

**Electronic Tools to Support Nutrition and Physical Activity Behaviour Change:
Public and Professional Experiences**

by

Jessica Lieffers

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AUTHORS DECLARATION

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the thesis.

This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

STATEMENT OF CONTRIBUTIONS

Jessica Lieffers was the sole author for Chapters 1, 2, 3, 4, and 10 which were written under the supervision of Dr. Rhona Hanning.

Research Presented in Chapters 5, 6, and 7: This research was conducted at the University of Waterloo by Jessica Lieffers under the supervision of Dr. Rhona Hanning. Helen Haresign and Christine Mehling served on the project advisory committee. Jessica Lieffers, Helen Haresign, and Christine Mehling contributed to study design. Jessica Lieffers conducted all of the one-on-one semi-structured interviews, and data analysis with the assistance of Dr. Rhona Hanning. Jessica Lieffers wrote the draft manuscripts, and Helen Haresign, Christine Mehling, and Dr. Rhona Hanning provided intellectual input on manuscript drafts. Dr. Frank Arocha was a second coder for the studies presented in Chapter 6 and 7, and provided intellectual input on the manuscript drafts for Chapters 6 and 7.

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Research presented in Chapter 9: This research was conducted at the University of Waterloo by Jessica Lieffers under the supervision of Dr. Rhona Hanning. Jessica Lieffers designed the survey, mounted the survey on SurveyMonkey®, pilot tested the survey, and conducted all data analysis. Dr. Vivienne Vance was a second coder for this study. Jessica Lieffers drafted the manuscript and Dr. Vivienne Vance, and Dr. Rhona Hanning provided intellectual input on manuscript drafts. A version of the work in Chapter 9 has been published in the Canadian Journal of Dietetic Practice and Research. Permission had been obtained by the editor of this journal to include this work as part of this thesis (please see back matter for letter of permission). The citation for this work is listed below:

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ABSTRACT

INTRODUCTION: Poor diet and physical inactivity are prevalent and contribute to the “epidemic” of overweight and obesity in Canadian adults. Different strategies can be utilized to help individuals improve their behaviours including electronic tools, more specifically websites and mobile apps. These approaches have gained substantial recent momentum for several different reasons including: a) Internet and mobile devices and their apps are commonly used worldwide, b) they have a broad reach, c) they are versatile (e.g., can incorporate different behaviour change techniques including behaviour self-monitoring and use of goals), and d) may be able to better support behaviour change than traditional methods. Although these tools have strong potential to help improve the behaviours of individuals, and positive outcomes have been seen in research to date, there are several important research gaps that need to be addressed to better optimize use. First, much of the research on these tools has focused on use in research trial settings; few studies have been conducted on individuals using these tools more naturally, outside of this supportive setting. Second, much of the research in this area has focused on quantitative outcomes (e.g., weight loss, change in servings of fruits and vegetables); qualitative data on user and professional experiences with and perceptions of these tools is lacking. Third, numerous different behaviour change techniques, like goal setting and tracking, have been incorporated into these tools, but little information is known about naturalistic use of and experiences with such techniques in these tools. Fourth, different adjuncts (e.g., messaging, professional support) have been added to electronic tools to enhance outcomes, however, little is known about user and professional experiences and perceptions with such supports when used outside of a research trial environment. Lastly, mobile apps

have the potential to help enhance the practice of Canadian dietitians, however, little information is available about use of these tools in dietetic practice. This thesis research used a combination of qualitative and quantitative research approaches through five studies that addresses these important research gaps. Studies #1, #2, and #3 evaluated Dietitians of Canada's web-based eaTracker® (<http://www.eaTracker.ca/>) "My Goals" feature, as well as dietitian contact-centre support and motivational messaging provided for Ontario users of this tool. The My Goals feature allows individuals to set goals ("ready-made" Specific – Measurable – Achievable – Realistic – Time related goals or "write your own" goals) and track goal related progress using the My Goals Tracker. EatRight Ontario (ERO), an organization that provides free nutrition assistance by toll-free call, email and website for Ontario, Canada residents, added additional adjunct supports for Ontario My Goals users including the opportunity to consult with an ERO contact centre dietitian about their goals, and goal-related motivational email and website delivered messaging. Study #4 examined adult user experiences with and perceptions of nutrition mobile apps for weight management when used outside of a research trial environment. Study #5 examined use of mobile device apps in Canadian dietetic practice.

METHODS: The University of Waterloo Office of Research Ethics provided approval for all studies. Study #1: A dataset containing anonymous data on all goals set with the eaTracker® My Goals feature from December 6, 2012 to April 28, 2014 by users ≥ 19 years of age from Ontario and Alberta, Canada, with active eaTracker® accounts was acquired from Dietitians of Canada. This dataset contained information on: a) self-reported user demographics, b) goals set with the feature, and c) My Goals Tracker use information. "Write your own" goals were

categorized by topic area and specificity. Descriptive statistics were used to summarize demographics, goals, and tracker use. Study #2 and #3: eaTracker® users from Ontario and Alberta, Canada who had set a goal with the My Goals feature at least 30 days previously (and for Ontario users, they had to have been signed up to receive ERO motivational messaging for at least 30 days) were recruited using a pop-up box on the eaTracker® website. Recruited participants completed a one-on-one semi-structured qualitative interview in-person, by phone or online, on the My Goals feature and ERO adjunct supports. ERO dietitians were also interviewed, having been recruited via ERO administration. Audio recorded interviews were transcribed. Transcripts were coded and codes were organized into categories using NVivo version 10 (QSR International, Doncaster, Australia). Study #4: Healthy adults who had been using publicly available mobile apps for nutrition behaviour change to manage body weight not for the purpose of a research trial were recruited via social media, posters, and word of mouth to complete a one-on-one in-person semi-structured interview. Transcribed interviews were coded, and codes were organized into categories and subcategories using NVivo 10. Study #5: A survey on diverse aspects of mobile app use in dietetic practice was drafted with different question types (n=49 possible questions), and mounted on the SurveyMonkey® (SurveyMonkey, Palo Alto, California) website following pre-testing by volunteer dietetic interns and dietitians. Dietitians of Canada promoted the final survey to dietitians from January 2012-April 2012 via their monthly member e-newsletter. Quantitative data were analyzed using descriptive statistics, and open-ended questions were coded, and underwent thematic analysis.

RESULTS: Study #1: Overall, n=16,511 goal entries (75.4% ready-made; 24.6% write your own) were included for analysis. These goals were set by n=8,067 adult users 19-85 years of age (83.3% female; mean age 41.1±15.0 years, mean body mass index (BMI) 28.8±7.6kg/m²). Of all included ready-made goals, 33.1% were from the “Managing your Weight” category. Of “write your own” goal entries, 42.3% were solely distal goals (most related to weight management); 38.6% addressed nutrition behaviour change (16.6% had unspecific general eating goals); 18.1% addressed physical activity behaviour change (47.3% without information on exercise amount and type). Many “write your own” goals were poor quality (e.g., non-specific) and likely unrealistic (e.g., no sugar). Less than 10% of goals were tracked. Study #2: Participants said goal setting for nutrition and physical activity behaviour change was beneficial, yet it was difficult to follow through with goals. In general, they showed enthusiasm for the My Goals concept, but the current feature had several functional limitations. Suggestions were provided to improve the My Goals feature and that could also be used for the development of future goal setting and tracking tools. Study #3: Although participants were enthusiastic about having the ability to consult with dietitians about their goals, no interviewed Ontario My Goals users had contacted ERO dietitians for goal-related assistance, and ERO dietitians reported encountering few to no individuals seeking this assistance while using My Goals. Limited knowledge of this service was the main explanation for this finding. Participants reported mixed thoughts and preferences on motivational messages (ranging from being helpful supports to not being helpful or wanted). Numerous suggestions were provided to improve both contact centre dietitian support and motivational messaging in the future. Study #4: Participants reported using a variety of apps to help them change their nutrition behaviours; MyFitnessPal® (MyFitnessPal, San Francisco, California) was the most popular.

In general, participants reported using them without any professional assistance. Most participants were enthusiastic about these tools; however, challenges were reported. Aspects of the experience users had with using these apps can be divided into the following categories: a) data entry, b) accountability, feedback and progress, c) technical and app-related factors, d) personal factors, and e) obsession. Data entry was done throughout the day for most participants; however, some waited until the end of the day to enter data and others used apps to pre-plan their food intake. Participants liked large food databases; however, sometimes foods were difficult to find. Difficulties estimating portion size and entering mixed dishes and restaurant foods were also reported. Barcode scanners, and data entry shortcuts (e.g., favourites, multi-add) were well liked and used often. Technical concerns (e.g., long loading time) were encountered by some users which sometimes caused them to end use. Personal factors (e.g., self-motivation, privacy, knowledge) also affected use. Some female participants mentioned that apps could promote an obsession with dietary intake recording and calories.

Study #5: In total, 139 dietitians answered some questions and 118 completed the survey. Mobile app use in dietetic practice was reported by 57.3%, and 54.2% reported that they had a client ask about or use a nutrition/food app. Just under half of all respondents (40.5%) had recommended nutrition/food apps to clients. Although respondents felt positively about mobile apps, several challenges were mentioned. From open-ended question responses, three themes emerged regarding factors that can affect dietitians' use of apps and whether they recommend them to clients: mobile device and app factors (access to information/tools, content quality, ease of use, accessibility/compatibility, and cost), personal factors (knowledge, interest, suitability, and willingness/ability to pay), and workplace factors.

CONCLUSION: Through evaluating the experiences and perceptions of those using a range of electronic tools and features to support nutrition and physical activity behaviour change outside of a research trial setting, this research provides in-depth information on emerging technology use for this purpose. Not only does this research have direct application to improve Dietitians of Canada's eaTracker® tools and associated supports, it can also be used to inform the next generation of apps and other electronic tools. This thesis research also provides information relevant to dietitians and other health professionals who work with individuals using electronic tools to support healthier nutrition and physical activity behaviours and body weights.

