; (6) believe that the behavior is consistent with the individual's self-image; (7) have a positive affect regarding the behavior and (8) encounter cues or enablers to engage in the behavior at the appropriate time and place (Elder et al., 1999).

Social cognitive theory is a highly prevalent and generally well-regarded conceptual framework within behavioral science that has been used to design a variety of behavioral interventions (Martin et al., 2015). According to social cognitive theory, health-compromising behaviors can be eliminated by self-regulatory efforts or enhanced through such behaviors as physical exercise, weight control, or preventive nutrition. The theory of reasoned action is a social cognitive theory of the relationships between attitudes and volitional behavior, which holds that intention is the immediate determinant

of behaviour, and that intentions are determined jointly by attitudes towards the behavior and perceived social pressures to engage in the behavior (Livingstone, 2008).

The adoption of health promoting behaviors is often viewed rather simplistically as a response to a threat to health. According to this view, individuals who become aware that their lifestyle puts them at risk for a threatening disease may make a deliberate decision to refrain from risky behaviors. This view of behavioral change is based on the questionable belief that individuals are rational beings who respond to a perceived risk in the most reasonable manner. Perceiving a health threat, based on social cognitive theory, appears to be a prerequisite for the motivation to end a risky behaviour (Schwarzer, 2001). People not only need to be aware of the existence of a health threat, they also need to understand the contingencies between their actions and subsequent outcomes. Smoking cessation programs, requiring usage of seatbelts, and drinking and driving campaigns have all resulted in positive change based on the impact of culture or societal norms, as these behaviors have become culturally unacceptable. The outcome expectancy of an action is among the most influential beliefs in the motivation to change (Schwarzer, 2001). People must be comfortable and familiar with the appropriate strategies in order to follow through with them.

In order for a WWP to successfully promote health behavior change, it must align with the individual's belief in her or his personal efficacy in applying the change. The individual's belief of whether or not she or he can make the behavior change is critical when people approach novel or difficult situations or try to adopt strenuous self-improvement regimens. Individuals attribute capabilities to themselves when they

forecast that they can change their behavior (Schwarzer, 2001). Social cognitive theory emphasizes the interactions between an individual's cognitions, on the one hand, and her or his behavior on the other, through processes such as self-efficacy and outcome expectancies. Outcome expectancies overlap with parallel concepts in the theory of reasoned action and the Health Belief Model. Outcome expectancies represent the expectancy that a positive outcome or consequence will occur as a function of the behavior. Self-efficacy (or self-confidence specific to a behavior) is a self-perception of having skills to perform the behavior (Elder et al., 1999).

The Health Belief Model holds that health behavior is a function of the perceptions an individual has of vulnerability to an illness and the perceived potential effectiveness of treatment with respect to deciding whether to seek medical attention. Developers of the Health Belief Model maintain that health-related behaviors are determined by whether individuals (1) perceive themselves to be susceptible to a particular health problem; (2) see this problem as serious; (3) are convinced that treatment or prevention activities are effective yet not overly costly in terms of money, effort, or pain and (4) are exposed to a cue to take a health action (Elder et al., 1999). In addition, the theory of reasoned action places relatively more emphasis on the concept of "behavioral intention," which in turn can be predicted by the individual's expectations regarding the outcomes of a behavior, attitudes toward the behavior, and normative beliefs the individual has with respect to what "influentials" (especially peers) would do in a specific situation (Elder et al., 1999).

Based on the previous literature outlining successful implementation of online health-related behavior change tools and the positive impact of self-efficacy and health belief models, the chosen mobile app may have the potential to encourage improvements in employees' general health behaviors. The previously mentioned literature supports the link between self-efficacy as a predictor of health behaviors, as well as self-efficacy as a link in the amount of effort individuals will expend on a task and the length of time they will persist in the face of obstacles. Self-efficacy is an important factor to measure in this evaluation because it may act as a predictor as to whether or not participants will adopt or use the Addo platform. As it is found that individuals who have a lower level of perceived self-efficacy will expend less effort and will be more inclined to abandon their attempts, it is noteworthy to monitor these perceived levels. In addition to self-efficacy, the literature has found that health behaviour theories can also influence positive health changes. As outlined in the literature review, these health theories can help enable individuals to engage in healthier behaviors by self-regulatory efforts, such as by becoming more aware of the existence of a health threat and understanding the contingencies between their actions and subsequent outcomes. Since Addo is based on these health behaviour change theories, it is a reasonable question to ask, does Addo help to facilitate behaviour change?

Chapter 3: Methodology

This research applied the RE-AIM framework to a process and outcome evaluation of the mobile app Addo using a convenience sample from workplaces in Nova Scotia. The evaluation included both a treatment and control consisting of adult employees who were recruited through a word-of-mouth strategy and Social Media. The evaluation was primarily quantitative: the treatment group received surveys, which was repeated at four time points and the control group received a similar survey, repeated at three time points. To supplement the survey results, the researcher conducted 10 brief qualitative interviews with the treatment group. This chapter describes the research framework, provides a detailed description of the tools of measurement, describes the RE-AIM framework in detail, outlines the recruitment strategy, describes the evaluation procedures, and concludes by providing an overview of the method of data analysis.

3.1. Ethics

The study followed the University of New Brunswick's ethics guidelines process; the research was reviewed and approved by the University of New Brunswick Research Ethics Board. The research project, in compliance with the Tri-Council Policy and with the UNB Policy indicated no risk of harm for human participants and was filed under the REB #2015-105.

3.2. Research Framework

The research began with an interview with the founder of Addo (see Appendix A) to familiarize the student investigator with how the mobile app worked, background information on the mobile app and the aspects of the evaluation that were of greatest interest. Topics included in the interview were the founder's intended target population (reach), his views on what constitutes high quality delivery of information (fidelity) and use (dose), his intentions and goals for users of the app and his expectations of the evaluation. During the interview and as previously mentioned in Chapter 1, the founder indicated that the company had created a survey intended to gauge user response and feedback for the mobile app. In order to provide an opportunity to compare feedback already obtained with the results of this research, these survey questions (see Appendix B) were incorporated into this research as part of the Health Behaviors Survey-A and used for the treatment group.

After the interview, tools were selected to assess the process and outcome evaluation of the Addo intervention, guided by the RE-AIM framework. The tools were selected to address all relevant components of the evaluation and the tools for the treatment and control groups were very similar. The Health Behaviors Survey for the treatment group (identified as Health Behaviors Survey-A) consisted of the Addo questions from the founder, plus the General Self-Efficacy Scale (see Appendix C) and RAND-SF-36 (see Appendix D). The Health Behaviors Survey for the control group omitted the Addo questions. The General Self-Efficacy scale was selected because it was a standardized and validated tool of measurement to assess an individual's self-efficacy

specific to their health behaviors. The RAND-SF-36 was chosen, also for its validated and standardized set of measurements, and also because of the components of measurement. The RAND-SF-36 is designed to measure physical health, abilities to complete day-to-day tasks, and emotional well-being which align with the physical and emotional health and wellbeing outcomes outlined in the goals of Addo.

The General Self-Efficacy Scale is a standardized instrument used to measure individual self-reported measures of self-efficacy relating to general and daily life. Once the results were obtained from participants, the student investigator, as per standardized instructions, analyzed the results of the completed scoring of the scale. Ratings were organized on a 4-point, Likert-type scale (1= Low to 4= High). The RAND-SF-36 is a standardized scale which consists of a set of generic, coherent, and easily administered quality-of-life measures organized into eight health concepts: physical functioning, bodily pain, role limitations due to personal or emotional problems, emotional well-being, social functioning, energy/fatigue, and general health perceptions. These measures are self-reported and are widely utilized by managed care organizations and by Medicare (USA) for routine monitoring and assessment of care outcomes in adult patients (RAND Corporation, 2015). Using the data from participants, the student investigator manually generated the overall health outcome scores with procedures developed (scoring instructions) in a two-step process designed by RAND (2015). Final scores were rated on a 5-point, Likert-type scale (1= Very Low to 5= Very High).

The previously mentioned survey were organized into one large survey intended for both Treatment and Control Groups. The surveys intended for the Control Group were

titled 'Health Behaviors Survey #1' through to 'Health Behaviors Survey #3' (see Appendix E) for a total of three surveys which included consistent measures: General Self-efficacy questionnaire (see Appendix C), the RAND SF-36 (see Appendix D), and demographic questions specific to involvement of WWPs within their workplace. The surveys intended for the Treatment Group were titled 'Health Behaviors Survey - A #1' through to 'Health Behaviors Survey – A #4' (see Appendix F) for a total of four surveys, which included consistent measures: the General Self-efficacy questionnaire (see Appendix C), the RAND SF-36 (see Appendix D), the Addo usage questionnaire (see Appendix B), and demographic questions. The treatment group were advised at Health Behavior Survey Time #1 to skip questions related to the Addo mobile app as they had not yet had exposure to the platform.

Overall, the study design ensured all members of the treatment group received all the essential elements of the intervention and that the evaluation was delivered in a comparable manner to all participants (Horner, Rew, & Torres, 2006). The control group received no intervention or communication other than the three online surveys. The evaluation was completed with both a treatment and a control group in order to add strength to the study. The control group helped to provide reliable baseline data to compare the results with the treatment group, and helped rule out situational or environmental influences such as age, sex, job or location. Both treatment and control groups were recruited through a convenience sample.

Both groups received the same two standardized and validated survey tools and questions specific to their organization's workplace wellness initiatives, while the

treatment groups received additional questions specific to Addo (see Appendix E for the control group Health Behavior Survey #1, #2, and #3 and Appendix F for the treatment group Health Behavior Survey-A #1, #2, #3, and #4). The control group received the Health Behaviors Survey a total of three times: #1 October 2015, #2 December 2015, and #3 February 2016. The treatment group received the Health Behaviors Survey – A, a total of four times: #1 October 2015, #2 November 2015, #3 December 2015, and #4 February 2016. This design allowed the student investigator to gauge participants' frequency of use of Addo, assess any intermediate effects of the program, and to maximize confidence that the evaluation was adequately capturing behavior changes due to the use of Addo (e.g., knowledge awareness, self-efficacy, social supports, beliefs and perceived environment).

Brief qualitative interviews of participants in the treatment group were conducted by the student investigator post-Addo mobile app in November 2015 (see Appendix G). The interview consisted of eight questions based on user perspectives of their Addo usage, and Addo's effectiveness, enjoyability, and applicability in the workplace. The purpose was to provide a descriptive perspective and gain a deeper understanding of perceptions and usability of the platform. The interviews were all completed in less than five minutes.

Ten participants were selected due to the total number of Addo users (n=44) and based on participant availability and usage scores. Usage scores were based on points found on the previously mentioned Leaderboard, which is a function of the mobile app and generated through completed challenges of individual users. Interviews were conducted with participants from a mixture of high scores (i.e., higher Addo users, n=4),

low scores (lower Addo users, n=4), and registered participants who did not log in to Addo or submit any points (n=2). The majority of interviews were conducted over the phone (n=6) to accommodate participant schedules, but were conducted in person when possible and all were audio-recorded. The student investigator transcribed all interviews verbatim.

The original research design was developed with the intent of conducting a post-mobile app interview with the Addo founder, Moses Robicheau, however he was not available because Addo ceased operations on March 9, 2016. Communication between the student investigator and the Addo founder became challenging between November 2015 and February 2016 and on March 9 2016, the student investigator was informed by Robicheau through email of the discontinuation of all future operations with the mobile app. The email suggested this decision was due to multiple reasons including the viability to continue operations and the potential lack of impact and negative perceptions about the app from previous users. The student investigator did not have research findings to communicate or discuss at this time. While this interview may have provided the research with further insight to the evaluation, the student investigator was able to use the participant interviews and Addo usage scores from the Leaderboard to maximize validity in the research process. Although the mobile app development was discontinued, this in itself was a result and did not negate the importance of examining the reach, efficacy, adoption, implementation and maintenance of the Addo platform and understanding the barriers and facilitators of implementation.

3.3. RE-AIM Framework

The RE-AIM (Reach, Effectiveness, Adoption, Implementation, and Maintenance) framework provides a practical means of evaluating health interventions and has been used primarily in studies (Hopkins et al., 2016; McGoey et al., 2016) focused on changing individual health behaviors (King et al., 2010). RE-AIM encourages health promoters and others to attend to essential elements of programs and policies to improve adoption and implementation that is sustainable, effective, and generalizable, and that can contribute to evidence-based health promotion (Glasgow, Boles, & Vogt, 2016). The RE-AIM framework is designed to ensure all components of evaluation are met, although it is not necessarily intended for use in the order implied by the acronym. For the purpose of this chapter, RE-AIM will be outlined in an order that reflects the series of events in the research methodology (Reach, Adoption, Efficacy, Implementation, and Maintenance).

The reach in RE-AIM pertains to individual-level (e.g., employee) participation and refers to the percentage and risk characteristics of the individuals who receive or are affected by a policy or program (Glasgow et al., 1999). For this research, the total reach for the intended population to participate was full-time employees from Purdy's Wharf, an office development in Halifax, Nova Scotia, Canada. Adoption operates at the setting level (the workplace) and addresses the percentage and representativeness of the organization or workplace that will conduct or adopt the given program (Glasgow et al., 2003; Glasgow et al., 1999). The factors associated with adoption include political and

cultural fit, cost, level of resources, and expertise required, and how similar a proposed service is to current practices of an organization or workplace (Glasgow et. al., 2003).

For the purpose of this evaluation, Addo was offered to individuals and organizations free of charge. This was done to improve accessibility of the Addo platform to a large range of workplace organizations regardless of their size or budget. In addition, the design of the Addo platform was created and intended for fully automated use, with requirements of minimal effort from an organization or employee in the implementation process. As previously mentioned, the original design to assess Addo, the mobile app, was through the level of activity or use of the program platform (the dose). This original research design was intended to assess the frequency of activity or logging into the platform and then compare it to the pattern of activity intended by the program developers (Donkin, 2013).

Due to the termination of program operations, the student investigator was unable to gain access to specific usage dose or activity logs in the form of analytics from the founder. However, the student investigator did have access to the previously mentioned Leaderboard, which showed the users' total points earned. The total points earned reflected higher or lower scores resulting from frequency of usage. These results and their relevance are described in detail in the results and discussion sections.

The efficacy or effectiveness of a program pertains to the impact of the intervention on specified outcome criteria and includes measures of intended results as well as potentially negative outcomes (Glasgow et al., 2003) This research was designed to assess effectiveness and measures of intended results through the use of the initial

interview with the Addo founder (see Appendix A). Pre-and post-Addo mobile app effectiveness was assessed through the use of survey questionnaire items in the validated general self-efficacy scale survey (see Appendix C), and the RAND SF-36 (see Appendix D). The General self-efficacy questionnaire and RAND-SF-36 surveys are supported by the previous literature outlining health behavior theories and used to assess behavioral quality of life, an additional aspect of effectiveness identified by RE-AIM (Glasgow et al., 1999). Additionally, post-implementation effectiveness was measured through the use of brief qualitative interviews (see Appendix G), with the specific question: “In your opinion, was doing daily challenges a helpful, or unhelpful way for you to make behavior changes in your health?”

Implementation refers to intervention integrity, or the quality and consistency of program delivery. A crucial question in determining which dimensions of an intervention may be practical enough to be effective in representative settings is “Was it delivered as intended?” (Glasgow et al., 2003; Glasgow et al., 1999). Implementation can be measured at both the individual level and the program level and for the purpose of this evaluation, the focus was on implementation at the individual level. At the individual level, measures of participation can be examined through adherence to regimes or follow-through with activities (Glasgow et al., 1999). The Addo platform, which is fully automated, provides employees with step-by-step instructions to register, begin, and use, all of which provide consistent program delivery to its users.

To assess implementation, or usage of the platform, individual usage scores, which are collected by the mobile app and displayed on the Leaderboard were monitored

and assessed to acknowledge individual usage. The qualitative interviews furthered the assessment of implementation with specific questions designed to measure participants' attitudes and perceptions of the platform (see Appendix G). To assess the internal validity of the intervention, fidelity strategies were used. Fidelity can be defined as the degree to which a program is implemented as intended by the program developers and it affects how well the program succeeds (Carroll et al., 2007). In this research, fidelity was assessed by comparing the results of an initial exploratory interview with the founder (see Appendix A) with questions specific to goals for the program such as 'What constitutes high quality delivery for each component of the Addo platform?' and 'What do you hope to get out of this evaluation?', and scores found from the Leaderboard.

At the individual level, maintenance refers to how well behavior changes hold up in the long term (Glasgow et al., 2003). Maintenance can be a major challenge in program interventions, as relapse following initial behavior change is ubiquitous (Glasgow et al., 1999). The monitoring of behavior change outcomes and change in self-efficacy scores were designed to assess maintenance via a three-month post-Addo mobile app follow up with the previously mentioned general self-efficacy scores (see Appendix C) and RAND-SF-36 questionnaire (see Appendix D). This component was critical in understanding the extent to which any behavior modifications became part of a routine or had an impact on the long-term outcomes of the individual. Components of the framework addressing specific dimensions of the RE-AIM framework can be found in Table 1:

3.4. Dimensions of the RE-AIM framework

Table 1. Dimensions of the RE-AIM framework

Reach	- Number of treatment group participants
Efficacy or Effectiveness	- Survey Questions: “Addo helped me change or improve my lifestyle behaviors” and “The component of Addo in which I improved the most was” - General self-efficacy questionnaire (pre and post Addo mobile app scores) - The RAND-SF 36 (pre and post Addo mobile app scores)
Adoption	- Percentage of treatment group who actually used the mobile app
Implementation	- Survey Questions: “How intuitive was the online platform to use?” and “Do you intend to do another Addo challenge?”
Maintenance	- Survey scores RAND-SF 36 questionnaire and General self-efficacy questionnaire (3 months post-Addo mobile app)

3.5. Recruitment:

3.5.1. Strategy

The student investigator designed and conducted the recruitment strategy for both the treatment and control groups with the aim of recruiting participants from a variety of occupational settings. At the time, the student investigator held the position of personal trainer at Purdy's Wharf Fitness Club, which is a fitness facility within a large complex of business organizations within the Halifax Regional Municipality. At that time, the fitness facility had 250 members, which permitted the student investigator, with the help of her colleagues, to target a large number of employees. Inclusion criteria for participants were to hold a full time-working position of at least 35 hours and to be between the ages of 18-65. The main recruitment strategy for both groups was an informal, word of mouth approach (see Appendix H for a sample template for details). While this strategy can traditionally be a challenging method for recruitment, it proved to be effective due to the large volume of clients and reach of the student investigator and her colleagues.

The treatment group was initially informed of the project, in person, and presented with an opportunity to participate in a WWP. An informal script was used by the student investigator and tailored for other personal training staff at Purdy's Wharf Fitness Club (see Appendix H for the script). In addition, a copy of the small recruitment advertisement circulated in a newsletter sent to all members of Purdy's Wharf Fitness Facility by electronic mail, scaled to size, can be found in Appendix I. Additionally, 10 organizations within Purdy's Wharf were recruited to participate at an organizational

level. The student investigator and the General Manager of Fitness and Recreational Services in Purdy's Wharf Fitness Club created an informal list of potential organizations to be contacted and electronic emails were sent to key contacts. A template of the target electronic emails and conversations can be found in Appendix L. There was no response from any of the recruitment letters.

Participants in the control group were recruited independently using word-of-mouth strategies (see Appendix J) at two other small fitness facilities at which the student investigator was employed, and through the use of online social media platforms, such as Facebook and LinkedIn (see Appendix K), which were not used as a recruitment method for the treatment group. The written advertisement on LinkedIn and Facebook can be found in the Appendix K. Based on the open link from Facebook and LinkedIn, it is possible that participants in the control group could have worked within Purdy's Wharf, but were not members of the fitness facility. Invitations were created and distributed independently and designed to have no crossover. It is unlikely that the control and test groups encountered one another due to the different strategies (word of mouth, social media, and the monthly newsletter). All communication with the control group was completed through the use of electronic mail.

While all participants were employees working within Nova Scotia, even within the province, there are large differences in cultural norms among workplaces in general. For example, what is acceptable or appropriate in the workplaces of academics may not be in a financial or legal workplace. In order to better understand the background of participants, the student investigator included demographic survey questions that asked

participants for their type of employment (job title), and workplace organization (employer).

Creation of the Addo Registration List All participants (treatment and control) who were recruited through word-of-mouth strategies received an email from the student investigator with a link that directed them to a typeform website. All participants (treatment and control) who were recruited either through the newsletter or social media advertisement, received a link in the posting which directed them to a typeform website. This website is referred to as the “Addo Registration List” and was created by the Addo founder (see Appendix M). The website was used to sort and store electronic mail addresses of interested participants, which enabled the student investigator to create a control and treatment group list to track participant survey completion over time. Addo had access to participants’ electronic mail addresses, which was part of the requirement for participation. The student investigator had access to the Leaderboard, which provided a cumulative listing of the participants’ point scores, but did not have access to specific frequency of participant log in scores.

3.5.2. Evaluation Procedures

In order to collect information prior to the start of the Addo challenge, the control group received Health Behavior Survey #1 and the treatment group received Health Behavior Survey-A #1 (although this survey contained questions about Addo usage, participants were asked to skip that section), and a consent form for participation in the project using Google Forms in October 2015. Participants were informed that the survey was brief with an expected completion time of five minutes. The control group received

an electronic mail confirmation thanking them for completing the survey and a reminder of the second survey to be sent in December. The treatment group received an electronic mail message thanking them for completing the survey and a prompt to register for the Addo mobile app and begin the challenge starting on October 14, 2015.

The Addo platform was designed to be user friendly and fully automated, and therefore, no further contact was made with treatment group participants by the student investigator or the Addo founder throughout the challenge, nor did the student investigator check the Leaderboard during the challenge. The control group did not participate in the challenge and therefore also had no contact.

In November 2015, at the end of the Addo challenge, Health Behavior Survey-A (this time, participants were asked to complete the questions about Addo) #2 was sent by electronic mail to the treatment group and participants were given a two-week period for completion. During this time, a total of 15 participants from the treatment group who were high, low, or non-users (based on Leaderboard results) were invited via electronic mail to participate in a brief interview about their experience with Addo (see Appendix D for the interview template). Ten people responded; all interviews were conducted by phone or in person, depending on participant preference, within a two-week time period.

The third phase of the evaluation was completed in December 2015. The control group received their second survey, Health Behavior Survey #2 and the treatment group was sent their third survey, Health Behavior Survey-A #3 (participants were asked again to complete the questions regarding Addo) by electronic mail and each group was given a two-week time period for completion.

The fourth and final phase consisted of administering a final survey to both the treatment and control groups. The control group received Health Behavior Survey #3 and the treatment group received Health Behavior Survey-A #4 (participants were asked to complete the questions regarding Addo one last time), by electronic mail. This phase was conducted in February of 2016, approximately three months after the initial survey. Hence, as indicated in Table 2 below, the treatment group received a total of four surveys and the control group received three.

3.5.3. Procedure Chart

Table 2. Procedure Chart

August 2015	October 2015	October 14th, 2015	November 2015	December 2015	February 2016
Interview w/ Founder of Addo + Access to previous users survey results	Treatment Group: Health Behavior Survey-A #1	Treatment Group: 21- Day Addo Challenge	Treatment Group: Health Behavior Survey-A #2 + Interviews	Treatment Group: Health Behavior Survey-A #3	Treatment Group: Health Behavior Survey-A #4
	Control Group: Health Behavior Survey #1	X	X	Control Group: Health Behavior Survey #2	Control Group: Health Behavior Survey #3

3.6. Data Analysis

The results of both the Health Behavior Survey and Health Behavior Survey-A were analyzed using the software package IBM SPSS Statistics, a widely used program for statistical analysis in social sciences. This software allowed the student investigator to obtain descriptive frequencies, mean and standard deviation of individual survey items, compare the survey results across time, and conduct a pairwise bi-variate model analysis and other analyses. All interviews were under 5 minutes in duration as responses were brief. After the student investigator transcribed the interviews verbatim, they were organized and grouped by key words.

Chapter 4: Results

This chapter describes the demographics of the participants before presenting the process and outcome results of the evaluation using the RE-AIM framework; the reach and adoption of the Addo program, the efficacy of the program to facilitate behavior change, the implementation or whether or not the program was used as intended, and participants' maintenance of behavior change.

4.1. Participant Description

A convenience sample of 102 employees from Nova Scotia volunteered to participate in the research study, 51 in the treatment group and 51 in the control group. The majority of participants lived in an urban setting, mainly within the Halifax Regional Municipality. Given that the fitness facilities where recruitment occurred were near or in downtown office complexes, it is not surprising that most of the participants were professionals. Occupations in both the treatment and control groups ranged from academia (28.8%), insurance/finance (18.6%), other (17.5%), health care (16.5%), law (12.4), and government (6.2%). All respondents were classified as full-time employees, working 35 hours or more, and between the ages of 20-69, with 55% between the ages of 20-39. In addition, the majority (82.9%) of all participants were female ($M=3.86$, $S.D.= 1.68$).

As part of the Health Behavior Survey, participants in both treatment and control groups were asked to rate their perceived level of general health on a 5-point Likert-type scale. At baseline, a large majority of participants (82%, $N=102$) rated themselves as having a level of health in the good to excellent range. At baseline, there was no

difference in age range, sex, overall health scores, or self-efficacy scores between the Treatment and Control Groups.

4.2. Reach and Adoption

Within the treatment group, usage rates of the mobile app were organized into two groups: participants who registered for the app but did not participate or log any points and participants who logged any amount of points throughout the 21-day competition. Because usage of the mobile app was sporadic, all users were grouped into the ‘usage’ category that logged any number of points, regardless if they logged one point or 1000 points. The following table (4.1 Addo Usage Scores) displays participant results of usage as taken from the Leaderboard once the Addo challenge was complete in November 2015.

4.2.1. Addo Usage Scores

Table 3. Addo Usage Score Treatment Group

Variable	November (n=44)
No Usage	39%
Usage	61%

Results from the treatment group’s usage scores had a high range of variability. Of the, 61% (n=44) of users, according to the Leaderboard and interviews held with high and low users, the majority of usage was completed sporadically. While a small amount of users may have logged points on most days, many users logged points one to two times over the course of the 21-day challenge in total. Although the majority of users

were shown to log points on the leaderboard, based on interviews with the treatment group, frequency of log in can be described as variable: “Once or twice [per day]”, “Only once”, or “every evening for probably four or five days”. The student investigator did not have access to the total points logged. The intended use of the mobile app was designed to be over a 21-day period, although based on the interviews of participants with both high and low usage scores, that majority of users did not use the mobile app consistently.

4.3. Efficacy

Based on survey results from the Health Behavior Survey-A #2, administered shortly after completion of the Addo challenge, 76.5% (n=44) agreed the user interface was easy to use, and 54% (n=44) of users agreed Addo was helpful in facilitating healthy behavior changes. Based on interview results, a small percentage (20%, n=10) of respondents indicated that the platform was “a bit convoluted” and “not user-friendly.”

As one participant explained:

Umm, I found it to be, repetitive. I found I would just log in, go tap tap tap, tap tap tap, Log out. So, after one week I stopped following it... it was just the same thing and then I would have to think back over the day. Oh yeah, so I had this many vegetables, oh how much water? Well I filled up my bottle three times? So tap tap tap. It just felt like I was going through motions and didn't really inspire me to do anything different.

4.4. Implementation

As previously mentioned, the extent to which the program was implemented as intended was evaluated relative to the results from the preliminary interview with the Addo founder compared to actual usage scores (the Addo Leaderboard), survey responses, and interview responses and is described in detail in the following paragraphs.