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LIST OF ABBREVIATIONS

BMI Body Mass Index

CIHR Canadian Institutes of Health Research

CFDR Canadian Foundation for Dietetic Research

COREQ Consolidated Criteria for Reporting Qualitative Research

CRTC Canadian Radio-television and Telecommunications Commission

d days

DC Dietitians of Canada

ERO EatRight Ontario

GPS Global Positioning System

kg kilograms

lb pounds

m meters

PDA Personal Digital Assistant

PEN Practice-based Evidence in Nutrition

SMART Specific – Measurable – Achievable– Realistic – Time-related

SPSS Statistical Package for the Social Sciences

SRC University of Waterloo Survey Research Centre

y years

CHAPTER 1: INTRODUCTION

In Canada, many adults fail to meet nutrition and physical activity recommendations (1-3) thought to prevent life threatening chronic non-communicable diseases. Indeed, in 2012, five of the top ten causes of death in Canadian adults were chronic non-communicable diseases with known linkages to poor nutrition and/or physical activity behaviours (i.e., heart disease, cancer, diabetes, stroke, kidney disease) (4). In addition, excess body weight, which is caused by an imbalance of energy intake and expenditure, is perhaps the most significant nutrition and physical activity issue affecting the health of Canadian adults. The 2012-2013 Canadian Health Measures Survey found that 28% of women, and 43% of men 18-79 years of age were overweight (Body Mass Index (BMI) ≥ 25.0 kg/m²) and 26% of women, and 27% of men in the same age range were obese (BMI ≥ 30 kg/m²) (5). Excess body weight is associated with increased chronic disease risk (e.g., certain cancers, type 2 diabetes, cardiovascular disease) (6-9), mental health problems (10, 11), and poor physical function (12). These illnesses and disabilities can lead to substantial health care costs (13). Weight management treatments can vary; however, lifestyle interventions to improve nutrition and physical activity behaviours are a central component of many clinical practice guidelines (14-16).

Interventions to improve nutrition and physical activity behaviours have traditionally been conducted in person with health professionals (e.g., dietitians) either one-on-one or in group settings, frequently with several sessions. These sessions typically incorporate and/or teach behaviour change techniques, such as goal setting, behaviour self-monitoring and provide feedback on behaviours, which are known to be associated with positive outcomes (17). Although intensive in-person lifestyle-based interventions administered by health professionals can result in positive outcomes (including better outcomes than medications) (18), and have

been recommended as part of clinical practice guidelines for weight management (14), the need for assistance with nutrition and/or physical activity behaviour change exceeds the capacity of health professionals to provide these types of services in one-on-one or small group sessions. Moreover, individuals may experience significant barriers associated with attending in-person sessions (e.g., time, cost, inability to attend due to health issues, embarrassment, and lack of services available in the community) which may decrease suitability for certain people.

Over the past several years, substantial interest has been generated in the use of electronic approaches, specifically websites and mobile apps, to assist with the nutrition and/or physical activity behaviour change process. Websites and mobile apps can be used on their own, alongside other equipment (e.g., pedometers, accelerometers), or as an adjunct to human administered sessions (e.g., in-person counselling, group sessions, walking groups) (19-25).

There are several reasons why there has been substantial interest generated in this area:

- 1) Internet and mobile apps are commonly used in the North American society;
- 2) these types of approaches have broad reach;
- 3) these types of approaches are versatile;
- 4) these types of approaches may be better to able support behaviour change compared to traditional methods.

More elaboration for each of these points will be provided in the next four paragraphs.

First, Internet and mobile apps are mainstream and highly used in our society. For example, according to the 2012 Canadian Internet Use Survey, 83% of households in Canada had home Internet access (up from 79% in 2010) (26) and 83% of Canadians ≥ 16 years of age accessed the Internet for personal use (up from 80% in 2010) (27). In addition, mobile devices and their apps have flourished in popularity over the past few years and are now an integral and

routine part of the daily lives of many Canadian adults. The Canadian Radio-television and Telecommunications Commission (CRTC) Communications Monitoring Report 2015 reported that 66% of Canadians ≥ 18 years of age owned a smartphone in 2014 which is up from 62% in 2013 and 24% in 2010 (28). Further, 49% of Canadian adults ≥ 18 years of age owned a tablet in 2014, which is up from 39% in 2013 and just 3% in 2010 (28). A survey conducted by Catalyst Canada found that smartphone owners had on average just under 19 apps on their device in 2015 (29). Such familiarity with apps in general may facilitate their acceptance for nutrition and physical activity behavior change support. In addition, because so many individuals already have access to the Internet and/or mobile devices, this approach is likely affordable for large fractions of the population.

Second, these approaches also potentially allow nutrition and physical activity behaviour change interventions to reach large proportions of the population (30). This large reach also includes individuals located in rural and remote areas.

Third, website and mobile app based approaches are also versatile and consequently have the ability to perform diverse functions to assist individuals with the behaviour change process. These functions include information delivery (including tailored information delivery), behaviour assessment and feedback, access to peer, family, and health professional support, assistance with use of goals, and access to nutrition and physical activity behaviour self-monitoring tools (which may include tools that provide feedback based on entered data) (19-24, 31).

Fourth, websites and mobile apps also have the potential to better assist individuals with use of different behaviour change techniques, notably self-monitoring and use of goals, compared to traditional methods. More specifically for self-monitoring, these tools have the

ability to allow users to record data about their behaviours using information stored in databases, and can provide expedient feedback, including comparisons with recommended targets, which may overcome some limitations and difficulties associated with paper-based records (32). Mobile apps may be especially suited to behaviour self-monitoring because users can record nutrition and physical activity data and receive expedient feedback in their normal environment when and where behaviours occur (33). Numerous free and low cost websites and mobile apps for nutrition and physical activity behaviour self-monitoring (e.g., eaTracker® (Dietitians of Canada, Toronto, Ontario), MyFitnessPal® (MyFitnessPal, San Francisco, California), Lose It!® (FitNow Inc., Boston, Massachusetts), Get Enough Helper App® (Dairy Farmers of Canada, Ottawa, Ontario)) have emerged and are now easily accessible from both the Internet and/or mobile app stores (e.g., Google Play Store™ (Google Inc., Mountain View, California), Apple App Store® (Apple Inc., Cupertino, California)). Websites and mobile apps can also be used to assist individuals with goal use for behaviour change. There are numerous ways that goals have been incorporated into these types of tools ranging from inclusion of goal setting education (e.g., as part of modules, tutorials) to online goal setting and tracking tools (34-41). The ability of websites and mobile apps to assist individuals with this technique is encouraging because previous studies have found that individuals have difficulties with goal use (e.g., have broad, unspecific goals or desired outcomes (e.g., lose 50 pounds, live as long as possible) with no time frame or a plan for achievement (42, 43), or how to set goals when behaviours vary on a day-to-day basis (44)).

In addition to these four advantages, websites and mobile apps also offer several additional positive advantages (e.g., private and anonymous use, little or no stigma, anytime accessibility, personalized tailoring, graphical feedback) (23, 30, 45-53). The Internet has also

been shown to be a place where individuals with stigmatized illnesses (which can include obesity) look for information and support (54, 55).

With substantial interest in websites and mobile apps for nutrition and physical activity behaviour change, it is not surprising that numerous research trials have emerged that have tested the effectiveness of interventions using these approaches. This work has revealed that websites and mobile apps can be as or more effective compared to traditional approaches for nutrition and physical activity behaviour change; however, attrition from these interventions is a common phenomenon and significant threat. Eysenbach (56) has proposed the “Law of Attrition,” which suggests that there are high levels of intervention non-use (non-use attrition) and/or dropouts (dropout attrition) in electronic self-help interventions. This author suggests that a reason for high attrition is because unlike a drug trial which has a prescribed dose, the “dose” of self-help electronic tool use is primarily user chosen; importantly, if tool use is not required or absolutely necessary for health (which would be the category where these types of electronic interventions would fall), limited use and discontinuation can be a simple process (56). High levels of attrition are relevant as higher engagement with these types of interventions has been associated with better outcomes (e.g., weight loss) (20, 49, 57-64). Eysenbach (56) suggests that there should be more emphasis placed on the study of attrition in research evaluating these types of electronic tools. If attrition levels can be decreased, the potential impact of these types of interventions could be strengthened.

Qualitative research may be an approach to provide relevant data on how to decrease attrition. In addition, this type of research can help reveal what works (or does not work) and with whom, how these tools are used in the normal environment of individuals, and what is needed to best use these tools in naturalistic settings. However, to date, there has been a strong

focus on understanding quantitative outcomes with these tools compared to qualitatively understanding user experiences and perceptions. Qualitative data from the user perspective have the potential to help enhance use of these types of tools and to inform future development of websites and mobile apps.

In addition, much of the existing research on use of websites and mobile apps for nutrition and/or physical activity behaviour change has been conducted in research trial settings; studies that have collected data outside of this environment are scarce. This gap is relevant because although research trials are essential to understand the effectiveness of website and mobile app interventions for nutrition and/or physical activity behaviour change, they generally have rigorous participant inclusion and exclusion criteria, motivated participants, and contact with research professionals which may not represent more naturalistic or real-world use (21, 65, 66). Some participants may also feel an obligation to finish a research study (48) when in the real-world they may have stopped tool use instead. Non-use attrition with a website intervention was also found to be more problematic in open access users compared to research trial participants (67). Research trials also provide users with the tools and do not allow for the natural adoption process to take place.

While the focus of this introduction thus far has been on electronic tool use for improvement of nutrition and physical activity behaviours in individuals, these tools, and more specifically mobile apps, also have the potential to be used by health care professionals to help increase the efficiency of their practice to better help their clients make nutrition and physical activity behaviour change. Dietitians, being at the forefront of helping individuals make nutrition behaviour changes, are one group of health professionals who may especially benefit from these tools. With the recent surge in popularity and mainstream availability of mobile

apps, one expects growing interest in these tools for use by dietitians in their practice, however, few data are available on this topic.