The Addo platform was offered to individuals as a trial sample, free of charge. According to the Addo founder, one indicator of successful implementation of the Addo platform would be organizational buy-in from a business or company to support employee participation in the initiative and additionally, to purchase the platform post-trial to run additional challenges. This did not happen in the research, although there is anecdotal evidence in which suggests there was limited buy-in from two organizations. As these organizations were not apart of the list of 10 organizations that were previously contacted by the student investigator to participate in the challenge, details of this process are not certain. In addition, anecdotal evidence suggests a small sample of employees outside of these two organizations formed their own group with the intent to motivate other employees and create teams among colleagues in order to create a supportive social environment. The results from the participant interviews indicate that peers may have provided some motivation. Interviewees with high scores on the Addo Leaderboard indicated they were part of a team or knew other participants who were registered. This social involvement described by one participant was considered valuable: *“I would love it if it was even more team oriented. Like if there were discussion boards so you could encourage each other on, umm, and I would like to get it more involved in the workplace*

next time, like actually having a bigger team'. Interviews with participants who had low scores on the Addo Leaderboard or logged no points (n=4) at all described the app as a platform that could be improved:

Well I wouldn't do Addo again because I didn't really understand what I was supposed to do ... But I would do a workplace wellness challenge. But I need like, something easy, user friendly, something easy to do, that prompts me on a daily basis. If it came up and said, like what have you done today? Or what did you do yesterday for physical activity, and I could type in a sentence and send it back that would be perfect.

An additional interview participant describes:

I am likely to participate in another workplace wellness challenge that could be like this, umm, because I think that it is a good initiative for companies to give to their employees. I don't think there is a one size fits all. There needs to be a lot of variety, options.

According to the founder, high quality delivery of implementation at the individual level can be defined as *"a noticeable difference, if you can see where people are walking or more people are packing their lunches. Something tangible. I think throughout the 21 days, seeing people actually change their behaviors or awareness"*.

Looking at the level of implementation at the individual level, of the total number of participants in the treatment group (n=51), 44 participants completed the Addo registration process, meaning they followed the URL link attached in the recruitment email (Appendix K) and created a free user account name to begin the Addo challenge.

These participants followed the standard process of downloading the app and completed at least one initial log in. The majority of participants used a consistent user name and electronic mail address, which allowed the student investigator to link usage scores to survey results after the Addo challenge.

Based on interview results, a recurring theme indicated that individuals either registered and were unsure what their next steps were, or they registered, logged points for a day or two, and then forgot about the challenge altogether, indicating a lack of engagement. Additionally, interviews with the treatment group described lack of motivation or attention to the platform as a main reason for disengagement, together with an overall general disinterest in the challenge itself. Participant interviews addressed the need for more interaction or push-notifications from the platform or frequent prompts. As one participant from the treatment group explains *“I only logged in once I think, to, during the whole time, because I think, I didn’t know, I didn’t know how to do it and nobody reminded me so therefore I wasn’t motivated to.”* In contrast, the Addo mandate expresses its intention to deliver tailored prompts and notifications based on user (in)activity, although many users did not feel engaged by the prompts or found notifications to be effective.

Participants were asked whether or not they would volunteer to participate in another Addo challenge. Based on survey results, 67% (n=44) of users would participate in another Addo challenge. In the interview, participants expressed mixed reviews on participating in another challenge, with hesitant responses such as: *“Um, No”*, *“Uh, probably not”*, and *“I don’t, uh, I don’t think so, no”*. Based on the total number of

participants in the treatment group, 39% (n=44) did not log any points or follow through with any usage of the platform. Roughly half of participants (54%, n=44) agreed they enjoyed using the Addo platform.

Participant responses from the treatment group survey indicate that component they enjoyed most was the exercise challenges, followed by challenges posed to facilitate psychological wellbeing. As users were recruited through a fitness facility, enjoyment of the fitness component is consistent with expected perceptions. The following results from Survey #2 indicate dimensions of the Addo platform users most enjoyed (Figure 4.1) and most improved (Figure 4.2).

Figure 4-1. Bar Graph outlining component of Addo most enjoyed (n=44)

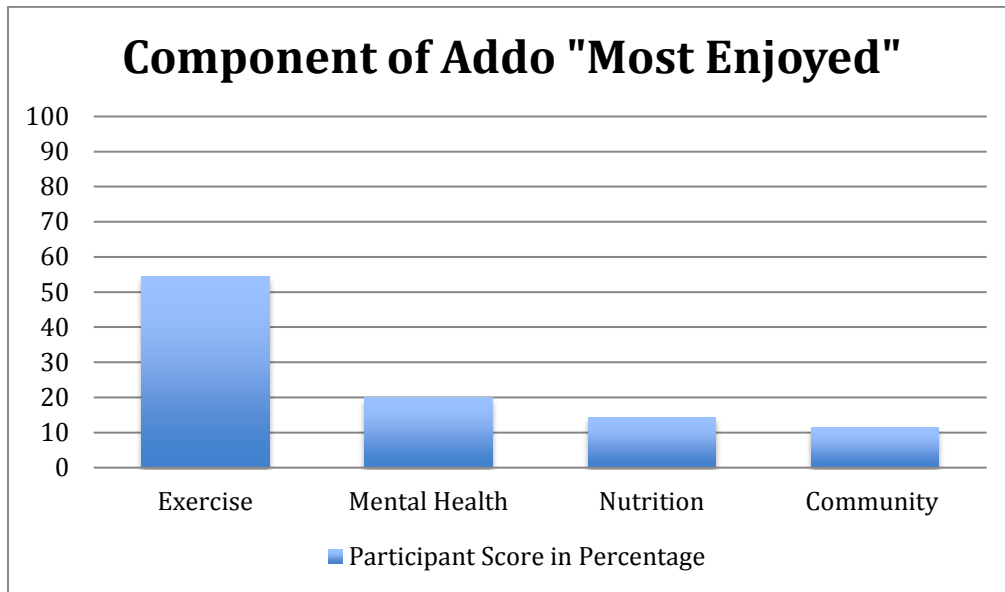
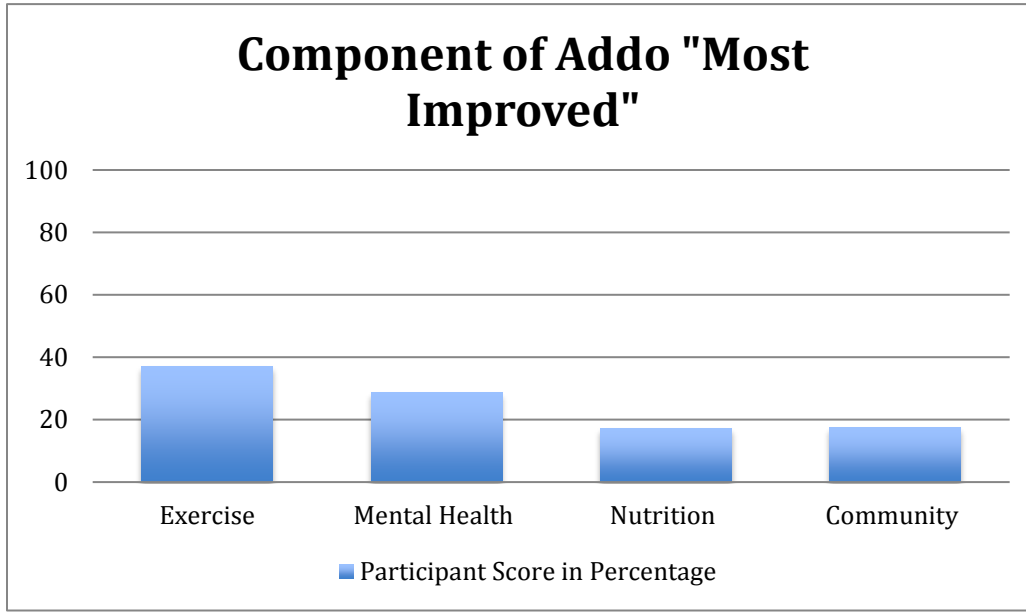


Figure 4-2. Bar Graph outlining component of Addo most improved (n=44)



4.5. Maintenance

The overall lack of participant usage of the Addo platform limits the evaluation of program maintenance over time. Based on the initial survey in October 2015 (Health Behavior Survey-A #1) sent prior to the use of the Addo mobile app, participants were asked the question, “In general, would you say your health is?” with answers ranging on a 5-point Likert Type Scale: 1 being excellent and 5 being poor. The majority, 77% (n=30), categorized themselves as one or two and only 2% (n=30) rated themselves with a four or five. Five months later in February 2016, the treatment group was sent Health Behavior Survey-A #4 and asked the same series of questions. Responses were consistent with 79% (n=24) of scores being a one or two, and 8% (n=24) as a four or five. In addition, the majority of the treatment group fell above the midline in self-perceived

general self-efficacy at each time point. These results indicate little room for overall improvement of perceptions of health outcomes and behaviors. A pairwise bivariate model was run to correlate general self-efficacy scores, overall RAND-SF-36 scores, and Addo usage scores. There was no change or correlation in any group over time; therefore there was no need to run a further analysis in any advanced models.

The following two tables present results compiled from the Treatment and Control Group Health Behaviors Survey at each time point. Table 4.2 represents the Treatment Group and describes the mean and standard deviation for general self-efficacy scores (4=High), and overall RAND-SF-36 scores (5=Very High): pre-Addo mobile app in October 2015, post-Addo mobile app in November 2015, post-Addo mobile app in December 2015, and post-Addo mobile app in February 2016. Table 4.3 represents the Control Group and describes the mean and standard deviation for general self-efficacy scores (4=High), and overall RAND-SF-36 scores (5=Very High): Time 1 October 2015, Time 2 December 2015, and Time 3 February 2016.

4.5.1. Treatment Group Health Behaviors Survey Time #1, #2, #3, and #4

Table 4 Treatment Group Health Behaviors Survey Time #1, #2, #3, and #4

Treatment Group	October (n=44)	November (n=31)	December (n=23)	February (n=24)
Variable	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)
General Self-Efficacy*	3.61 (.538)	3.65 (.486)	3.70 (.470)	3.71 (.464)
RAND Overall Score**	3.86 (.955)	3.90 (1.044)	3.96 (1.107)	3.90 (1.044)

*General Self-Efficacy scores are rated out of 4, indicating high

**RAND Overall scores are rated out of 5, indicating very high

4.5.2. Control Group Health Behaviors Survey Time #1, #2, and #3

Table 5 Control Group Health Behaviors Survey Time #1, #2, and #3

Control Group	October (n=51)	December (n=45)	February (n=42)
Variable	Mean (S.D.)	Mean (S.D.)	Mean (S.D.)
General Self-Efficacy*	3.79 (.453)	3.71 (.589)	3.81 (.397)
RAND Overall Score**	3.88 (.867)	4.11 (.910)	4.11 (.910)

*General Self-Efficacy scores are rated out of 4, indicating high

**RAND Overall scores are rated out of 5, indicating very high

The following Figure 4.3 represents the results of the general health scores and overall RAND-SF-36 scores at each time phase for the treatment group. Figure 4.4 represents the results of the general health scores and overall RAND-SF-36 scores at each time phase for the control group.

Figure 4-3. Graph representing mean descriptive statistics at each time phase for the treatment group

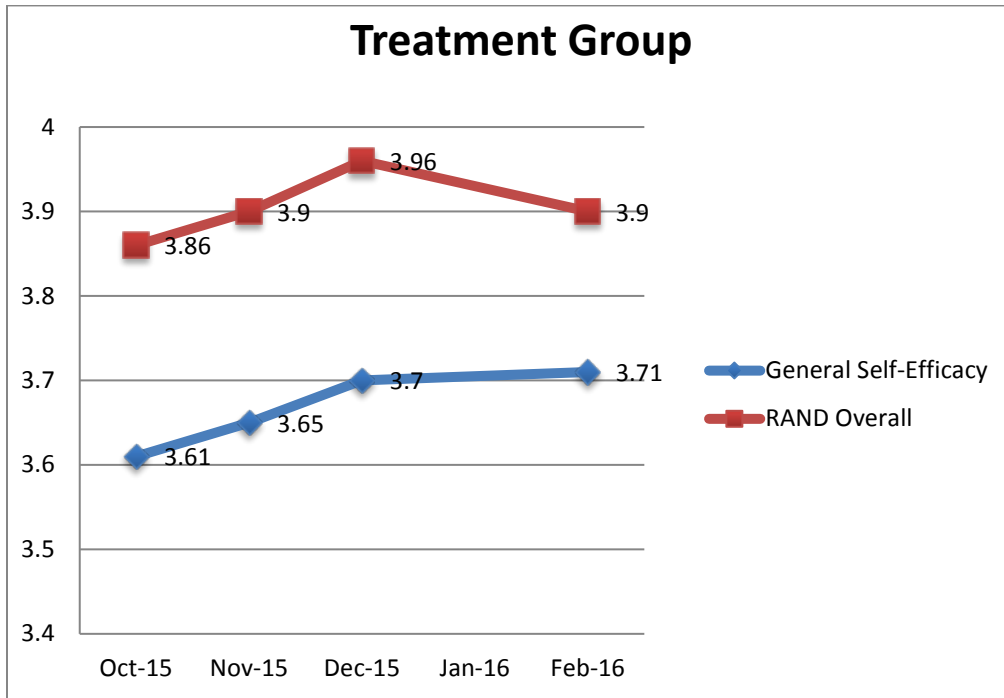
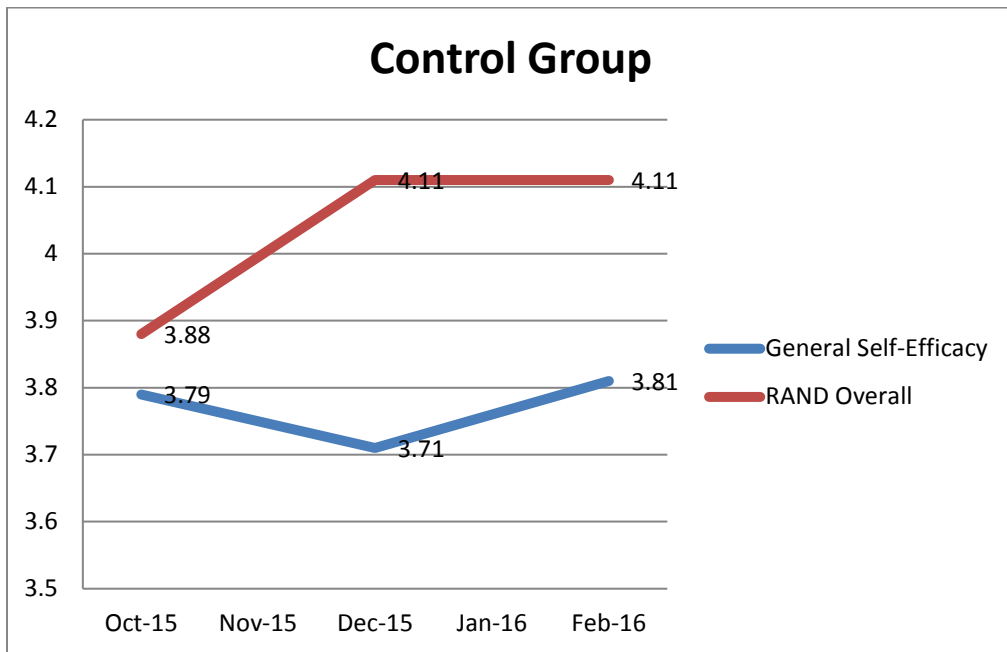


Figure 4-4. Graph representing mean descriptive statistics at each time phase for the control group



Based on Figure 4.3 and Figure 4.4, the results from the RAND overall scores and general self-efficacy scores did not have a significant change between October 2015 to February 2016 in either treatment or control groups.

The results from this section further indicate the lack of behavior change seen in both groups. The following provides a summary of these results in relation to the RE-AIM framework.

- In describing the reach and adoption of Addo, results from the treatment group's usage scores indicate that 61% (n=44) of users completed sporadic usage of the platform, logging points one to two times over the course of the 21-day challenge in total.

- Based on both survey response and interview response, users gave mixed reviews regarding the effectiveness of the Addo mobile app.
- Implementation was evaluated both at the organizational and individual level and compared with preliminary interviews results with the Addo founder. Addo was implemented minimally into workplaces at the organizational level and implemented sporadically at the individual level.
- Although there was an overall lack of implementation and use of the Addo mobile app, both Treatment and Control groups scored high levels of General Health and Self-Efficacy at baseline. Additionally, the perceived health scores were maintained at high levels throughout the process. The following chapter will discuss in detail these results and their potential implications.

Chapter 5: Discussion

This research study evaluated the mobile app “Addo,” which was designed to help employees make healthier lifestyle choices in the areas of physical fitness, nutrition, mental health, and social wellbeing. Overall, due to the positive self-perceived health of participants at baseline and the lack of implementation and usage of the mobile app by participants, it is apparent that this app had little influence on health behavior change.

5.1. Usage of the mobile app Addo

Overall, the results from the evaluation indicate that Addo had little impact on participants. There could be several reasons for this, including the already positive perceptions of employees regarding their health, the nature of the app and the un-engaging design of Addo, and the small ‘dose’ it provided.

As previously mentioned, the majority of users (77%, n=45) in the treatment group indicated in the Health Behaviors Survey-A #1 to have an above average score of general health and overall health score from the Rand-SF-36 tool. Additionally, the majority of users (64%, n=44) in the treatment group scored above the midline in self-perceived general self-efficacy. These findings suggest that the treatment group self-rated as being above average in overall health and their perceptions of general self-efficacy towards health behaviors. The above average results from the Health Behavior Survey-A #1 indicate that the group of participants started with a high baseline, which does not allow much room to improve. When people start off with high levels of health, it is debatable as to whether there is a need for an intervention. Although the literature

attributes higher self-efficacy with improved follow-through of behavior change (thus increasing the likelihood that these individuals would follow through with the usage of Addo), the results show the lack of uptake and indicate that they may not have felt that further improvement was needed.

Previous literature (Holloway & Watson, 2002), would suggest that this sample of individuals, due to high levels of general self-efficacy, would be likely to believe they hold the skills and/or abilities to follow through with decisions or actions related to health behavior change, although more research needs to be done to establish what motivates such individuals to participate and actively engage in similar programing. In addition, previous literature suggests that individuals who perceive themselves to be healthy are more likely to participate in a wellness program and openly share their perceived health status (Damschroder et al., 2009), which could help explain why the majority of participants registered for the program and completed each of the Health Behavior surveys.

The findings are consistent with the previously mentioned Baicker et al. (2010) study, describing the average participant in a WWP as someone holds a previously established general awareness of her/his health and the tendency to have a higher level of health from the outset. Although the participants in this study reported high levels of general health and self-efficacy, there was not a large uptake or follow through with the mobile app; many did not actually use it. In this research, participants were recruited from a fitness facility, which may also reinforce that they were already interested in their health. The fact that their self-assessed health behavior scores were relatively high may

indicate that they also had positive behaviors in the other areas addressed by the app such as mental health, nutrition or community involvement. The combination of high baseline scores with an overall lack of implementation of the Addo platform make it difficult to draw any conclusions regarding human behavior change as a result of Addo.

Typically, those that do not participate in WWPs tend to be employees who are less health-conscious or who may need the extra motivation to improve their level of health. This further suggests the question, how do health promoters target individuals who are less health conscious and may need the motivation the most? This study's population sample suggests that individuals who participate in a WWP tend to hold a previous foundation of awareness for their health behaviors and may be the healthiest subset of employees. In contrast to the literature, however, the study's results show that this healthier subset of employees did not follow through with the health promotion activity encouraged by the mobile app. Although the participants perceived themselves to hold high levels of overall health, their adoption of the mobile app was found to be low with many users (39%, n=45) indicating no usage of the app, and the majority of participants who did use the app, used it sporadically. These findings suggest that the Addo tool did not deliver the results as was intended by its creators, as the intention was for usage of the app to be consistent over a 21-day period.

Some of the responsibility for non-use lies with the app itself: the termination of operations speaks to this. Addo's mandate was to promote simple and attainable goals, which users could set and achieve. The results of the study show that the majority of users did not find the challenges to be engaging or interactive enough to maintain their attention.

Attitudes, perceptions and usage rates of the chosen mobile app indicate the need to re-visit the Addo approach in order to improve implementation. An alternative to developing new apps is to capitalize on apps that are already established. The growing trend of mobile apps to improve health behaviors, such as “Nike Fitness”, “My Fitness Pal”, meditation tools “Headspace” and “Calm”, or nutrition applications “Weight Watchers” or “Zoom” are growing in popularity, although this does not necessarily mean that they are effective. This research did not ask about participants’ use of other apps and if that use impacted their decision to use or not use Addo, or if use of other apps affected their health behaviors.

Furthermore, it is important to consider the potential behavior change ‘dose’ of this app. One to two uses per day at most to prompt behavior change, in the myriad of health related daily decisions may be too small a dose to have impact. The use of a mobile app is considered one dimension of a WWP. Programs with multiple components, such as an online tool in conjunction with additional forms of health behavior tools, could have more of an impact, as multi-dimension interventions have the ability to influence users on many different levels and capture a wider reach. Additionally participants indicated additional prompts or notifications could be helpful. For example, reminders to log points may have improved interest and encouraged participants to continue. Based on this research, it is questionable where an app can be an effective standalone tool; it may be more effective when used in conjunction with other strategies.

5.2. Barriers and facilitators to implementation

Due to the underwhelming level of uptake and implementation of the Addo platform, assessing potential barriers and enablers to facilitating workplace wellness

programs may help inform future development and implementation of programs. Based on the Grol and Wensing (2004) framework, barriers and enablers should be assessed through three avenues: (1) relating to individual professionals, (2) relating to social context, and (3) relating to organizational and economic context. The following paragraphs will examine these avenues in greater detail.

In relation to individual professionals, or employees working within an organization, having an educational component in a WWP can act as a barrier based on the variety of individual learning needs and strategies, individual perceived behavioral control, self-efficacy, social norms, and varying stages of motivation. The Addo mobile app was designed to tailor its behavior changes to accommodate the individual user. However, because the majority of individuals did not follow through with the use of the mobile app, there was no uptake of information by the intended individual. It is not clear the extent that social context, leadership styles and level of commitment, existing values and programs, and opinions of key people impacted the lack of implementation.

One participant, who was interested in the implementation of WWPs, suggested that a lack of awareness of existing program initiatives and lack of knowledge of current activities by employees outside of the workplace could act as major barriers to implementing WWP. Additionally, organizations and their employees are often unsure where to begin, invest, or where to target their efforts, as they are unaware of what programs or interventions employees are currently being exposed to, and what is or is not currently working. One strategy to encourage participation in WWPs is the use of incentives (Makrides, 2011), as they may help encourage employees to take part in

activities that they would not generally do to practice healthier behaviors. The most commonly cited incentive for participating in a WWP according to a research study conducted by Kruger et al. (2007) was a convenient time, convenient location, and paid time off to do so. While the mobile app Addo could conveniently be used at any location with an internet connection, there were no other incentives for using it other than ‘bragging rights’ to be high on the Leaderboard..

From an individual or employee perspective, behavior changes or the motivation to create behavior changes will vary based on many factors such as age, gender, job role or title, level of income, family and social support, rural versus urban living, seasonal work, and many more. In addition, based on the individual, an employee may perceive a WWP to be a bonus or helpful incentive to help form healthy habits, or it may be an additional bother or nuisance adding stress to the workday that an employee would prefer to do on their own time or not at all. If an employee is interested in participating in a workplace wellness initiative, the individual’s awareness, motivation, attitude and beliefs play a large role in their level of commitment. In addition, the lack of adoption, reach, and implementation of the Addo app was a large barrier, as the overwhelming majority did not share an interest in using the mobile app to change their lifestyle behaviors while in their working environment.

5.3. Cultural fit in the Workplace

For the purpose of this study, the workplace environment can be described as a unique community culture for employees. Culture has been defined in a number of ways, but most simply, as the learned and shared behavior of a community of interacting human

beings (Useem & Useem, 1963). This is an important aspect to consider when evaluating the implementation of a tool designed to influence human health behaviors in a complex environment. The concept of the workplace environment is recognized as a predictor of employee health and a reflection of the overarching environment, but its influence on the delivery and engagement in health promotion programs is not adequately understood (Zwetsloot & Leka, 2010).

This research was important because it helped fill a data gap regarding the use and impact of apps in the workplace. The results from this evaluation indicated little need for this app, low use, and no impact, all of which can help inform future app development: first to ensure there is a need for a proposed app within a particular workplace population (i.e., is it reaching its intended audience), second, to ensure that the qualities of the app will engage employees in adopting and implementing the app's objectives, and third, that the 'dose' of the app and its design is sufficient to achieve and maintain positive health impact (either as a stand-alone intervention or in combination with other health promoting strategies). As the app market for health promotion continues to grow, it is important that evidence-based evaluation inform their development and use.

Given the low implementation of the mobile app (39%, n=45, of the treatment group did not register for the Addo app, but did complete the Health Behavior Survey-A #2, post-Addo mobile app), impactful outcomes cannot be expected. The majority of users (76%, n=31) found the platform easy to use in terms of how to log into the platform, knowledge of tasks to complete, and how to score points, although did not find it an effective tool to implement healthy behavior changes (57%, n=31). Additionally,

almost half the individuals (46%, n=45) disagree that the mobile app was helpful in assisting them to achieve behavior change. If the majority of individuals forget to log points, or do not follow through with the program, the health-behavior information provided by Addo, regardless of its quality, will not reach the intended population.

These results could have something to do with the environment, social norms, culture, as well as the Addo app itself. Additionally, these findings may imply that the workplace was not an appropriate venue for the mobile app. Given the nature of the device, participants were expected to log points once or twice per day. Looking broadly at the environment and culture of the workplace, it cannot be expected employees will log points, or participate in a WWP challenge after working hours as it is intended to be part of the working day, and this could be seen as taking time away from personal leisure, family or household activities. In addition, when considering the use of apps in workplaces, it is important to remember that many organizations have firewalls or deny access to certain social media platforms, which may deter the use of a mobile app.

Future research assessing specific characteristics of WWPs may help in understanding how to further improve and tailor interventions that target a wide range of employees with varying levels of health and needs. In populations where need is greater or where apps are more motivating, a more positive outcome is possible than occurred with this research. While this research appeared to have no negative impact on participants, it is important to consider that implementing a program into the workplace that may not be user-friendly or actively engaging for all employees at every level has the potential for negative effects of the program in terms of self-efficacy and behavior

change motivation. This is an important factor to consider, as the aim of a WWP is to encourage the employee to create healthier lifestyle alternatives and not to discourage or produce feelings of guilt, insecurities, or shame towards their current behaviors.

5.4. Study Strengths

The research design was created with both a Treatment and Control Group, which adds significant strength and validity to the methodology and results of this project. The use of the RE-AIM framework further adds significant strength to the research design as it provided valuable guidelines and a consistent point of reference throughout the evaluation. In addition, the sample size for both groups remained reasonably consistent throughout the process. Surveys were completed over a six-month period, to assess for maintenance of perceived health scores, self-efficacy, and views on the Addo mobile app. The Health Behaviors Survey is comprised of three validated and widely used health surveys and follow standardized scoring. The addition of the interviews provided useful insights into the results of the study and the usability of the mobile app.