Given the high prevalence of poor nutrition and physical activity behaviours in the general population, and the strong interest and potential of websites and mobile apps to help support the behaviour change process, an understanding of the use of these tools in naturalistic settings is essential. In this thesis, naturalistic settings are considered those where individuals are using these tools as part of their normal lives and not for the purpose of a research trial. In this thesis, sometimes the term real-world is used instead of naturalistic. Using a combination of qualitative and quantitative research approaches, this thesis research: a) evaluated naturalistic use of a publicly available Canadian website-based nutrition and physical activity goal setting and tracking feature as well as messaging and contact dietitian centre adjunct supports for users of this feature, b) investigated user experiences with and perceptions of publicly available mobile apps to support nutrition behaviour change for weight management when used outside of a research trial environment, and c) examined mobile device and app use in Canadian dietetic practice.

Chapter 2 describes the theoretical framework (Diffusion of Innovations (68)) that is relevant to and informed aspects of this thesis research. Chapter 3 encompasses a review of relevant peer-reviewed literature. Chapter 4 presents the rationale and objectives for the five research studies presented in this thesis. Chapters 5-9 detail information about the five separate research studies. Chapter 10 is a discussion of results from the five separate research studies, strengths and limitations of this thesis research work, and future directions.

Before moving forward to the next chapter, because in qualitative research the researcher is the key data collection instrument, I want to provide some information about my

orientation for readers to provide some context and to help set the stage for this thesis research. I am female, have an undergraduate degree in nutrition, and am a dietitian with research interests on the use of technology-based tools in dietetic practice. In fact, I have had a long standing in interest in technology-based tools in general since childhood. My familiarity with apps to support behavior change has been hone, through a published review paper in the *Canadian Journal of Dietetic Practice and Research* (69) and serving on Dietitians of Canada's eaTracker advisory committees (2010-4). I therefore acknowledge the potential for a positive bias towards the use of self-monitoring, goal setting and tracking and professional support in diet behavior change. I also acknowledge the potential for a pro-technology bias. Because of my awareness of this potential, I intentionally avoided personal use of websites and mobile apps for diet and physical activity behavior change. I also reviewed and re-reviewed the transcripts and codes to ensure that I was authentically representing the perspectives of all participants.

CHAPTER 2: THEORETICAL FRAMEWORK

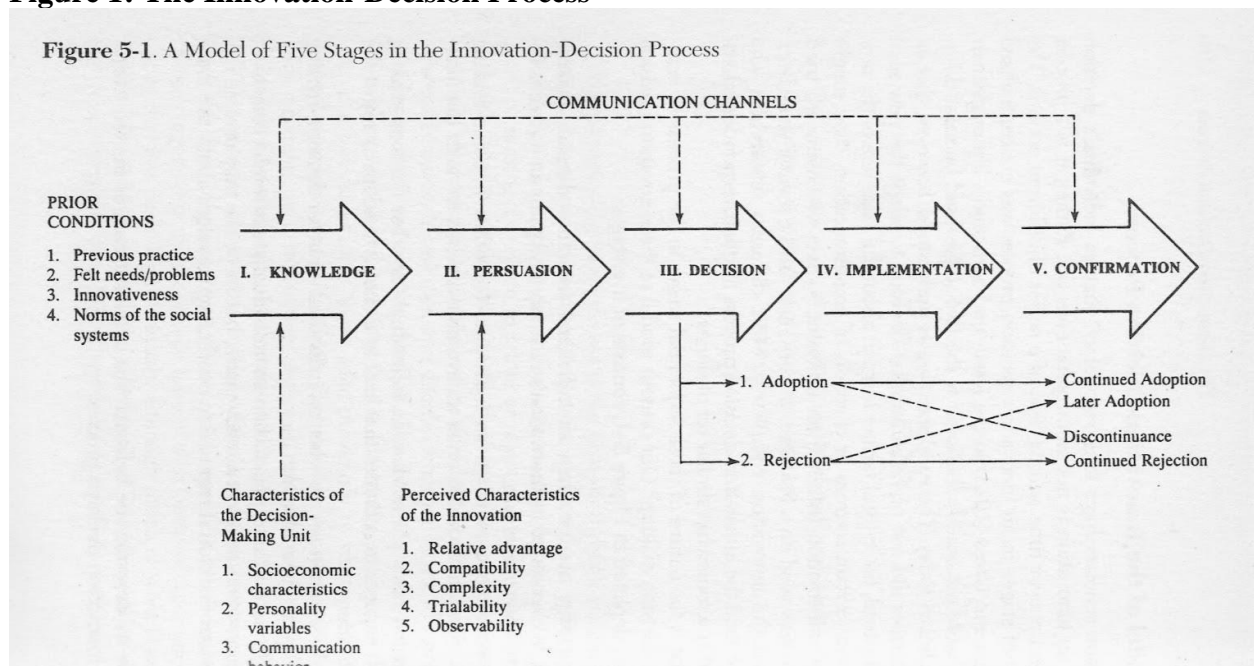
The Diffusion of Innovations (68) framework was relevant to this thesis research. This framework was first developed by Everett Rogers in 1962 and provides insight into how new innovations (e.g., guidelines, information technology tools, products, services, ideas) are dispersed and taken up in populations of individuals. Although Rogers was initially interested in studying the diffusion and uptake of agricultural innovations in the United States in the 1950s, he found that there were extensive similarities in innovation diffusion processes across different disciplines (e.g., agriculture, education) which led him to believe that how innovations are spread and taken up by groups of individuals is universal (68). This led him to propose the Diffusion of Innovations framework in 1962. This framework has since been applied in diverse settings including disciplines relevant to this thesis research (e.g., public health, nutrition, dietetics, and information technology).

Diffusion is defined “as the process by which 1) an *innovation* 2) is communicated through certain *channels* 3) over *time* 4) among members of a *social system*” ((68), p.11). First, an *innovation* “is an idea, practice, or object that is perceived as new by an individual or other unit of adoption.” ((68), p.12). Second, new innovations are spread through *communication channels* (e.g., mass media channels, interpersonal channels). Third, *time* is the duration taken to adopt an intervention and has different dimensions (e.g., how long it takes from individual’s discovery of the innovation to adoption or rejection, how long it takes for the individual to adopt the innovation relative to other individuals in the population, and the speed with which the innovation is taken up by a population as a group) (68, 70). Fourth, *social system* is “a set of interrelated units that are engaged in joint problem solving to accomplish a common goal” ((68), p.23). Within the Diffusion of Innovations framework, there are sub-

sections including the Innovation-Decision Process, the Attributes of Innovations, Innovativeness and Adopter Categories, and the Rate of Adoption which will be described below.

Innovation-Decision Process: There are five stages in the Innovation-Decision Process (**Figure 1**). These stages include: *knowledge* (person finds out about the innovation and learns some information about it), *persuasion* (person develops a positive or negative attitude regarding the innovation), *decision* (a choice is made about whether to use the innovation or not), *implementation* (the innovation is used by the person), and *confirmation* (a decision is made about whether to continue or discontinue innovation use) (68).

Figure 1: The Innovation-Decision Process



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Attributes of Innovations: The Diffusion of Innovations framework suggests that there are five innovation characteristics that affect whether an innovation is adopted as well as the extent to which it is adopted. These include: *relative advantage* (whether the innovation offers improvements over what is already available), *compatibility* (how well does the innovation fit into the individual's life (e.g., beliefs, norms, needs, values, practices)), *complexity* (degree of difficulty of using the innovation), *trialability* (whether the user is able to try the innovation before a commitment is made), and *observability* (how much the beneficial outcomes from the innovation can be noticed by others) (68). These characteristics are especially important in the *persuasion* stage of the Innovation-Decision Process (68) (see Figure 1).

Innovativeness and Adopter Categories: The Diffusion of Innovations framework suggests that there are different types of individuals in a society in terms of the length of time it takes them to adopt an innovation; these categories have been termed: *innovators*, *early adopters*, *early majority adopters*, *late majority adopters*, and *laggards* (68). The distribution of these different types of individuals in a population is thought to follow a normal distribution (i.e., *innovators* (2.5%), *early adopters* (13.5%), *early majority adopters* (34%), *late majority adopters* (34%), *laggards* (16%)) (68).

Rate of Adoption: This is the speed at which an innovation is taken up by a population. Rogers suggests that innovations are adopted over time in a sigmoid curve shaped fashion (slow initial uptake, followed by a steep increase in uptake, followed by a plateau in uptake) (68).

For this thesis research, the Diffusion of Innovations framework provided insight into directions to explore to better understand the entire adoption process of websites and mobile apps to support nutrition and physical activity behaviour change. In this thesis, mobile apps

and websites were considered new innovations, and aspects of the diffusion process were explored. The Innovation-Decision Process provided justification for conducting this research outside of a research trial setting and guidance into directions to explore to help understand the adoption process of websites and mobile apps. Research trial settings do not allow for an in-depth understanding of the natural process that individuals experience when deciding to use or not to use a website or mobile app. The Attributes of Innovations helped to identify the types of innovation characteristics that are important for individuals during the mobile app and website adoption process. Further, Eysenbach (56) suggested that these attributes can also affect whether an individual discontinues use of ehealth innovations in the *confirmation* stage of the Innovation-Decision Process.

CHAPTER 3: LITERATURE REVIEW

3.1 Website and mobile app use for nutrition and/or physical activity behaviour change

Dozens of studies have emerged over the past several years that have examined website and mobile app use for nutrition and/or physical activity behaviour change. This work has primarily been conducted in research trial settings, however, a few studies have also examined use of these tools outside of research trial settings. Most of these studies have focused on quantitative outcomes; qualitative studies of user experiences with websites and mobile apps for nutrition and/or physical activity behaviour change exist, but are considerably rarer.