5.5. Student Investigator Potential Bias

As previously mentioned, the student investigator held a position in the facilities in which participants were recruited. This position provided the opportunity to build rapport with many potential study participants. It is possible this rapport could have influenced their decision to participate in the research, their uptake of the Addo mobile app and the completion of interviews and surveys. However, due to the overall lack of

implementation, general disinterest in the app, and no change in health behavior outcomes, this influence appears to have been minimal or non-existent.

5.6. Study Limitations

The statistical analysis chosen to assess efficacy and maintenance of behavior change due to the use of the mobile app Addo did not account for potential test-re-test effects, which means it did not assess whether the prior test experience influenced the results. Given that initial test results were already high, this impact is likely to be small (Salthouse & Tucker-Drop, 2009). Due to the results, which indicated a lack of implementation, reach and adoption of the mobile app, it proved to be unnecessary to conduct any further testing identifying behavior modifications.

An additional limitation of this study addresses the survey questions written and provided by the Addo founder, used to evaluate user opinions and perceptions of the Addo platform. This is a limitation because the questions provided to participants were arguably written in a manner that could have been considered leading, and favorable to the use of the Addo platform. The student investigator asked the founder of Addo if he would like to phrase the survey questions, the founder felt it was preferable to be able to compare the results from previous data collection to the data from this research so asked that they stay the same.

This App seemed to target the same groups as most WWPs, (users who are overall health conscious), and in future it would be useful to explore strategies to attract non-traditional groups. This is an area that needs further research in order to determine how to best target these individuals.

Chapter 6: Conclusion

This chapter concludes with a brief overview of the key takeaway messages from this research where the mobile app Addo was evaluated in a workplace environment using the framework of RE-AIM.

Based on the body of existing literature supporting the health behavior theories on which Addo was based, the results of this study were unexpected. Given that the app developers had considered behavior change theories in its development, the limited uptake and negligible impact was a surprise. Although positive health outcome measures were not attained, the health habits of participants and their attitudes, perceptions and usage rates of the Addo app may assist with the development and implementation strategies of future WWPs. Additionally, this study helps to further the body of knowledge on evaluation of health and wellness mobile apps through the user perspectives regarding such factors as: a platform that is socially engaging, user friendly, multidimensional, and contains enough variety to maintain interest.

The growing trend of mobile applications to improve health behaviors (Edwards et al., 2016) has the potential to be effective due to current trends and popularity and have the potential to reach a large volume of the population at a very low cost. As previously mentioned, the actual usage of the mobile app Addo had a low level of adoption and participants did not believe the program was helpful in assisting them in achieving health behavior changes. Due to sporadic usage and user disengagement, it can be concluded that the one-dimensional component of Addo was ineffective. A more sound approach to

improve engagement and usage would involve the use of a multi-component approach, which provides users with multiple tools or forms of information to add variety and interest. In addition to a mobile app, real-time, face-to-face supports (with appropriate assurances of confidentiality) could be an effective addition to WWP.

The findings regarding reach and usage may be useful to future program developers and workplace wellness initiatives. For employers, these results may impact the process of decision making regarding how to proceed in implementing and using future WWP. A factor to consider is that the workplace was not originally designed for “fun” or “fitness”. The ideology is that we go to work to achieve, accomplish, and pay our bills. It is possible that a mobile app is not the appropriate modality for the workplace. Based on the results of this evaluation, there is an opportunity to improve the overall perceptions, usage, and uptake of workplace wellness initiatives and make the workplace a healthier environment (Cahalin et al., 2015). Through the use of an initial need assessment, an organization can tailor and refine a program to fit the overall wants and needs of its individual employees (Despres, Almeras & Gauvin, 2014).

In addition, an initial need assessment can help an organization assess what programs may already be in place, what is currently working in their favor, and how to improve and/or create additional support systems. In order to do this, an initial strategy to engage stakeholders, such as employees and employers, should involve a broad range of individuals from the initial stages in order to provide a sense of team or community and follow specific cultural social norms to tailor the intervention to the culture of the organization (Despres, Almeras & Gauvin, 2014). If everyone is involved from the initial

stages in the creation, development, and implementation of the program, the likelihood of program uptake is much greater.

Results from this research may be of interest to the community of employees or users of mobile apps similar to Addo and their employers. Employees who are healthier tend to require less sick time or doctor visits and are considered to be more productive and happier, which impacts the organization as a whole. In addition, employees who are healthy and happy may create improved environments for their clients or consumers as well as their interpersonal support networks. At the administration or policy level, this research has the potential to assist in further understanding the characteristics of WWP that are more or less effective in encouraging employees to participate in healthy behaviors and benefit organizations looking to invest in a workplace wellness initiative.

As previously mentioned in the Medisys (2008) study, many work sites engage in some variation of health promotion programming designed to improve worker health and reduce health care costs. The workplace wellness community of employees and employers can use the results of this research to consider how to invest and develop effective workplace wellness strategies. As the population of Canada continues to age and evolve, our health intervention strategies must also evolve. In addition, a number of pre-existing well-established tools or programs already exist (Fit Bit, Weight Watchers, etc.), which prompts the question, do employees need new apps in the workplace, or are there existing platforms that could be considered useful or effective?

Previous research suggests that clarifying factors related to behavior changes that are more or less effective may improve implementation of more effective interventions

(Butterfoss, 2006). Studies show that effective interventions focus on a broader range of issues rather than simply targeting individuals. They usually broaden their scope to include a focus on interpersonal relationships, organizational changes, and environmental factors that in turn will influence health behaviour change (Glanz et al., 2010). This evaluation of the Addo mobile app has the potential to act as a building block for future workplace wellness initiatives, especially in identifying pitfalls to avoid.

The overall insights from this research indicates the following: first, it is important to assess baseline behaviors and needs and interests of a group prior to proceeding; second, it is important to consider the target level of implementation – either at the individual or organizational level or both; and third it is important to choose a sufficient number and variety of strategies that are engaging, appropriate, and impactful. In this research, the ‘fit’ between the target group’s existing health status and the app’s objectives were not complementary, the app was a stand-alone initiative targeted mainly to individuals, and although the Addo app design was based on behavior change strategies, the ‘packaging’ of the app did not give sufficient attention to how to engage users on an ongoing basis.

When the research was undertaken, there were many positive aspects of Addo that were considered such as the design based on proven health behaviour theories, the positive response from previous users, and its automatic format which allowed for minimal instruction from the organizational level. The results, however, were negative. Although the report on the Addo evaluation was not completed prior to the discontinuation of the app, the results support the founder’s decision. From a larger

perspective, this evaluation provided useful insights into the characteristics of people who do sign-up for a WWP and the characteristics of the app itself.

The increased understanding of barriers and facilitators for the implementation of this app can inform consideration about future mobile apps in the workplace. Overall, the results from this evaluation indicated little need for this app, low use, and no impact, all of which can help inform future app development: first to ensure there is a need for a proposed app within a particular workplace population (i.e., is it reaching its intended audience), second, to ensure that the qualities of the app will engage employees in adopting and implementing the app's objectives, and third, that the 'dose' of the app and its design is sufficient to achieve and maintain positive health impact (either as a stand-alone intervention or in combination with other health promoting strategies). As the app market for health promotion continues to grow, it is important that evidence-based evaluation inform their development and use.

Bibliography

- Andrejevic, M. (2013). *Infoglut: how too much information is changing the way we think and know*. New York, NY: Routledge.
- Arhippainen, L., & Tahti, M. (2003). Empirical evaluation of user experience in two adaptive mobile application prototypes. Linköping Electronic Conference Proceedings. *Proceedings of the 2nd International Conference of Mobile and Ubiquitous Multimedia (27-34)*. Finland: University of Oulu, Finland.
- Baicker, K., Cutler, D., & Song, Z. (2010). Workplace wellness programs can generate savings. *Health Affairs*, 29(2), 304-311.
- Bauman, A., Phongsavan, P., Schoeppe, S., & Owen, N. (2006). Physical activity measurement – A primer for health promotion. *Promotional Education*, 13(2). 92-103.
- Blissmer, B., Prochaska, J. O., Velicer, W. F., Redding, C. A., Rossi, J. S., Greene, G. W., . . . Robbins, M. (2010). Common factors predicting long-term changes in multiple health behaviors. *Journal of Health Psychology*, 15(2), 205-214.
doi:10.1177/1359105309345555; 10.1177/1359105309345555
- Burke, L. E., Ma, J., Azar, K. M. L., Bennett, G. G., et al. (2015). Current science on consumer use of mobile health for cardiovascular disease prevention. A scientific statement from the American heart association. *American Heart Association*.
Retrieved from:
<http://circ.ahajournals.org/content/circulationaha/early/2015/08/13/CIR.000000000000232.full.pdf>. DOI: 10.1161/CIR.0000000000000232

- Butterfoss, F. D. (2006). Process evaluation for community participation. *Annual Review of Public Health, 27*. 323-340. Doi:10.1146/annurev.pubhealth.27.021405.102207
- Cahalin, L. P., Kaminsky, L., Lavie, C. J., Briggs, P., Cahalin, B. L., Myers, J., ... Arena, R. (2015). Development and implementation of worksite health and wellness programs: a focus on non-communicable diseases. *Progress in Cardiovascular Disease, 58*(1), 94-101.
- Carroll, C., Patterson, M., Wood, S., Booth, A., Rick, J., & Balain, S. (2007). A conceptual framework for implementation fidelity. *Implementation Science, 2*(40). Doi:10.1186/1748-5908-2-40
- Centers for Disease Control and Prevention (2014). Practical use of program evaluation among sexually transmitted disease (STD) programs. *Division of STD Prevention. Retrieved from: <http://www.cdc.gov/std/program/pupestd.htm>*
- Cook, R. F., Billings, D. W., Hersch, R. K., Back, A. S., & Hendrickson, A. (2007). A field test of a web-based workplace health promotion program to improve dietary practices, reduce stress, and increase physical activity: Randomized controlled trial. *Journal of Medical Internet Research, 9*(2). E17. Doi:10.2196/jmir.9.2.e17
- Damschroder, L. J., Aron, D. C., Keith, R. E., Kirsh, S. R., Alexander, J. A., & Lowery, J. C. (2009). Fostering implementation of health services research findings into practice: A consolidated framework for advancing implementation science. *Implementation Science : IS, 4*, 50-5908-4-50. doi:10.1186/1748-5908-4-50; 10.1186/1748-5908-4-50

- Deitz, D., Cook, R. F., Hersch, R. K., & Leaf, S. (2014). An innovative approach to risk reduction in the workplace. *American College of Occupational and Environmental Medicine, 56*(5). 547-553.
- Despres, J. P., Almeras, N., & Gauvin, L. (2014). Worksite health and wellness programs: Canadian achievements and prospects. *Progress in Cardiovascular Disease, 56*(5), 484-492.
- Donkin, L., Hickie, I. B., Christensen, H., Naismith, S. L., Neal, B., Cockayne, N. L., & Glozier, N. (2013). Rethinking the dose-response relationship between usage and outcome in an online intervention for depression: Randomized controlled trial. *Journal of Medical Internet Research, 15*(10). E231. Doi:10.2196/jmir.2771
- Edmunds, S., Stephenson, D., & Clow, A. (2011). The effects of a physical activity intervention on employees in a small and medium enterprise: a mixed methods study. *Public Relations and Public Affairs, 46*. 39-49. Doi: 10.3233/WOR-121523
- Edwards, E. A., Lumsden, J., Rivas, A., Steed, L., Edwards, L. A., Thiyagarajan, A., ... Walton, R. T. (2016) Gamification for health promotion: systematic review of behavior change techniques in smartphone apps. *BMJ Open, 6*. 1-9.
doi:10.1136/bmjopen-2016-012447
- Elder, J. P., Ayala, G. X., & Harris, S. (1999). Theories and intervention approaches to health-behavior change in primary care. *American Journal of Preventative Medicine, 17*(4). 275-284. doi: 10.1016/S0749-3797(99)00094-X

- Engbers, L. (2008). Monitoring and evaluation of worksite health promotion programs – current state of knowledge and implications for practice. *The World Health Organization*. 1-42.
- Gillison, F., Stathi, A., Reddy, P., Perry, R., Taylor, G., Bennett., ... Greaves, C. (2015). Process of behavior change and weight loss in a theory-based weight loss intervention program: a test of the process model for lifestyle behavior change. *International Journal of Behavioral Nutrition and Physical Activity*, 12(2). doi:10.1186/s12966-014-0160-6
- Glanz, K., & Bishop, D. B. (2010). The role of behavioral science theory in development and implementation of public health interventions. *Annual Review of Public Health*, 31, 399-418. doi:10.1146/annurev.publhealth.012809.103604.
- Glasgow, R. E., Klesges, L. M., Dzewaltowski, D. A., Estabrooks, P. A., & Vogt, T. M. (2006). Evaluating the impact of health promotion programs: using the RE-AIM framework to form summary measures for decision making involving complex issues. *Health Education Research*, 21(5), 688-694. Doi:10.1093/her/cyl081
- Glasgow, R. E., Lichtenstein, W., & Marcus, A. C. (2003). Why don't we see more transition of health promotion research to practice? Rethining the efficacy-to-effectiveness transition. *American Journal of Public Health*, 93(8), 1261-1267.
- Glasgow, R. E., Boles, S., & Vogt, T. (2016). What is RE-AIM? *Virginia Polytechnic Institute and State University. Human Nutrition, Foods, and Exercise*. Retrieved from: http://www.re-aim.hnfe.vt.edu/about_re-aim/what_is_re-aim/index.html

- Glasgow, R. E., Vogt, T. M., & Boles, S. M. (1999). Evaluating the public health impact of health promotion interventions: The RE-AIM framework. *American Journal of Public Health, 89*(9). 1322-1327.
- Goetzel, R. Z., Fabius, R., Fabius, D., Roemer, E. C., Thornton, N., Kelly, R. K., & Pelletier, K. R. (2015). The stock performance of C. Everett Koop award winners compared with the Standard & Poor's 500 index. *Journal of Occupational and Environmental Medicine, 58*(1), 9-15.
- Grol, R., & Wensing, M. (2004). What drives change? Barriers to and incentives for achieving evidence-based practice. *Medical Journal of Australia, 180*(6). 57-60.
- Government of Canada. (2012). Corporate social responsibility. *Canada*. Retrieved from: <https://www.ic.gc.ca/eic/site/csr-rse.nsf/eng/rs00591.html>
- Harden, A., Peersman, G., Oliver, S., Mauthner, M., & Oakley, A. (1999). A systematic review of the effectiveness of health promotion interventions in the workplace. *Occupational Medicine, 49*(8). 540-548.
- Harrison, R., Flood, D., & Duce, D. (2013). Usability of mobile applications: literature review and rationale for a new usability model. *Journal of Interaction Science, 1*(1). DOI:10.1186/2194-0872.
- Hind, J. A., & Rouse, M. J. (2012). Defining workplace wellness programs a rapid systematic review. *Ivey Business School at Western University*. London: Ontario. 1-7.
- Holloway, A., & Watson, H. E. (2002). Role of self-efficacy and behaviour change. *International Journal of Nursing Practice, 8*(2), 106-115.

- Hopkins, L., Turner, T., Gomez, S., Going, S., Kutob, R., Stump, C., ... Hingle, M. (2016). Evaluating the public health impact of a community-based family-focused diabetes prevention program using RE-AIM. *Journal of Nutrition Education and Behavior, 48*(7).
- Horner, S., Rew, L., & Torres, R. (2006). Enhancing intervention fidelity: A means of strengthening study impact. *Journal of Specialized Pediatric Nursing, 11*(2). 80-89.
- Howlett, N., Trivedi, D., Troop, N. A., & Chater, A. M. (2015). What are the most effective behavior change techniques to promote physical activity and/or reduce sedentary behavior in inactive adults? A systematic review protocol. *British Medical Journal, 5*. 1-7. Doi:10.1136/bmjopen-2015-008573
- Kelloway, E. K., & Day, A. L. (2005) Building healthy workplaces: What we know so far. *Canadian Journal of Behavioral Science, 37*(4), 223-235.
- King, D. K., Glasgow, R. E., & Leeman-Castillo, B. (2010). Reaiming RE-AIM: using the model to plan, implement, and evaluate the effects of environmental change approaches to enhancing population health. *American Journal of Public Health, 100*(11), 2076-2084. Doi:10.2105/AJPH.2009.190959
- Kohl, L F., Crutzen, R., & de Vries, N. K. (2013). Online prevention aimed at lifestyle behaviors: a systematic review of reviews. *Journal of Medical Internet Research, 15*(7).

- Kruger, J., Yore, M. M., & Bauer, D. R. (2007). Selected barriers and incentives for worksite health promotion services and policies. *American Journal of Health Promotion, 21*(5). 439-447.
- Lane, A., Murphy, N., & Bauman, A. (2013). An effort to 'leverage' the effect of participation in a mass event on physical activity. *Health Promotion International*, doi:10.1093/heapro/dat077
- Livingstone, C. (2008). Dictionary of sport and exercise science and medicine. *Elsevier Limited*. Retrieved from: <http://medical-dictionary.thefreedictionary.com/theory+of+reasoned+action>
- Makrides, L., Smith, S., Allt, J., Farquharson, J., Szpilfogel, C., Curwin, S., Veinot, P., Wang, F., & Edington, D. (2011). The healthy lifeworks project: a pilot study of the economic analysis of a comprehensive workplace wellness program in a Canadian government department. *Journal of Occupational and Environmental Medicine, 53*(7), 799-805.
- Marshall, A. L., Leslie, E. R., 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.S0749379703001119
- McGinnis, J. M., & Foege, W. (2000). Guide to community preventive services: Harnessing the science. *American Journal of Preventive Medicine, 18*(1 Suppl), 1-2.

- McGoey, T., Root, Z., Bruner, M. W., & Law, B. (2016). Evaluation of physical activity interventions in children via the reach, efficacy/effectiveness, adoption, implementation, and maintenance (RE-AIM) framework: a systematic review of randomized and non-randomized trials. *Preventative Medicine*, 82. 8-19.
- McHugh, J., & Suggs, L. S. (2012). Online tailored weight management in the worksite: Does it make a difference in biennial health risk assessment data? *Journal of Health Communication*, 17. 278-293. Doi:10.1080/10810730.2011.626496
- Medisys Health Group. (2008). Wellness in the workplace: Aligning intentions and outcomes. A survey of Canada's top 100 employers perceptions of workplace wellness programs. Retrieved from:
https://www.medisys.ca/wpcontent/uploads/2014/07/wellness_top_100.pdf
- Meyer, S. B., Coveney, J., & Ward, P. R. (2014). A qualitative study of CVD management and dietary changes: problems of 'too much' and 'contradictory' information. *BMC Family Practice*, 15(25). 1-4.
- Michie, S., & Johnston, M. (2012). Theories and techniques of behaviour change: developing a cumulative science of behaviour change. *Healthy Psychology Review*, 6(1). 1-6. Doi:10.1080/17437199.2012.654964
- Moore, G. F., Audrey, S., Barker, M., Bond, L., Bonell, C., Hardeman, W., ... Baird, J. (2015). Process evaluation of complex interventions: medical research council guidance. *BMJ: Research Methods and Reporting*, 350. 1-6.
doi:10.1136/bmj.h1258

- Morrison, E., & MacKinnon, N. J. (2008). Workplace wellness programs in Canada: an exploration of key issues. *Healthcare Management Forum*, 26-32.
- Nova Scotia Health Authority (2016). Chapter 2: management of Nova Scotia's hospital system capacity. *Report of the Auditor General; Health and Wellness*.
- Nova Scotia Health Research Foundation. (2009). Major health issues in Nova Scotia: an environmental scan. *Management Consulting Services Inc.* 1-59. Retrieved from: http://www.nshrf.ca/sites/default/files/environmental_scan_current_major_health_issues.pdf
- Patton, M. Q. (2001). Education, knowledge management, best practices, and high quality lessons learned. *American Journal of Evaluation*, 22. 329-336. Doi: 10.1177/109821400102200307
- Pronk, N. P. (2015) Workforce fitness: description, contextual issues and implications for public health. *Frontiers in Public Health Services and Systems Research*, 4(5). 19-24. Doi:10.13023/FPHSSR.0405.04
- Office for National Statistics. (2014). Measuring national well-being programme. Retrieved from: <http://www.ons.gov.uk/ons/guide-method/user-guidance/well-being/about-the-programme/index.html>
- Op den Akker, H., Cabrita, M., Op den Akker, R., Jones, V. M., & Hermens, H. J. (2015). Tailored motivational message generation: a model and practical framework for real-time physical activity coaching. *Journal of Biomedical Informatics*, doi:10.1016/j.jbi.2015.03.005; 10.1016/j.jbi.2015.03.005

- Payne, H. E., Lister, C., West, J. H., & Bemhardt, J. M. (2015). Behavioral functionality of mobile apps in health interventions: a systematic review of the literature. *JMIR Mhealth Uhealth*, 3(1). doi:10.2196/mhealth.3335
- Pitt-Catsoupes, M., James, J. B., & Matz-Costa, C. (2014). Workplace-based health and wellness programs: the intersection of aging, work, and health. *The Gerontologist*, 55(2). 262-270. doi:10.1093/geront/gnu114
- Rachlis, M. (2004). Prescription for excellence: how innovation is saving Canada's health care system. Toronto, Ontario Canada: Harper Collins.
- RAND Corporation. (2015). 36-item short form survey from the RAND medical outcomes study. Retrieved from:
http://www.rand.org/health/surveys_tools/mos/mos_core_36item.html
- Richardson, C. G., Hamadani, L. G., & Gotay, C. (2013). Quantifying Canadians' use of the internet as a source of information on behavioral risk factor modifications related to cancer prevention. *Chronic Disease and Injuries in Canada*, 33(3). 123-128.
- Salthouse, T. A., & Tucker-Drob, E. M. (2009). Implications of short-term effects for the interpretation of longitudinal change. *Neuropsychology*, 22(6), 800-811.
- Saunders, R. P., Evans, M. H., & Joshi, P. (2005). Developing a process-evaluation plan for assessing health promotion program implementation: A how-to guide. *Society for Public Health Education*, 6(2). 134-147. Doi: 10.1177/1524839904273387

- Schlinger, H. D., Jr., & Normand, M. P. (2013). On the origin and functions of the term functional analysis. *Journal of Applied Behavior Analysis, 46*(1), 285-288.
doi:10.1002/jaba.6
- Schwarzer, R. (2001). Social-cognitive factors in changing health-related behaviors. *Current Directions in Psychological Science, 10*(2), 47-51.
- Shegog, R., Bamps, Y. A., Patel, A., Kakacek, J., Escoffery, C., Johnson, E. K., & Ilozumba, U. O. (2013). Managing epilepsy well: emerging e-tools for epilepsy self-management. *Epilepsy and Behavior, 29*(1), 133-140.
- Spittaels, H., De Bourdheaudhuij, I., Brug, J., & Vandelanotte, C. (2007). Effectiveness of an online computer-tailored physical activity intervention in a real-life setting. *Health Education, 22*(3), 385-396. Doi: 10.1093/her/cyl096
- Song, T. K., Shepard, R. J., & Cox, M. (1982). Absenteeism, employee turnover, and sustained exercise participation. *Journal of Sports Medicine, 22*, 392-399.
- Statistics Canada, Canadian Institute for Health Information. (2009). Health Indicators. 1-107.
- Statistics Canada. (2010). Internet use by individuals, by type of activity (internet users at home). Retrieved from: <http://www.statcan.gc.ca/tables-tableaux/sum-som/101/cst01/comm29a-eng.htm>
- Steckler, A., & McLeroy, K. R. (2008). The importance of external validity. *American Journal of Public Health, 98*(1), 9-10. Doi; 10.2105/AJPH.2007.126847

- Strecher, V. J., DeVellis, B. M., Becker, M. H., & Rosenstock, I. M. (1986). The role of self-efficacy in achieving health behavior change. *Health Education Quarterly*, *13*(1), 73-92.
- Teixeira, P. J., Carraca, E. V., Marques, M. M., Rutter, H., Oppert, J.M., Bourdeaudhuij, I. D., ... Brug, J. (2015). Successful behavior change in obesity interventions in adults: a systematic review of self-regulation mediators. *BMC Medicine*, *13*(84).
- Truxillo, D. M., Cadiz, D. M., & Hammer, L. B. (2014). Supporting the aging workforce: a review and recommendations for workplace intervention research. *Organizational Psychology and Organizational Behavior*, *2*. 351-381.
doi:10.1146/annurev-orgosych-032414-111435
- Turner-McGrievy, G. & Tate, D. (2011). Tweets, apps, and pods: results of the 6-month mobile pounds off digitally (mobile POD) randomized weight-loss intervention among adults. *Journal of Medical Internet Research*, *13*(4). DOI: 10.2196/jmir.1841
- Useem, J., & Useem, R. (1963). *Human Organizations*, *22*(3).
- Watson, W., & Gauthier, J. (2003). The viability of organizational wellness programs: an examination of promotion and results. *Journal of Applied Social Psychology*, *33*(6). 1297-1312.
- Weiss, C. H. (1973). Where politics and evaluation meet. *Evaluation*, *1*(3). 37-45.
- World Health Organization. (1998). Health promotion evaluation: recommendations to policy-makers. *Report*. 1-8. Retrieved from:
<http://apps.who.int/iris/bitstream/10665/108116/1/E60706.pdf>

Zwetsloot, G., & Leka, S. (2010). Corporate culture, health, and well-being. In S. Leka & J. Houdmont (Eds.), *Occupational health psychology* (pp. 250–268). West Sussex, UK: Wiley-Blackwell.

Appendix A.

Exploratory Interview with the Addo Founder

Dear Moses Robicheau (Founder, Addo),

You are invited to participate in a research study conducted by Ms. Kaleigh Meisner, under the supervision of Dr. Mary McKenna of the University of New Brunswick. The study is for a Master's Thesis in Applied Health Services Research. The objectives of the research study are to evaluate the effectiveness of the Workplace Wellness Application, Addo.

If you decide to volunteer, you will be asked to complete an informal 10-minute interview. Interview questions focus on the structure and usage of the Addo platform. Information from this interview, with your consent, will be identified by name and may contribute to the results of the study. Participation is voluntary. You may be contacted again in the future and asked for your consent to respond to further questions, if they arise throughout the study. You may decline to answer any questions that you do not wish to answer and you can withdraw your participation at any time with no penalty. There are no known or anticipated risks from participating in this study.

The data collected from this study will be maintained on a password-protected computer database. As well, the data will be electronically archived after completion of the study and maintained for five years and then erased.

Should you have any questions about the study, please contact either Kaleigh Meisner, student investigator (kaleighmeisner@gmail.com), or Mary McKenna, faculty investigator (mmckenna@unb.ca). Further, if you would like to receive a copy of the results of this study, please contact Ms. Kaleigh Meisner.

This project has been advised by the Research Ethics Board from the University of New Brunswick and is on file as REB 2015-105. However, the final decision about participation is yours. If you have any comments or concerns resulting from your participation in this study, please feel free to contact Steven Turner in the Office of Research Ethics at (506) 453-5189, or [ethics@unb.ca].

Consent to Participant

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

- I agree to participate
- I do not wish to participate

Name:

Signature:

Questions for Founders/Stakeholders:

1. What does the term Addo mean?
2. What is the target population for the Addo platform?
3. Can you give me an example of a challenge for users of the platform?
4. In what area of lifestyle/health behavior do you predict to see the most impact? Or, would you like to see the most impact?
5. What are the strengths of the Addo platform?
6. What are the limitations/weaknesses of the Addo platform?
7. How many times per day do you expect clients to log into the Addo platform?
8. What constitutes high quality delivery for each component of the intervention? For example, how do you measure success in the community component compared to the nutrition component of the challenge?
9. Where do you see this challenge in the future? Using Addo in organizations as a sole corporate wellness program? Or as a part of a larger corporate wellness program?
10. The survey completed with previous participants, is this survey conducted with every challenge you run? What do you do with that information?
11. The questions in the survey are formed in favor of Addo. Would you be interested in rewording them to make them neutral or do you prefer to keep them the same?
12. What do you hope to get out of this evaluation, outcome and process?