3.1.1 Quantitative studies

3.1.1.1 Research trial settings

3.1.1.1.1 Websites

Numerous studies have examined quantitative outcomes from using website-based tools for nutrition and/or physical activity behaviour change in research trial settings; several review articles have summarized this work (19-21, 23, 24, 50, 71-73). Many of these studies have focused on weight management in middle aged women; the paucity of data on this topic in males is not surprising as this population has been understudied in the weight management literature in general (74). The following sections will discuss studies that have: a) compared websites to various types of limited intervention control groups, b) compared websites to in-person sessions, and c) assessed the impact of adding email prompts and health professional support to website interventions.

3.1.1.1.1 Websites vs. limited intervention control groups

Several studies conducted in various settings (e.g., churches, workplaces, universities) have tested the effectiveness of websites, without accompanying in-person or telephone-administered health professional assistance, against various types of limited intervention control groups (e.g., usual care, generic information, waitlist) in adults. The websites used for these interventions varied and frequently included multiple components such as: provision of general information or education; behaviour assessment and feedback tools; stage-matched tailored information and/or educational modules; goal setting and/or progress tracking tools; nutrition and/or physical activity behaviour self-monitoring and feedback tools; emailed newsletters with information on various topics (e.g., goals); and automated personalized feedback and/or tips provided via website or email. Some interventions also included opportunities to interact online with other participants. Because multiple techniques were frequently used simultaneously, isolating the effectiveness of individual components (e.g., goal setting tools, behaviour self-monitoring) is not easily possible.

In some short term interventions (i.e., ≤ 12 weeks), individuals who were assigned to website groups had statistically significantly more favourable changes in behaviours including increased fruit and vegetable intakes (75, 76), increased fiber intakes (76), decreased saturated fat intakes (77), increased frequency of dairy product consumption (37), and increased physical activity (75, 76, 78-80) compared to those assigned to limited intervention control groups. In another short term nine week study, Hurling et al (81) also found statistically significantly greater improvements in physical activity behaviours in individuals who were using a website and mobile phone based intervention compared to control group participants who only received oral information on physical activity recommendations. Positive results have also been found

in longer term interventions. For example, Sternfeld et al (82) found statistically significant decreases in saturated and trans fat intakes, and statistically significant increases in vegetable and fruit intakes, moderate and vigorous physical activity, and walking in individuals following a 16 week tailored workplace email and website-based intervention with a strong goal setting component compared to those assigned to a non-contact control group. Larger improvements in physical activity behaviours (i.e., active transportation, leisure physical activity, decrease in sitting) that reached statistical significance were also seen in individuals who had access to a website-based intervention for six months compared to those assigned to a no intervention control group (83).

Studies have also found statistically significantly higher losses of body weight (37, 45, 84, 85), and % body fat (85) in website intervention groups compared to minimal intervention control groups. For example, in a six week weight loss intervention in people with overweight or obesity, Rothert et al (45) found using last observation carried forward analyses that a group receiving access to a tailored website intervention lost $0.8 \pm 0.1\%$ of self-reported body weight compared to a $0.4 \pm 0.1\%$ loss in a control group who received access to a website with generic weight loss resources at the three month follow-up period ($p < 0.0005$); of note, there were still statistically significant weight loss differences between the two groups at the six month follow-up period. In addition, Moutappa et al (37) found that in participants who expressed a desire to lose weight, those assigned to a five week website intervention that provided: personalized feedback based on online assessments; opportunities to set short and long term goals; and emailed newsletters lost more self-reported body weight following the intervention compared to those assigned to a waitlist control group (website: $-0.89 \pm 2.27\text{kg}$; control: $+0.20 \pm 2.87\text{kg}$, $p < 0.05$). Further, in an eight week workplace intervention, Dennison et al (84) found that

individuals with a BMI $\geq 23\text{kg/m}^2$ randomized to an educational website to stimulate self-regulatory skill development lost significantly more weight compared to a no intervention control group (website: $-2.0 \pm 3.5\text{kg}$; control: $-0.3 \pm 2.8\text{kg}$, $p < 0.001$). Lastly, in a six month intervention conducted in healthy active duty male United States Air Force personnel, Veverka et al (85) found that participants randomized to a website with stage of change matched health information lost significantly more weight and % body fat compared to control participants (weight change: website: -2.2kg ; control: $+1.0\text{kg}$, $p < 0.05$; % body fat change: website: -1.5% ; control: $+0.6\%$, $p < 0.001$).

Although several studies have found modest improvements in behaviours and anthropometric measures in individuals who used websites compared to those who were assigned to limited or no intervention control groups, not all research has reported these types of positive findings. For example, in adults who self-reported a BMI from $24\text{-}31\text{kg/m}^2$ participating in a two month website weight management intervention, Van Genugten et al (86) found no statistically significant differences in measured BMI, skinfold thickness, and waist circumference change, and self-reported dietary intakes (i.e., fat, sweetened beverage, snacks) and physical activity behaviours in individuals randomized to a tailored self-regulatory website intervention that encompassed four modules compared to those randomized to a generic information control website six months after the two month website intervention period. In a nine month intervention, Duncan et al (34) also found no statistically significant differences in nutrition and physical activity behaviours in males 35-54 years of age randomized to a website and mobile phone based intervention compared to a group who received a similar intervention provided in a paper-based format. Finally, in adults with obesity, McConnon et al (87) found that after a 12 month intervention, there was no statistically significant differences in

researcher measured weight loss in participants randomized to a website that provided personalized advice based on self-reported progress compared to those randomized to usual care (usual care: -1.9kg; website: -1.3kg, $p=0.56$). Some, but not all, of the failure of such interventions to support positive changes may be due to factors such as limited guidance on how much the intervention should be used (34), limited Internet use in general (87), positive effects of being in a generic intervention or print-based control group (34, 86), participant expectations of the intervention did not match what was actually delivered (34), and quantifying dietary intake using food frequency questionnaires (34) which have limitations. However, across studies, dropouts and intervention non-use were thought to be key reasons for less positive findings which will be described in more detail in the next paragraph.

Although studies had a focus on reporting effectiveness outcomes (e.g., weight loss), many also reported information about attrition. Substantial levels of intervention non-use and/or dropout attrition was seen in both studies that reported benefits with website use compared to a control group and those that did not find any benefits. It should be noted that high drop-out rates were often also observed in control conditions and have also characterized traditional diet and physical activity interventions to support weight loss in general (88, 89). First, in interventions that did not find benefits with website use over a control group, intervention non-use and/or dropout attrition was a common phenomenon. For example, McConnon et al (87) found that 47% of participants never used the study website, that website use decreased over time (i.e., 53% of participants were using the website at six months compared to 29% of participants at 12 months), and 51% of participants from the website intervention group had dropped out by one year compared to 30% in the control group; of note, the authors also mentioned these high occurrences of non-use and dropouts in the website

group were found despite relatively positive intervention satisfaction ratings. In addition, Duncan et al (34) found that only 10% of participants had chosen a friend via the study social media platform, and that 53.2% of participants in the website group had dropped out by nine months compared to 45.8% in the control paper-based group. Kelders et al (90) found that only 3% of participants used the intervention program as intended and 36% did not use the intervention at all. Lastly, van Genugten et al (86) found that only 15% of participants completed 4/4 tailored modules in their two month intervention. Substantial occurrences of intervention non-use and dropouts were also seen in studies that found statistically significant improvements in outcomes in website intervention groups compared to control groups. For example, Dennison et al (84) found that about 1/3 of participants randomized to a website intervention never completed any sessions. Spittaels et al (83) also found that only ~30% of participants had re-accessed the website assessment tool to obtain updated tailored advice on physical activity three months into the intervention period in response to an email.

In order to help understand intervention non-use attrition, some studies have conducted multivariate statistical models to understand predictors of this phenomena; not surprisingly with the diversity of interventions and participants, mixed results have been found. For example, in a website intervention to increase physical activity in individuals with hip and/or knee osteoarthritis, Bossen et al (48) found that having a comorbidity was a statistically significant independent negative predictor and higher age was a borderline statistically significant independent negative predictor of program completion. Wanner et al (67) found that age and nationality were statistically significantly related to repeated use of their tailored physical activity behaviour change intervention website whereas sex, smoking status, education, and BMI were not. However, Glasgow et al (91) found that older age, being female,

and having higher baseline motivation levels statistically significantly predicted ongoing engagement with a website-based weight loss intervention; African American ethnicity and higher self-efficacy at baseline were statistically significantly negatively associated with ongoing website engagement; and having a diabetes or coronary artery disease diagnosis were not statistically significantly associated with engagement.

Participation in either a website intervention or a limited intervention control group requires self-motivation to see positive results. It seems that website interventions can perform better than various types of limited intervention control groups; however, not all studies have reported these results. Both non-use attrition and dropouts are common phenomena and may explain some poor results. Specific participant characteristics may be linked to more positive responses, however, results are mixed.

3.1.1.1.2 Websites vs. in-person sessions

Although websites may result in better outcomes compared to various limited intervention control groups, three studies have found that they may not be superior compared to in-person sessions for weight management purposes. First, Harvey-Berino et al (92) found in a six month study of healthy adults with overweight or obesity that those randomized to weekly in-person intervention sessions lost statistically significantly more weight compared to individuals randomized to a website condition featuring weekly group chats with or without monthly substitution of one of the website chat sessions with an in-person session (in-person only: $-7.6 \pm 6.2\text{kg}$; website only: $-5.5 \pm 5.6\text{kg}$; website + in-person: $-5.7 \pm 5.5\text{kg}$). Of note, this study found high self-monitoring adherence and attendance in group sessions amongst all three groups which may explain the high levels of weight loss in all groups. However, it did not

measure user satisfaction with the website intervention which may have been helpful to explain less successful results with this tool.