Appendix B.

Pre-Evaluation survey questionnaire: written and reported by the Addo founder to assess outcomes of previous use

1. I enjoy using Addo:
1 Disagree --- 5 Agree
2. I would recommend Addo to a friend:
1 Disagree --- 5 Agree
3. I would participate again?

Yes
No

4. The user interface was easy to use:
1 Disagree --- 5 Agree
5. Addo helped me change or improve my lifestyle behaviors?
1 Disagree --- 5 Agree
6. I enjoyed the competitive nature of Addo
1 Disagree --- 5 Agree
7. The competitiveness pushed me to accomplish the challenges
1 Disagree --- 5 Agree
8. I enjoyed the social component of Addo
1 Disagree --- 5 Agree
9. The social component of Addo pushed me to accomplish more challenges
1-Disagree --- 5 Agree
10. The component of Addo in which I improved the most was:
 1. Nutrition
 2. Exercise
 3. Mental
 4. Community
11. The component of Addo in which I enjoyed the most was:
 1. Exercise
 2. Nutrition
 3. Mental

4. Community

Appendix C.

Validated general self-efficacy scale survey

Rating Scale:

1 = Not at all true 2 = Hardly true 3 = Moderately true 4 = Exactly true

Items:

1. I can always manage to solve difficult problems if I try hard enough.
2. If someone opposes me, I can find the means and ways to get what I want.
3. It is easy for me to stick to my aims and accomplish my goals.
4. I am confident that I could deal efficiently with unexpected events.
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.
6. I can solve most problems if I invest the necessary effort.
7. I can remain calm when facing difficulties because I can rely on my coping abilities.
8. When I am confronted with a problem, I can usually find several solutions.
9. If I am in trouble, I can usually think of a solution.
10. I can usually handle whatever comes my way.

Appendix D.

Validated short-form medical health outcomes survey RAND SF-36

General Health:

1. In general, would you say your health is:

1. Excellent
2. Very Good
3. Good
4. Fair
5. Poor

2. Compared to one year ago, how would you rate your health in general now?

1. Much better now than one year ago
2. Somewhat better now than one year ago
3. About the same
4. Somewhat worse now than one year ago
5. Much worse now than one year ago

The following items are about activities you might do during a typical day. Does **you health limit you** in these activities? If so, how much? (**Circle one number on each line**)

	Yes, Limited a Lot	Yes, Limited a Little	No, Not limited at All
3. Vigorous activities , such as running, lifting heavy objects, participating in strenuous sports	[1]	[2]	[3]
4. Moderate activities , such as moving a table, pushing a vacuum cleaner, bowling or playing golf	[1]	[2]	[3]
5. Lifting or carrying groceries	[1]	[2]	[3]
6. Climbing several flights of stairs	[1]	[2]	[3]
7. Climbing one flight of stairs	[1]	[2]	[3]
8. Bending, kneeling or stooping	[1]	[2]	[3]
9. Walking more than a mile	[1]	[2]	[3]
10. Walking several blocks	[1]	[2]	[3]
11. Walking one block	[1]	[2]	[3]

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**?

(**Circle one number on each line**)

	Yes	No
12. Cut down the amount of time you spent on work or other activities	1	2
13. Accomplished less than you would like	1	2
14. Were limited in the kind of work or other activities	1	2
15. Had difficulty performing the work or other activities (for example, it took extra effort)	1	2

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?

- | | | |
|--|---|---|
| 16. Cut down the amount of time you spent on work or other activities | 1 | 2 |
| 17. Accomplished less than you would like | 1 | 2 |
| 18. Didn't do work or other activities as carefully as usual | 1 | 2 |

During the **past 4 weeks**, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

(Circle One Number)

- 19. Not at all 1
- Slightly 2
- Moderately 3
- Quite a bit 4
- Extremely 5

20. How much **bodily** pain have you had during the **past 4 weeks**?

- None 1
- Very mild 2
- Mild 3
- Moderate 4
- Severe 5
- Very severe 6

These questions are about how you feel and how things have been with you **during the past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the **past 4 weeks** . . .

(Circle one number on each line)

All of the Time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	None of the Time
--------------------	---------------------	---------------------------	---------------------	-------------------------	---------------------

21. Did you feel full of pep?	1	2	3	4	5	6
22. Have you been a very nervous person?	1	2	3	4	5	6
23. Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
24. Have you felt calm and peaceful?	1	2	3	4	5	6
25. Did you have a lot of energy?	1	2	3		5	6
26. Have you felt downhearted and blue?	1	2	3	4	5	6
27. Did you feel worn out?	1	2	3	4	5	6
28. Have you been a happy person?	1	2	3	4	5	6
29. Did you feel tired?	1	2	3	4	5	6

During the **past 4 weeks**, how much of the time has your **physical health or emotional problems** interfered with your social activities (like visiting with friends, relatives, etc.)?

(Circle One Number)

30. All of the time 1
 Most of the time 2
 Some of the time 3
 A little of the time 4
 None of the time 5

How TRUE or FALSE is each of the following statements for you.

(Circle one number on each line)

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
31. I seem to get sick a little easier than other people	1	2	3	4	5
32. I am as healthy as anybody I know	1	2	3	4	5
33. I expect my health to get worse	1	2	3	4	5
34. My health is excellent	1	2	3	4	5

Control Group: Health Behaviors Survey #1, #2, and #3

Dear participant,

You are invited to participate in a research study conducted by Kaleigh Meisner, under the supervision of Mary McKenna of the University of New Brunswick. The objectives of the research study are to evaluate general health behaviors. The study is for a Master's thesis.

If you decide to volunteer, you will be asked to complete a 5-minute online survey that is completed anonymously. Survey questions focus on general health behaviors and self-efficacy. Participation in this study is voluntary. You may decline to answer any questions that you do not wish to answer and you can withdraw your participation at any time by not submitting your responses. There are no known or anticipated risks from participating in this study.

It is important for you to know that any information that you provide will be confidential. All of the data will be summarized and no individual could be identified from these summarized results. Furthermore, the web site is programmed to collect responses alone and will not collect any information that could potentially identify you (such as machine identifiers).

The data, with no personal identifiers, collected from this study will be maintained on a password-protected computer database in a restricted access area of the university. As well, the data will be electronically archived after completion of the study and maintained for two years and then erased.

Should you have any questions about the study, please contact either Kaleigh Meisner, student investigator (kaleighmeisner@gmail.com), or Mary McKenna, faculty investigator (mmckenna@unb.ca). Further, if you would like to receive a copy of the results of this study, please contact either investigator.

I would like to assure you that this study has been reviewed and received ethics clearance through a University of New Brunswick Research Ethics Committee. However, the final decision about participation is yours. If you have any comments or concerns resulting from your participation in this study, please feel free to contact Steven Turner in the Office of Research Ethics at 1-506-453-5189, or ethics@unb.ca

Thank you for considering participation in this study.

Consent to Participant

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

- I agree to participate.
- I do not wish to participate (please close your web browser now).

General Health:

1. In general, would you say your health is:

- 6. Excellent
- 7. Very Good
- 8. Good
- 9. Fair
- 10. Poor

2. Compared to one year ago, how would you rate your health in general now?

- 6. Much better now than one year ago
- 7. Somewhat better now than one year ago
- 8. About the same
- 9. Somewhat worse now than one year ago
- 10. Much worse now than one year ago

The following items are about activities you might do during a typical day. Does **you health limit you** in these activities? If so, how much? (**Circle one number on each line**)

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	Yes, Limited a Lot	Yes, Limited a Little	No, Not limited at All
3. Vigorous activities , such as running, lifting heavy objects, participating in strenuous sports	[1]	[2]	[3]
4. Moderate activities , such as moving a table, pushing a vacuum cleaner, bowling or playing golf	[1]	[2]	[3]
5. Lifting or carrying groceries	[1]	[2]	[3]
6. Climbing several flights of stairs	[1]	[2]	[3]
7. Climbing one flight of stairs	[1]	[2]	[3]
8. Bending, kneeling or stooping	[1]	[2]	[3]
9. Walking more than a mile	[1]	[2]	[3]
10. Walking several blocks	[1]	[2]	[3]
11. Walking one block	[1]	[2]	[3]

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**?

(Circle one number on each line)

	Yes	No
12. Cut down the amount of time you spent on work or other activities	1	2
13. Accomplished less than you would like	1	2
14. Were limited in the kind of work or other activities	1	2
15. Had difficulty performing the work or other activities (for example, it took extra effort)	1	2

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?

16. Cut down the amount of time you spent on work or other activities	1	2
17. Accomplished less than you would like	1	2
18. Didn't do work or other activities as carefully as usual	1	2

During the **past 4 weeks**, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

(Circle One Number)

19. Not at all 1
Slightly 2
Moderately 3
Quite a bit 4
Extremely 5

20. How much **bodily** pain have you had during the **past 4 weeks**?

- None 1
Very mild 2
Mild 3
Moderate 4

Severe 5
 Very severe 6

These questions are about how you feel and how things have been with you **during the past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the **past 4 weeks** . . .

(Circle one number on each line)

	All of the Time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	None of the Time
21. Did you feel full of pep?	1	2	3	4	5	6
22. Have you been a very nervous person?	1	2	3	4	5	6
23. Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
24. Have you felt calm and peaceful?	1	2	3	4	5	6
25. Did you have a lot of energy?	1	2	3	4	5	6
26. Have you felt downhearted and blue?	1	2	3	4	5	6
27. Did you feel worn out?	1	2	3	4	5	6
28. Have you been a happy person?	1	2	3	4	5	6
29. Did you feel tired?	1	2	3	4	5	6

During the **past 4 weeks**, how much of the time has your **physical health or emotional problems** interfered with your social activities (like visiting with friends, relatives, etc.)?

(Circle One Number)

30. All of the time 1
 Most of the time 2
 Some of the time 3
 A little of the time 4
 None of the time 5

How TRUE or FALSE is each of the following statements for you.

(Circle one number on each line)

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
31. I seem to get sick a little easier than other people	1	2	3	4	5
32. I am as healthy as anybody I know	1	2	3	4	5
33. I expect my health to get worse	1	2	3	4	5
34. My health is excellent	1	2	3	4	5

This next section is about your perception or control over your behavior:

Rating Scale:

1 = Not at all true 2 = Hardly true 3 = Moderately true 4 = Exactly true

Items:

1. I can always manage to solve difficult problems if I try hard enough.
2. If someone opposes me, I can find the means and ways to get what I want.
3. It is easy for me to stick to my aims and accomplish my goals.
4. I am confident that I could deal efficiently with unexpected events.
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.
6. I can solve most problems if I invest the necessary effort.
7. I can remain calm when facing difficulties because I can rely on my coping abilities.
8. When I am confronted with a problem, I can usually find several solutions.
9. If I am in trouble, I can usually think of a solution.
10. I can usually handle whatever comes my way.

Demographics:

1. Age:
2. Current workplace organization
3. Occupation:
4. Do you know of any current wellness programs at your workplace?
5. If so, have you taken part in any programs?
6. If not, would this be something you would be interested in taking part in?
7. Do you currently have a gym membership?

Appendix F.

Treatment Group: Health Behaviors Survey #1, #2, #3, and #4.

Addo Challenge

Date

Dear Employee,

You are invited to participate in a research study conducted by Ms. Kaleigh Meisner, under the supervision of Dr. Mary McKenna of the University of New Brunswick. The study is for a Master's Thesis in Applied Health Services Research. The objectives of the research study are to evaluate the effectiveness of the Mobile Application, Addo. You will be the first to participate in a workplace wellness challenge during the debut of the online platform/mobile application. Addo is designed using three behavior change theories: Social Cognitive Theory, The Theory of Reasoned Action and The Health Belief Model.

What is Addo?

Addo is an online platform/mobile application, designed to influence healthy behavior change through four dimensions of wellness: physical activity, nutrition, mental health and community involvement.

What Should I Expect?

Addo is offering a free 21-day wellness challenge to individuals and companies. The application is designed to provide you with 16 challenges to choose from each day, based on your interests, needs and motivation level. You may remain anonymous by using a generic username, compete as in individual, or compete in teams.

If you decide to volunteer, you will be asked to complete four 5-minute online surveys that are completed anonymous. There will be one survey prior to the challenge, a second immediately after, a third one-month after, and one last time in February 2016. The survey questions are an integral component of the research methodology and focus on general health behaviors, self-efficacy and your perception of Addo. Participation in this study is voluntary. You may decline to answer any questions that you do not wish to answer and you can withdraw your participation at any time. There are no known or anticipated risks from participating in this study.

It is important for you to know that any information that you provide will be confidential. The data will be summarized and no individual will be identified in the results. Furthermore, the website is programmed to collect responses without any identifying information. The data, with no personal identifiers, collected from this study will be maintained on a password-protected computer database. As well, the data will be electronically archived after completion of the study and maintained for five years and then destroyed.

Should you have any questions about the study, please contact Kaleigh Meisner, Student Investigator [kaleighmeisner@gmail.com], or Dr. Mary McKenna, Faculty Investigator [mmckenna@unb.ca]. Further, if you would like to receive a copy of the results of this study, please contact Ms. Kaleigh Meisner.

I would like to assure you that this study has been reviewed and received ethics clearance from the University of New Brunswick Research Ethics Committee. However, the final decision about participation is yours. If you have any comments or concerns resulting from your participation in this study, please feel free to contact Steven Turner in the Office of Research Ethics at (506) 453-5189, or [ethics@unb.ca].