Second, in 12 month weight maintenance intervention, Harvey-Berino et al (93) studied how well participants randomized to a website intervention (weekly contact for 12 months consisting of bi-weekly online group chat sessions led by a therapist and bi-weekly emails from a therapist), a frequent in-person contact intervention (weekly contact for 12 months consisting of bi-weekly in-person group meetings and bi-weekly therapist phone calls), or a low intensity in-person contact intervention (monthly meetings with a support group for first six months of the maintenance intervention period; no therapist contact for the remaining six months) maintained weight loss following a six month in-person behavioural weight loss intervention. After six months in the weight maintenance intervention, the authors reported that the website group gained statistically significantly more weight compared to the frequent in-person contact group (website: $+2.2 \pm 3.8\text{kg}$; frequent in-person: $0 \pm 4\text{kg}$). After 12 months in the weight maintenance intervention, the website group had a statistically significantly smaller overall weight loss compared to both in-person groups (website: $-5.7 \pm 5.9\text{kg}$; low intensity in-person: $-10.4 \pm 9.3\text{kg}$; frequent in-person: $-10.4 \pm 6.3\text{kg}$). In addition, there were statistically significantly more participants in both in-person groups who lost $\geq 5\%$ body weight after 12 months in the weight maintenance intervention compared to the website group (low intensity in-person: 81.3%; frequent in-person: 81%; website: 44.4%, $p=0.02$). One limitation of this study was that a substantial number of participants in the website group would have preferred to be in an in-person group (70% of website group participants felt this way after six months in the weight maintenance intervention); this value is much higher than the number of participants in the frequent in-person group who would have preferred to be in the website

group (40% of participants in the frequent in-person group would have preferred to be in the website group after six months in the weight maintenance intervention). This finding could possibly help to explain poorer outcomes seen with the website intervention. Participant satisfaction with the website intervention was also not measured in this study; this finding could also help to explain poorer results seen with this intervention type.

Third, Svetkey et al (94) tested outcomes in participants randomized to one of three 30 month weight maintenance interventions encompassing either: a) monthly personal contact sessions; b) access to an interactive website (with telephone reminders to log in if participants did not use the website); or c) a self-directed control group. These participants all lost at least 4kg during a six month group behavioural weight loss intervention. Overall, at 30 months, participants in the monthly contact sessions group gained less weight (+4.0kg) compared to the website (+5.2kg, $p=0.008$) and control (+5.5kg, $p=0.001$) groups. There was no statistically significant difference in weight regain between the website and control groups ($p=0.51$). However, earlier in the weight maintenance intervention, weight regain was statistically significantly less in the website group compared to the control group. Unfortunately, this study did not report information about website non-use and user satisfaction with the website at the end of the weight maintenance intervention; these data would possibly be helpful to explain why the website group performed similarly to the control group.

Although in-person interventions may result in better outcomes compared to website interventions, there are higher costs associated with this type of support (95). In addition, some website interventions still led to substantial amounts of weight loss and maintenance; therefore, these types of interventions are still well worthy of use especially for individuals located in rural and remote areas where access to health professional support may be scarce.

Therefore, pursuing future research in this area is still a worthwhile venture.

3.1.1.1.3 Enhancements to website interventions

With high levels of non-use and dropout attrition, and modest effects seen with website-based interventions, there has been interest in developing strategies to support the achievement of better outcomes with these tools. The addition of email prompts and health professional support to website interventions have been two studied enhancements that will be described in the following sections.

3.1.1.1.3.1 Email prompts

Over the past few years, curiosity has emerged about whether sending email prompts to users of website interventions for nutrition and/or physical activity behaviour change helps to stimulate increased intervention use. Although studies have found that email message prompt(s) can help to stimulate website visits and logins, website visits and logins following emailed prompts can still be quite low. For example, Schneider et al (96) found that only 6.3% of users who received a single email prompt to revisit a computer-tailored lifestyle behaviour change website three months after the baseline visit actually visited the website again; of interest, this low proportion of website re-visit was still higher than that found in participants who did not receive a prompt (i.e., 0%). A second study by Schneider et al (97) found that only 25.7% and 12.1% of participants who received an email message prompt to revisit a computer-tailored lifestyle behaviour change website clicked on the link in the email and logged onto the website, respectively. Again, these authors also found that participants who received a prompt were more likely to re-visit the website compared to those who did not (97).

In addition, Woodall et al (98) found that 23.5% of participants who were sent email message prompts approximately every five weeks with information about new content on a nutrition education website actually logged into the website within five days of receiving at least one email message; the authors also found that most of the logins happened on the same day or the day after the email was sent. Robroek et al (99) also found that website visits were higher when participants were receiving email messages from the website compared to when they were not.

Although message content and timing (97), as well as personal variables (e.g., age, quantity of prior Internet use, and ethnicity) (98) may affect whether email messages stimulate website logins, to date, there is little information about reasons for limited response and effectiveness of these prompts. Receiving high volumes of email messages has been suggested as one possible mechanism (96, 98), but this has not been investigated in depth.

3.1.1.1.3.2 Health professional support

Some studies have found that adding professional support to website interventions through different channels (e.g., in-person, telephone, electronic) may increase intervention effectiveness (59, 100, 101) and website usage (84). For example, a classic 12 month study conducted in overweight adults at risk for type 2 diabetes by Tate et al (59) found that participants randomized to a weight loss intervention delivered by website with email counseling lost more weight compared to those who received the website intervention only (website + email: $-4.4 \pm 6.2\text{kg}$; website only: $-2.0 \pm 5.7\text{kg}$, $p=0.04$). In a second weight loss study, Tate et al (101) also found that adults with overweight or obesity randomized to a website intervention with added email counseling had better weight loss outcomes compared to

individuals randomized to the same website intervention containing computer-automated feedback, or a website containing no counseling or computer-automated feedback (website only group). At three months, individuals randomized to the email counseling and computer-automated feedback groups lost statistically significantly more measured body weight compared individuals randomized to the website only group (email counseling: $-6.1 \pm 3.9\text{kg}$, computer-automated feedback $-5.3 \pm 4.2\text{kg}$, website only: $-2.8 \pm 3.5\text{kg}$); there were no statistically significant differences between the two message groups ($p=0.95$). At six months, individuals who received email counseling lost statistically significantly more weight compared to those assigned to the website only group (email counseling: $-7.2 \pm 6.2\text{kg}$, computer-automated feedback: $-4.9\text{kg} \pm 5.9\text{kg}$, website only: $-2.6 \pm 5.7\text{kg}$); the computer-automated feedback group was not statistically significantly different from the other two groups. Of note, these analyses only included individuals with measured data at three and six months; however, intent-to-treat analyses also revealed similar results. In a 12 month non-weight loss intervention, Alexander et al (100) found a statistically significant higher change in fruit and vegetable consumption in generally healthy adults randomized to a tailored behavioural intervention website with motivational interviewing counseling provided by email compared to those randomized to a an untailed website (tailed website + email counseling: $+2.80$ servings/day, tailed website only: $+2.68$ servings/day, untailed website: $+2.34$ servings/day). Dennison et al (84) also found that adults with a $\text{BMI} \geq 23\text{kg/m}^2$ randomized to coaching calls were statistically significantly more likely to complete a meaningful number of website modules compared to those who did not receive those calls (25.9% vs. 17.8%, $p=0.026$).

The studies mentioned above suggest that the addition of professional support to

website interventions is positive in terms of effectiveness and website use; however, this type of service may not always be well suited to or acceptable to users. For example, in individuals with obesity, Yardley et al (102) found that many participants using their website-based weight management tool did not participate in their allocated face-to-face sessions (or telephone/email sessions if they could not attend in-person) with the nurse. A second website-based weight management intervention in individuals with a BMI $\geq 23\text{kg/m}^2$ found more participant withdrawals in a website arm with telephone coaching compared to a website only arm; moreover, 57.9% of participants randomized to the website and telephone coaching arm did not participate in any coaching calls and the coaching arm did not experience statistically significantly more weight loss than the website only arm (84). The authors were unclear why there was limited use of this support. They postulated that some participants may have liked the idea of coaching support, but were just difficult to reach; however, they noticed that many of the dropouts in this intervention arm occurred just after group assignment and also just before users were supposed to receive their first call from the coach (84). The authors felt this suggested that some users were not comfortable or interested in this type of service and would prefer to be using the website in a more self-directed manner (84).

3.1.1.1.2 Mobile apps

Compared to website interventions, there are substantially fewer studies that have tested the effectiveness of mobile apps for nutrition and/or physical activity behaviour change. Importantly, many of the published studies in this area have tested apps installed on previous generation devices (e.g., Personal Digital Assistant (PDA), portable Casio® (Casio Computer Company Limited, Tokyo, Japan) computers from the 1980s and 1990s) (103-112) which had

more limited functionality compared to devices and apps available today. However, interventions using apps installed on current generation devices (e.g., iPhone® (Apple Inc., Cupertino, California) are now emerging with increasing frequency (51, 113-118).

To date, peer-reviewed interventions that have specifically examined the effectiveness of mobile apps for nutrition and/or physical activity behaviour change have focused primarily on behaviour self-monitoring. However, these apps have also incorporated various other components including: feedback messages based on entered data (106, 116); social support (51, 118); BMI calculators (111); weight self-monitoring tools (51, 111, 116, 119); recipes/meal plans (105); educational games (120); and meal pacer/relaxation programs (121). Studies using mobile apps for nutrition and/or physical activity behaviour change have been summarized in reviews by the author (69) and others (122, 123). Like website-based interventions, many of these studies had a focus on women trying to lose weight.

In general, short term studies (i.e., ≤ 12 weeks) that have tested mobile app use for nutrition and/or physical activity self-monitoring find that they can be an effective stand-alone intervention; apps supported improvements in behaviour change which were not seen in limited intervention control group participants (e.g., those who received only standard information handouts). For example in healthy adults ≥ 50 years of age who participated in an eight week intervention, Atienza et al (104) found that those who self-monitored vegetable and whole grain intakes with a PDA app had statistically significant higher increases in self-reported vegetable servings/1000kcal (increase from 1.5 servings to 2.5 servings) and a trend towards increased dietary fibre intakes from grains/1000kcal compared to controls receiving standard information handouts. In inactive healthy adults ≥ 50 years of age who participated in an eight week intervention, King et al (110) found that those who self-monitored physical

activity with a PDA app and a pedometer reported higher minutes/week of moderate to vigorous physical activity compared to controls who received standard paper-based physical activity resources (PDA + pedometer: 310.6 ± 267.4 minutes/week; control: 125.5 ± 267.8 minutes/week, $p=0.048$). In short term interventions, self-monitoring using mobile apps has also resulted in better behaviour change outcomes compared to those seen in individuals self-monitoring using paper records. For example, in a three week intervention conducted in adults with overweight or obesity, Beasley et al (105) found at the end of the study that 43% of participants self-monitoring their diet using a PDA application were adherent to the Ornish diet compared to 28% who were self-monitoring using paper records ($p=0.039$).

In longer term interventions, better behaviour change outcomes have also been seen in individuals self-monitoring using mobile apps compared to those using paper records. For example, in a six month weight loss intervention with frequent in-person sessions, Burke et al (106) found that participants who were diet and physical activity behaviour self-monitoring with a PDA app with or without personalized feedback messages decreased their energy intake more than individuals self-monitoring using a paper record ($p=0.03$). In the same group of participants, Archarya et al (103) reported that individuals using a PDA for self-monitoring (with or without feedback messaging) had higher increases in fruit and vegetable intakes, and larger decreases in refined grain intakes compared to individuals self-monitoring using paper records (fruit: $p=0.02$; vegetables: $p=0.04$; refined grains: $p=0.02$); however, there were no differences between groups in changes for whole grain intakes ($p=0.66$).

Self-monitoring using mobile apps has also resulted in more favorable anthropometric changes compared to limited intervention control groups or paper record self-monitoring in both short and long term interventions. In a six week weight loss intervention, Lee et al (120)

found statistically significant decreases in body weight (-2.0kg), BMI (-0.75kg/m²), and fat mass (-1.2kg) in a group using a mobile app for diet and physical activity self-monitoring (which also included a quiz-based learning tool) but not in a control group receiving usual care. In an eight week weight loss intervention, Burnett et al (108) found that diet and physical activity self-monitoring using a mobile app resulted in more weight loss compared to controls self-monitoring using paper records (mobile app: -3.7 ± 1.2 kg; paper record: -1.5 ± 1.5 kg, $p < 0.05$). In another eight week weight loss intervention conducted in women who were using meal replacement supplements, Brindal et al (116) found that participants who were using a current generation smartphone app (Celebrity Slim® (Celebrity Slim Probiotec, Laverton North, Australia)) had more % weight loss compared to individuals using an information only app (Celebrity Slim®: -3.2%; control: -2.2%, $p = 0.08$). In a longer term six month pilot weight loss study, Carter et al (113) found that participants who were using a current generation smartphone app (My Meal Mate) that allowed individuals to self-monitor their diet and physical activity behaviours, provided opportunities to set goals, and delivered feedback, lost more weight compared to those self-monitoring using a commercial website or paper record (smartphone app: -4.6kg; website: -1.3kg; paper record: -2.9kg). In another six month weight loss intervention with frequent in-person group sessions, Burke et al (106) found that more participants who self-monitored using a PDA with feedback lost $\geq 5\%$ of their body weight compared to those self-monitoring using paper records ($p < 0.05$) and a PDA without feedback ($p = 0.09$) (PDA with feedback: 63% of participants; PDA without feedback: 49%; paper record: 46%). Of note, the overall % weight loss was not different between groups. At 24 months, there were no statistically significant differences between groups in the % of individuals who achieved $\geq 5\%$ weight loss and the mean % weight loss (107). Lastly, in another recent six

month pilot weight loss study, Allen et al (51) found a trend for better weight loss outcomes when the publically available self-monitoring smartphone app Lose It![®] was used alongside in-person counseling sessions compared to app use alone and in-person sessions alone.

Although several studies have found benefits with mobile app self-monitoring compared to paper records (or usual care), not all studies have found these types of outcomes. In a 12 week weight management intervention with frequent group sessions, Shay et al (112) found no statistically significant differences in decreases of body weight, waist circumference, and % body fat in individuals who self-monitored diet and physical activity using the Calorie King[®] website (Family Health Network, Costa Mesa, California), the Calorie King[®] PDA app (Family Health Network, Costa Mesa, California), or paper records. However, they did find statistically significant better self-monitoring adherence in individuals who self-monitored using their preferred method compared to those who did not. Of note, this study had a high dropout rate (47%). In a controlled clinical six month weight loss trial in adults with overweight or obesity also with frequent in-person group sessions, Yon et al (111) found that there were no statistically significant differences in decreases in dietary intakes of energy, fat, and % calories from fat, increases in physical activity, and weight loss between groups who were diet and physical activity self-monitoring using either a PDA application or a paper record. Of interest, many participants in the PDA group did not like the application. In an eight week feasibility weight loss intervention, Wharton et al (117) found that weight loss was similar in participants who were diet self-monitoring using the Lose It![®] app, the smartphone memo tool, or a paper record. Of note, participants in the memo and paper record groups received some diet counseling, which was not the case for the smartphone app group. In primary health care patients with a BMI $\geq 25\text{kg/m}^2$, Laing et al (118) found in a six month

randomized controlled trial that adding the MyFitnessPal® app to usual care did not provide any benefit in terms of weight loss or systolic blood pressure improvements compared to usual care alone (p values: ns).

Like website interventions, high levels of intervention non-use were also seen in mobile app interventions despite their ability to be used by individuals when on the go; however, non-use tended to be improved compared to other methods (e.g., paper records, websites). Of note, since most of these studies focused on behaviour self-monitoring, much of the data on intervention non-use were quantified using various types of self-monitoring adherence measures. First, Carter et al (113) found that there were higher mean levels of diet self-monitoring adherence (measured using the number of days an energy intake between 500kcal and 5000kcal was recorded) in smartphone app users compared to those using websites or paper records in their six month weight loss intervention (smartphone: 92 days; website: 35 days; paper record: 29 days). Second, in an eight week weight loss intervention, Wharton et al (117) found that participants who self-monitored with the Lose It!® smartphone app had better self-monitoring adherence (measured using the number of days with no recorded data) compared to those who self-monitored using the smartphone memo function or paper records (smartphone app: 10.3 days (mean); smartphone memo function: 21.0 days; paper record: 21.3 days, $p=0.04$). Third, Allen et al (51) found during a six month weight loss intervention that individuals who used the Lose It!® smartphone app without in-person counseling recorded dietary intake a median of 23% of possible days, and physical activity a median of 9% of possible days; when the app was used alongside health professional support, individuals recorded diet and physical activity a median of >50% and >20% of possible days, respectively. Fourth, in a weight loss study with frequent in-person group sessions, Burke et al (106) found

that adherence to PDA self-monitoring (measured using the proportion of participants who recorded an energy intake that was $\geq 50\%$ of their weekly caloric goal) decreased over time; however, it was less than that seen for paper records (week 2: PDA group: ~96-97% of participants were adherent to self-monitoring, paper record: 85%; week 26: PDA groups: ~53-60%, paper record: 31%).

Overall, several studies have demonstrated that use of mobile apps primarily for diet and physical activity self-monitoring can result in positive outcomes compared to paper records or various minimal intervention control groups; however, like website interventions, not all of these studies found benefits with this tool. In addition, although non-use levels may be slightly better with mobile apps compared to other methods, this phenomenon is still an important issue despite the high portability of these tools.

3.1.1.1.2.1 Content analysis of current generation mobile apps

Some of the sub-optimal outcomes seen with nutrition and/or physical activity behaviour change mobile apps (especially with some of the newer generation apps) may be due to the characteristics of the apps studied. Recently, another group of studies has surfaced which has examined the incorporation of evidence-based practices (124, 125), behaviour change theory (126-130), and/or behaviour change techniques (128, 131-133) into free and/or paid nutrition and/or physical activity behaviour change mobile apps available from app stores (e.g., Apple App Store®, Google Play™). Based on other relevant literature on the importance of incorporating these types of components into behaviour change interventions (e.g., (134)), the motivation behind these studies was that mobile apps that incorporate more and specific behaviour change techniques, behaviour change theoretical constructs, and evidence-based

practices are thought to be superior compared to mobile apps that do not incorporate these components. These studies gathered this type of information either by examining the description of the apps available in the app stores (124, 129, 131) or the actual apps themselves (125-128, 130, 132, 133). Despite differences between studies in how these components were assessed, overall, this work suggests that there is limited incorporation theoretical constructs, behaviour change techniques, and evidence based practices into apps. Although this is an important finding, these studies did not report how these components were incorporated and the quality of their incorporation. In addition, these studies also did not examine whether apps should and need to incorporate all of these components; for example, users may be using more than one app simultaneously or receiving other assistance outside the app which makes incorporation of many components into one app possibly unnecessary.

3.1.1.2 Naturalistic studies

3.1.1.2.1 Websites

To date, naturalistic studies on nutrition and/or physical activity behaviour change websites have encompassed retrospective analyses of database captured information on use of publicly available free or subscription-based websites (65-67, 135-141) designed primarily for weight management purposes (e.g., The Biggest Loser Club Australia® (SP Health Co Pty Ltd., Sydney, Australia) (66, 136), SparkPeople® (SparkPeople, Cincinnati, Ohio) (65)). These studies have found that users are typically females with overweight or obesity.