Thank you for considering participation in this study.

Consent to Participant

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

- I agree to participate.
- I do not wish to participate (please close your web browser now).

General Health:

1. In general, would you say your health is:

- 11. Excellent
- 12. Very Good
- 13. Good
- 14. Fair
- 15. Poor

2. Compared to one year ago, how would you rate your health in general now?

- 11. Much better now than one year ago
- 12. Somewhat better now than one year ago
- 13. About the same
- 14. Somewhat worse now than one year ago
- 15. Much worse now than one year ago

The following items are about activities you might do during a typical day. Does **you health limit you** in these activities? If so, how much? (**Circle one number on each line**)

	Yes, Limited a Lot	Yes, Limited a Little	No, Not limited at All
3. Vigorous activities , such as running, lifting heavy objects, participating in strenuous sports	[1]	[2]	[3]
4. Moderate activities , such as moving a table, pushing a vacuum cleaner, bowling or playing golf	[1]	[2]	[3]
5. Lifting or carrying groceries	[1]	[2]	[3]
6. Climbing several flights of stairs	[1]	[2]	[3]
7. Climbing one flight of stairs	[1]	[2]	[3]
8. Bending, kneeling or stooping	[1]	[2]	[3]
9. Walking more than a mile	[1]	[2]	[3]
10. Walking several blocks	[1]	[2]	[3]
11. Walking one block	[1]	[2]	[3]

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of your physical health**?

(**Circle one number on each line**)

	Yes	No
12. Cut down the amount of time you spent on work or other activities	1	2
13. Accomplished less than you would like	1	2
14. Were limited in the kind of work or other activities	1	2
15. Had difficulty performing the work or other activities (for example, it took extra effort)	1	2

During the **past 4 weeks**, have you had any of the following problems with your work or other regular daily activities **as a result of any emotional problems** (such as feeling depressed or anxious)?

16. Cut down the amount of time you spent on work or other activities	1	2
17. Accomplished less than you would like	1	2
18. Didn't do work or other activities as carefully as usual	1	2

During the **past 4 weeks**, to what extent has your physical health or emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?

(Circle One Number)

- 19. Not at all 1
- Slightly 2
- Moderately 3
- Quite a bit 4
- Extremely 5

20. How much **bodily** pain have you had during the **past 4 weeks**?

- None 1
- Very mild 2
- Mild 3
- Moderate 4
- Severe 5
- Very severe 6

These questions are about how you feel and how things have been with you **during the past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the **past 4 weeks** . . .

(Circle one number on each line)

	All of the Time	Most of the Time	A Good Bit of the Time	Some of the Time	A Little of the Time	None of the Time
21. Did you feel full of pep?	1	2	3	4	5	6
22. Have you been a very nervous person?	1	2	3	4	5	6
23. Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
24. Have you felt calm and peaceful?	1	2	3	4	5	6
25. Did you have a lot of energy?	1	2	3	4	5	6

26. Have you felt downhearted and blue?	1	2	3	4	5	6
27. Did you feel worn out?	1	2	3	4	5	6
28. Have you been a happy person?	1	2	3	4	5	6
29. Did you feel tired?	1	2	3	4	5	6

During the **past 4 weeks**, how much of the time has your **physical health or emotional problems** interfered with your social activities (like visiting with friends, relatives, etc.)?

(Circle One Number)

- 30. All of the time 1
- Most of the time 2
- Some of the time 3
- A little of the time 4
- None of the time 5

How TRUE or FALSE is each of the following statements for you.

(Circle one number on each line)

	Definitely True	Mostly True	Don't Know	Mostly False	Definitely False
31. I seem to get sick a little easier than other people	1	2	3	4	5
32. I am as healthy as anybody I know	1	2	3	4	5
33. I expect my health to get worse	1	2	3	4	5
34. My health is excellent	1	2	3	4	5

This next section is about your perception or control over your health behaviors:

This next section is about your perception or control over your behavior:

Rating Scale:

1 = Not at all true 2 = Hardly true 3 = Moderately true 4 = Exactly true

Items:

1. I can always manage to solve difficult problems if I try hard enough.
2. If someone opposes me, I can find the means and ways to get what I want.
3. It is easy for me to stick to my aims and accomplish my goals.

4. I am confident that I could deal efficiently with unexpected events.
5. Thanks to my resourcefulness, I know how to handle unforeseen situations.
6. I can solve most problems if I invest the necessary effort.
7. I can remain calm when facing difficulties because I can rely on my coping abilities.
8. When I am confronted with a problem, I can usually find several solutions.
9. If I am in trouble, I can usually think of a solution.
10. I can usually handle whatever comes my way.

If you have never used the Addo platform or did not adopt Addo into your routine, please skip this section:

1. I enjoy using Addo:
1 Disagree --- 5 Agree
2. I would recommend Addo to a friend:
1 Disagree --- 5 Agree
3. I would participate again?
Yes
No
4. The user interface was easy to use:
1 Disagree --- 5 Agree
5. Addo helped me change or improve my lifestyle behaviors?
1 Disagree --- 5 Agree
6. I enjoyed the competitive nature of Addo
1 Disagree --- 5 Agree
7. The competitiveness pushed me to accomplish the challenges
1 Disagree --- 5 Agree

8. I enjoyed the social component of Addo
1 Disagree --- 5 Agree
9. The social component of Addo pushed me to accomplish more challenges
1-Disagree --- 5 Agree
10. The component of Addo in which I improved the most was:
 5. Nutrition
 6. Exercise
 7. Mental
 8. Community
11. The component of Addo in which I enjoyed the most was:
 5. Exercise
 6. Nutrition
 7. Mental
 8. Community

Demographics:

1. Age:
2. Occupation:
3. Gender:
4. In the last 6 months have you participated in any of the following: joined a new gym or fitness class outside of work, participated in a free education session offered by PWFC, any health promotion activities with your workplace. Please specify:

Appendix G.

Brief-qualitative interview questions with Treatment Group (n=10) post Addo challenge

Dear participant,

You are invited to participate in a research study conducted by Kaleigh Meisner, under the supervision of Mary McKenna of the University of New Brunswick. The objectives of the research study are to evaluate the effectiveness of the Mobile Application and Online Platform of Addo, the health behavior change challenge. The study is for a Master's thesis.

If you decide to volunteer, you will be asked to complete an informal 10-minute interview. Interview questions focus on the structure and usage of the Addo platform. Participation in this study is voluntary. You may be contacted again in the future for further questions, if they arise throughout the study. You may decline to answer any questions that you do not wish to answer and you can withdraw your participation at any time with no penalty. There are no known or anticipated risks from participating in this study.

The data collected from this study will be maintained on a password-protected computer database. As well, the data will be electronically archived after completion of the study and maintained for two years and then erased.

Should you have any questions about the study, please contact Kaleigh Meisner, student investigator (kaleighmeisner@gmail.com), or Mary McKenna, faculty investigator (mmckenna@unb.ca). Further, if you would like to receive a copy of the results of this study, please contact either investigator.

Consent to Participant

With full knowledge of all foregoing, I agree, of my own free will, to participate in this study.

- I agree to participate
- I do not wish to participate

Name:

Signature:

Questions for Addo Challenge users:

1. How many Addo Challenges have you participated in?
2. Do you intended or would you like to do another Addo challenge?
3. How did you find the online platform to use?
4. How many times per day did you log into the Addo platform when in the challenge?
5. In your opinion, was doing daily challenges a helpful, or unhelpful way for you to make behavior changes in your health?
6. Did you participate in challenges pertaining to all four dimensions of wellness i.e. physical activity, nutrition, mental health and community involvement?
7. What component of Addo did you enjoy the most?
8. What component of Addo did you enjoy the least?

Appendix H.

Sample script designed for participants within the treatment group as a method of recruitment.

“Hi Sally Smith, its nice to see you today. As you know, [Kaleigh is| I am currently a graduate student in health services research. I am telling you this because you have expressed previous interest in learning more about how you can participate in the study. [We are] I am looking for organizations to compete in a workplace wellness challenge. If you are interested or think your company may be, I will email you or your employer detailed information on the workplace wellness challenge, Addo and [Kaleigh’s] my research project.”

Appendix I.

Copy of the advertisement (true to size) sent VIA month newsletter to all fitness facility members in Purdy’s Wharf as recruitment for the Treatment Group.



Appendix J.

Sample script designed for participants within the control group as a method of recruitment.

“Hi Sally Smith, its nice to see you today. As you know, I am currently a graduate student in health services research. I am telling you this because you have expressed previous interest in learning more about how you can participate in the study (note that in prior interactions with clients, the student researcher informally raised the topic of the research). I am looking for participants to complete a survey on their general health behaviors. If you are interested, I will email you information that will link you to a consent form and a Google Form, which is where the survey is located.”

Sure that sounds great, I would like to help.

“Thanks Sally, I already have your email (because of position as a personal trainer) so look forward to hearing from me later!”

Appendix K.

Advertisement posted on Facebook and Linked In, designed for the Control Group as a recruitment method.

If you hold full-time employment, please take 5-minutes to read the details of my Master's Thesis Research Study and follow the steps below to participate!

You are invited to participate in a research study conducted by Kaleigh Meisner, under the supervision of Dr. Mary McKenna of the University of New Brunswick. The objectives of the research study are to evaluate the effectiveness of a Workplace Wellness Application. The study is for a Master Degree in Applied Health Services Research.

What Should I Expect?

The portion of the research study you are invited to participate in consists of an analysis of general health behaviors in the workplace.

If you decide to volunteer, you will be asked to complete three 5-minute online surveys that are completely confidential. After the initial survey, you will be asked to complete the same survey in December and again in February 2016. The survey questions are an integral component of the research methodology and focus on general health behaviors and self-efficacy. Participation in this study is voluntary. You may decline to answer any questions that you do not wish to answer and you can withdraw your participation at any time. There are no known or anticipated risks from participating in this study.

Why Should I Participate?

Workplace wellness has the advantage of access to employees at an age when interventions can change the long-term health trajectory. Through small organizational changes, we can improve the behavior of our employees. These lifestyle changes have the ability to improve the current and long-term health of employees by improved energy, less sick-time, and less frequent doctor visits.

It is important for you to know that any information that you provide will be confidential. The data will be summarized and no individual will be identified in the results. The data, with no personal identifiers, collected from this study will be maintained on a password-protected computer database. As well, the data will be electronically archived after completion of the study and maintained for five years and then destroyed.

How do I sign up?

Follow the link below:

Complete the Consent form and Health Behaviors Questionnaire:

https://docs.google.com/forms/d/1p2piH6AY557OwVOt9yX80DpRFmWYQW9uPPL5HZVQdCE/viewform?usp=send_form

Complete this same survey through email prompt in December 2015 and February 2016.

Kaleigh Meisner is your main point of contact and is accessible by email for any questions of concerns throughout the challenge (kaleighmeisner@gmail.com).

Please note that this project is part of Kaleigh Meisner's Masters research.

Appendix L

Sample copy of an email sent to the Treatment Group for recruitment purposes.

Dear _____,

I would like to introduce myself. I am a Personal Trainer at Purdy's Wharf Fitness Club and a Master's student at the University of New Brunswick. In conjunction with Healthy Workplace Month in October, and as part of my Masters Thesis, I am offering you and your employees an opportunity to participate in a wellness challenge. The challenge is designed for your employees using a mobile application, Addo.

Below is a link that will provide you further details on what the Addo Challenge entails, as well as more about the background of healthy workplace month and it's conjunction with my Master's Thesis. Please complete the following two-step process:

Step-One:

Complete the Health Behaviors Questionnaire by following the following link:

https://docs.google.com/forms/d/1p2piH6AY557OwV0t9yX80DpRFmWYQW9uPPL5HZVQdCE/viewform?usp=send_form

Step Two:

Register for the Addo Challenge by following the following link and using the product key 37a6a79283f6:

https://dev.addotime.com/social/wolfpack_signup/67832781b6aed9a36aa8b05d3628eb2f3ce7537e1443551526

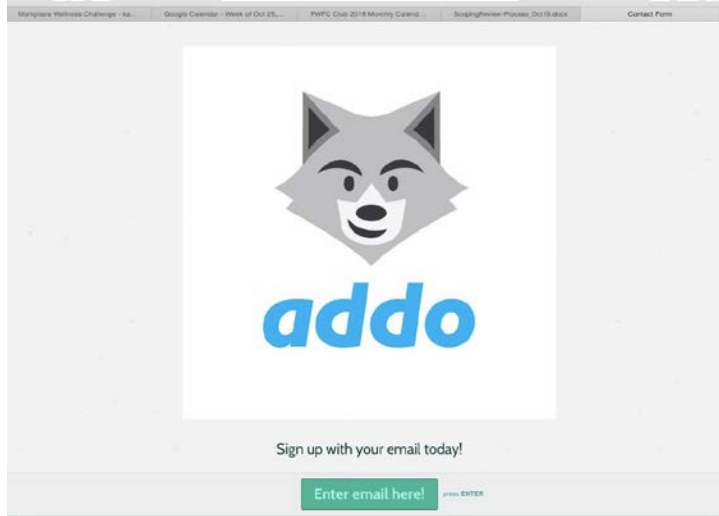
Please do not hesitate to contact me with any questions or how to get started. You may call me at 902 478-6863 or by email at kaleighmeisner@gmail.com

Thank you for your consideration and time,
Kaleigh

Appendix M.

Screen Shot of the Addo Registration List sign up from the participant screen

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Curriculum Vitae

Candidate's full name: Kaleigh Lynn Meisner

Universities attended:

University of New Brunswick: Master's of Applied Health Services Research, 2014-2017

Saint Mary's University: Bachelor of Arts Honors Psychology, 2010-2014

Conference Presentations:

Crossroads Interdisciplinary Health Research Conference, 2016

Canadian Association for Health Services and Policy Research Conference, 2017

Canadian Public Health Association Conference, 2017