Some of these studies have described weight loss results using self-reported information and have found positive outcomes. For example, Johnson and Wardle (138) found in a website weight loss program, where users had two self-reported body weight values

documented at least 28 days apart, that 47.6% of males and 40.7% of females with overweight or obesity lost >5% body weight. In addition, Jonasson et al (137) found that in individuals with complete data, 29% lost 5-9.9% of body weight and 20% lost $\geq 10\%$ of body weight after six months of being signed up for a weight loss website. Neve et al (136) also found that 21% and 29% of users of their weight loss website for 12 and 52 weeks, respectively, lost $\geq 5\%$ of their body weight.

Importantly, these types of studies also showed that positive self-reported outcomes are related to program adherence (65, 136-139). For example, Hwang et al (65) found that users who had recorded their body weight four times per 30 days on the website lost 5.09kg more body weight compared to individuals with less weight entry days. Neve et al (136) also found statistically significant Spearman correlations between % weight change and website logins and use of different website features (e.g., -0.55 for % weight change and login frequency, $p < 0.001$; -0.39 for % weight change and food diary entries, $p < 0.001$; -0.38 for % weight change and exercise diary entries, $p < 0.001$). However, these same authors also found that users did not need to use the website every day to achieve clinically relevant weight loss levels (e.g., 12 week subscribers who lost $\geq 10\%$ of their weight logged on to the website a median of 34 days, had a median of 25 days of diet self-monitoring, and a median of 12 days of exercise self-monitoring) (136). Jonasson et al (137) also found that weight loss was related to the number of logins and weigh-ins recorded on the website and Johnson and Wardle (138) found that adherence to diet and physical activity self-monitoring and forum posts was statistically significantly associated with $\geq 5\%$ weight loss in women and the same variables (except for forum posts) were associated with $\geq 5\%$ weight loss in men.

However, like use of website-based interventions in research trial settings, there were also high levels of non-use and dropout attrition reported in naturalistic studies. Importantly, attrition with naturalistic use has been shown to be higher compared with use as part of research trials (67). For example, Kaipainen et al (139) found that only 25% of individuals who had registered for an online Mindless Eating Challenge returned to the website again. In addition, Neve et al (136), found that only 35% and 30% of individuals who were signed up for 12 and 52 week subscriptions for a weight loss website, respectively, were active users at the end of their subscription. Binks et al (135) also found that only small fractions of users had interacted with different website components (e.g., 13.7% had used the meal planner, 10.8% had used the nutritional data look up tool, 17.6% had used the activity log, 7.8% had used the support group message board) which suggests that website use can be quite low. Verheijden et al (141) also found that only ~10% of users used their module based website intervention for healthy weight and behaviours more than once. In addition, like in research trial settings, these studies have found that use can decrease over time (66, 136).

Several studies that have examined naturalistic use of website interventions have also attempted to identify statistically significant predictors of website use and have also found mixed results. Verheijden et al (141) found independent predictors of repeated website use were obesity (vs. normal weight), sufficient baseline moderate physical activity (vs. insufficient physical activity), sufficient vegetable consumption levels (vs. insufficient vegetable consumption levels), age ≥ 41 years (vs. 15-20 years of age), and never and former smokers (vs. current smokers); sex, fruit consumption, alcohol consumption, and educational level were not statistically significant independent predictors. Neve et al (66) also found that age 45-65 years (vs. 18-25 years of age), higher baseline exercise and breakfast eating were

protective against non-use attrition, whereas emotional eating, meal skipping, and using sugar in coffee or tea predicted non-use attrition. Wanner et al (67) also found that male (vs. female) users and older users were more likely to be adherent to a website-based physical activity intervention.

Like research trials, use of websites in naturalistic settings can result in self-reported weight loss. However, intervention usage levels can be quite low. Identification of statistically significant predictors of website use has also revealed variable results which is not surprising given the heterogeneity in studied websites and variables selected for study. Importantly, this type of analysis likely does not tell the whole story; it encompasses choosing variables that the researcher believes will impact website use and fails to understand factors that affect website use from the user perspective.

3.1.1.2.2 Mobile apps

Very few studies have examined mobile app use outside of a research trial environment. A study by Helander et al (142) examined naturalistic use of a free photography diet self-monitoring app (The Eatery (Massive Health Inc., San Francisco, California)). This app allows users to rank the healthiness of their foods and the foods eaten by others by examining pictures taken of their food. The authors found that 86.4% of individuals who had downloaded the app (~190,000 downloads) never used the app or only used the app to take one picture, and only 2.6% used the app for more than one week and took ≥ 10 pictures; the authors also mentioned that these individuals were not likely tracking all of their food. In addition, individuals who were more likely to become active users of this app were those who self-identified as following a strict diet. The authors also mentioned that the app did not contain

behaviour change techniques such as goal setting which could provide users with a more focused reason to use the app and possibly enhance use.

3.1.2 Qualitative studies

Qualitative research on websites or mobile apps for nutrition and/or physical activity behaviour change has perhaps been most frequently conducted prior to and during the intervention development process. These types of studies have collected information on topics including: user needs and issues (143-146); user thoughts on electronic tools and/or specific features for this purpose (144, 147, 148); website layout suggestions (149); and other types of characteristics users would like to see in these tools (e.g., fast, quick) (143, 144, 147, 150, 151). User feedback on prototypes, and existing tools prior to actual use has also been collected (64, 144, 149-151). Some studies have also tested usability through a series of task or scenario- based activities in which participants speak aloud what they are thinking during tool use (149, 152). Importantly, this research has the potential to provide valuable information on factors that may affect adoption of a website or mobile app. Qualitative research is also well suited to user centered design (153) approaches which have been utilized to develop relevant websites (150, 151) and mobile apps (154).

Qualitative research has also been used to obtain information about experiences and perceptions of actual website and mobile app use; these types of studies are the focus of this section. Administration of open-ended questionnaire questions following an intervention (155, 156) has perhaps been the most common way to collect qualitative data on this topic; however, these types of data are usually not well described and typically do not provide the same level of depth as one-on-one semi-structured interviews or focus groups. Therefore, the studies

described in this section focus on those that used one-on-one semi-structured interviews or focus groups for data collection.

3.1.2.1 Websites

Only a handful of studies have collected qualitative data using focus groups (25, 39, 47, 157, 158) or one-on-one semi-structured interviews (35, 48, 159-164) from adults after use of a website designed for nutrition and/or physical activity behaviour change. These studies were all conducted in research trial settings; participants varied by study (e.g., cancer survivors (160), university students and employees (25, 157, 161, 162), hip and/or knee osteoarthritis patients (48)), but were frequently female. The amount of time users were given to use the website also varied by study (range: ≤ 12 weeks (25, 47, 48, 160-162) to one year (163, 164)). Study sample sizes were also diverse (range: $n=4$ (159) to $n=35$ (163, 164); importantly, few studies specifically reported sampling to reach data saturation (35, 163).

In general, the websites used did not appear to be publicly available. They were used for various processes which included for example: self-assessment (159); providing educational information (25, 35, 39, 47, 157, 158); behaviour self-monitoring (25, 35, 158, 160-164); goal setting activities and tools (35, 158, 160); connecting online with other participants (160-162, 164); and electronic counseling (163, 164). Only one study used a publicly available website (Calorie King® (Calorie King, Nedlands, Australia)) (161, 162).

Despite study heterogeneity, there were common qualitative findings across this work which are described in detail below. These findings are separated into different categories and include: professional and group support; time; information; self-monitoring; and goals.

Professional and group support: There were reports of little usage of online forums and chat features (160-162, 164) for different reasons (e.g., not interested in forum discussions with other participants (161, 162), difficulties participating in chat sessions with professionals (e.g., technical problems, incompatible schedules, lack of awareness of chat times) (164)). Some participants also mentioned reading comments written in the forum, but not would not post themselves (160).

Participants across different studies were passionate about having access to more health professional, research professional, and/or group social support, especially in face-to-face settings (47, 48, 160-162, 164). Participants felt that websites can be impersonal (47), and cannot replace trusted health professional contact (159). Face-to-face contact was felt to give interventions a human touch (162), and was motivational (162).

Time: Participants appreciated that website interventions were flexible and could be done on their own time and at their own pace (47, 48, 164), which was sometimes why they were chosen (25). However, lack of time to interact with the website (25, 47, 157), and enter foods (161, 162) was reported. Participants also reported that online modules or lessons took too long to complete and wanted the content broken down into smaller sections (39, 164). Chat sessions were sometimes scheduled at inconvenient times (164). The time barrier also appeared to be easier to overcome in face-to-face compared to website interventions (25).

Information: Some studies mentioned that the information provided by website interventions was not considered new to participants (25, 47, 159, 164). Interestingly, Tracey et al (25) found that participants completing a face-to-face group intervention were receptive to hearing repetitive information from session leaders (possibly because leaders could add own

personal perspective), but were not as interested in receiving this same information via a website.

Self-monitoring: Participants liked being able to document and see progress (35), e.g., thorough graphical representation (160, 164), and to receive feedback (161, 162). Websites were found to be helpful for developing behaviour awareness and motivation to make improvements (25, 160, 164). Some participants desired an area where comments about reasons for highs and lows could be recorded for researchers (160). However, there were also concerns reported. Self-monitoring adherence was reported to be difficult when activity routines were always the same (35). Participants using a public website (Calorie King®) also found that foods were sometimes difficult to enter into the program if they were not pre-prepared or standard (162).

Goals: Although many of these studies incorporated goals in some capacity (25, 35, 47, 48, 158, 160-162), they did not report in-depth findings on this topic. However, one small study in cancer survivors (n=8) found that participants liked having the option to choose their pedometer step count goals from a list of personalized goals of different difficulties depending on their level of perceived health. They also reported feeling less guilt with this type of system (160).

Several important limitations were found in this research. Participants were primarily recruited from study completers only; only two studies conducted purposeful sampling to capture different types of participants (e.g., different levels of weight loss (162), different adherence levels (48)). There was also limited focus on understanding in-depth user experiences with individual website components (e.g., goal setting and tracking tools). Some studies also had methodological concerns surrounding qualitative rigour and study

generalizability (e.g., small sample sizes possibly without data saturation, no inter-rater reliability analysis). Qualitative information about user experiences with websites was sometimes grouped with other types of user experiences (e.g., in-person sessions, paper-based resources) (25, 35, 47, 161, 162) which can potentially cause confusion for readers. Very little information was provided in these studies about the experiences of individuals in making decisions to adopt these tools, and how individuals use these tools in their normal day-to-day lives; these studies instead had a large focus on identifying user wants, useful website components, suggestions for improvement, and likes and dislikes.

In summary, a handful of studies have conducted qualitative research to understand user experiences with websites following their use. This work was all conducted in research environments and does not provide insight into naturalistic adoption and use of these tools. Time was found to be an important barrier to website use despite the flexibility to use these tools when desired by users. In addition, even though websites have numerous functionalities, participants still desired more in-person health professional support; investigation of methods to provide low cost or free live professional support to users alongside website interventions is warranted. Few qualitative data were also reported on goal use in website interventions despite how commonly this technique is incorporated into these tools; further investigation is needed to understand how to optimize use of this technique in these tools. These studies also had several methodological limitations that limit study usefulness.

3.1.2.2 Mobile apps

Studies have emerged in the health and information technology literature that have collected qualitative data using one-on-one semi-structured interviews (53, 165-172) or focus

groups (173-175) from adults after using nutrition and/or physical activity behaviour change mobile apps. A study has also emerged on user experiences with wearable technologies (e.g., Fitbit® (Fitbit Inc., San Francisco, California), Nike FuelBand® (Nike Inc., Beaverton, Oregon) (165)) which was also discussed in this section despite being a slightly different technology from a mobile app. These studies were usually conducted following a short term research trial or field test lasting ≤ 12 weeks (53, 166, 169, 171, 172, 175); however, studies that collected data on user experiences and perceptions with these tools outside of research trial environments were also found (165, 170, 173, 174). Participants were primarily healthy adults, many of whom were female.

Unlike the website studies described in the previous section, this work mainly explored user experiences with publicly available products (e.g., MyFitnessPal®, SparkPeople®, Accupedo-Pro® Pedometer (Corusen LLC, Keller, Texas) (165, 166, 170, 173-175). Study sample sizes varied between studies (range: $n=12$ (166) to $n=41$ (53)); however, only one study reported sampling to reach data saturation (166).

Like website interventions described in the previous section, mobile apps were used for various purposes which included for example: pedometry (166); goal setting and tracking (168, 171); behaviour self-monitoring and feedback (sometimes using data from external pedometers or accelerometers) (53, 167, 169); and providing messages (e.g., reminders, feedback) (53, 168). In studies that examined mobile app use outside of research trial settings, apps were likely used for a variety of purposes which were not always described; in addition, these non-research trial studies also sometimes incorporated information about other types of user experiences including: user experiences with websites and/or other electronic tools (e.g., text messaging) (170, 174); user experiences with a variety of health-related mobile apps and

speculation about what it would be like to use them (173); and user experiences using mobile apps purposefully for the study one-on-one semi-structured interview (170).

Like the website studies described in the previous section, despite study heterogeneity, there were common qualitative findings across this work which are described in detail below. The findings are separated into different categories which include: convenience; self-monitoring; goals; online social support; and messaging.

Convenience: Participants generally liked the portability of these tools. They found them beneficial for data recording, and liked that they allowed them to access information when on the go or when they had a moment of spare time (166, 168-170). Users also felt that barcode scanners were helpful for dietary intake data entry (170, 174). Despite the high portability of mobile apps, there were some negative concerns surrounding convenience mentioned. Users stated that being in a rush, and holidays decreased dedication to data entry (169) and some had to develop a new routine to carry their smartphone at all times so that it could track their steps (166). Users also felt that entering data with a barcode scanner was difficult when entering foods with many ingredients (170). In addition, tablets were felt to be less portable than smartphones (175).

Self-monitoring: In general, participants felt positively about use of these tools for behaviour self-monitoring. These tools helped to increase their knowledge and awareness of behaviours and motivated them to make adjustments throughout their day to meet their goals (53, 165-167, 169, 170, 175). Having access to numbers and graphs about progress (including about long term progress, trends) was motivational and well-liked by participants (53, 165, 166, 169, 170, 174). Participants also liked diet self-monitoring with large food databases where exact items could be found (170, 174). With mobile apps or wearable technologies that

collect automatic physical activity self-monitoring data, some, but not all participants, reported checking the tools multiple times each day to inform themselves of their progress (166) which helped prompt and motivate them to increase activity levels if they were low (165, 166). In addition, some wearable technology users reported being disappointed when they forgot their device during times when completing activities because information would not be captured; some participants appeared more concerned about getting credit for their activity, than about the health benefits of the activity itself (165).

One study also found that participants were more dedicated to data entry at the beginning of a study (i.e., recorded data more frequently, recorded more information) and they reported changing the way that they recorded data over time (i.e., only recorded necessary information, less frequent entries) (169). Participants in this same study also spoke about the ability to use mobile apps for cyclic self-monitoring (i.e., use app for a period of time, stop use, and restart app use again) (169).

Despite the positive general feelings about mobile app use for behaviour self-monitoring, there were some concerns reported. For diet self-monitoring, participants expressed the desire to precisely record food intake and had concerns about the potential for errors (173). Participants also reported difficulties locating correct foods in databases (175). Dietary intake data entry was reported to be time consuming and not sustainable in the long term (170, 175). Some participants reported having limited Internet access with their device which made recording meals eaten away from home challenging (175); they also reported difficulties recalling information if a delayed entry needed to be made (175). In addition, participants wanted a notes section to self-monitor information about feelings (170).

Goals: There was more qualitative information on goal use in these studies compared to

the website studies mentioned earlier. Overall, participants felt positively about the use of goals as part of these technologies. Goals provided targets to work towards and helped individuals improve behaviours (165, 166, 170).

In terms of goal setting, participants sometimes rarely changed system provided goals (165); however, fixed system provided goals were not always optimal for users (53). User chosen goals were also desired by some participants as they could pick goals to best meet their needs (171). Studies did find though that participants may also benefit from and/or desire professional support with goal setting when using mobile apps (171, 172); however, concerns were raised about the costs of accessing this type of service (171).

Several tools also provided rewards for goal achievement which included positive messaging (53), virtual points (165) and virtual prizes (e.g., ribbons and trophies (168), flowers and butterflies (171)). Virtual prizes were found to be motivating for some users; however, others did not find them helpful (168, 170). One possible reason for little interest is that users knew when they were getting a reward and there were no surprises (168). In the study that examined wearable technology use, some participants mentioned doing activities to obtain system provided rewards (and possibly less so for the health benefits of the activity per se) (165); in addition, some participants reported that they had found ways to manipulate tool use to get extra points (165).

Online social support: The ability to share information (e.g., on progress) from these tools with others through social media (e.g., Facebook® (Facebook Inc., Menlo Park, California)) and forums was commonly mentioned. Some participants found this activity helpful for increasing accountability (168), supportive (165), and motivating (170). Participants also reported that information sharing with those who were equal (e.g., another

user at the same physical activity level met in an online community) (165) or who were going through a similar situation (173) to be more acceptable or motivating. Information sharing also stimulated competition between some users which was also motivating (165). Reporting accomplishments (e.g., running distances) via social media also resulted in positive feelings when other network members “liked” these posts (173).

Despite the positive effect that online information sharing had for some participants, there were some concerns reported. For example, online sharing features were not commonly used by some participants (165, 168). Some participants did not like the idea of sharing this type of information in general (165) or with everyone in their social media network (168, 173); they felt this information was private, not appropriate to share, and/or of interest to others (168, 173). Concerns about privacy (165, 168) and forums being untrustworthy (170) were also raised. In addition, some participants who posted their progress to social media found that they frequently did not get any attention (e.g., “likes”) from other network members, which caused some negative feelings (168).

Messaging: Participants had mixed and varied thoughts both within and between studies on the content and delivery of different types of mobile device provided messaging (53, 168, 173); therefore, it was difficult to draw decisive conclusions on this topic. Participants were not always happy with the messages they received; individual message content and delivery preferences appeared to be important for determining the success of messaging.

Several important limitations were found in this research that were both similar and different from those identified in the qualitative website studies described in the previous section. One limitation was that there was a stronger focus on studying tools for physical activity behaviour change; there were fewer studies that focused on mobile apps for nutrition

behaviour change. Like the website qualitative studies mentioned previously, qualitative information about user experiences and perceptions with mobile apps was sometimes grouped with other types of user experiences (e.g., websites, speculation about what it would be like to use mobile apps) which made identifying findings specific for mobile apps difficult. Also like the website studies mentioned above, some studies had methodological limitations surrounding qualitative rigour and study generalizability (e.g., small sample sizes possibly without data saturation, no inter-rater reliability analysis described). In addition, very little information was provided in these studies about user experiences in making decisions to adopt these tools and how mobile apps are used in the normal lives of individuals; like the website research mentioned previously, these studies instead had a large focus on identifying user wants, likes and dislikes, useful mobile app components, and suggestions for improvement.

In summary, studies have emerged that have examined user experiences following mobile app use. Overall, users found these tools convenient and a powerful self-monitoring tool. Like website studies, participants desired health professional assistance while using these tools and participants had mixed feelings on use of online social support. Unlike website based studies, this work was both conducted in research trial settings as well as in more naturalistic settings. However, studies conducted in naturalistic settings were limited by the fact that they frequently combined their results with other tools and approaches which makes it difficult to identify specific findings for mobile apps. More research is also needed to understand naturalistic adoption of these tools.

3.2 Current generation mobile device and app use by health professionals in their practice

To date, there are few studies that have specifically examined use of mobile devices (e.g., smartphones (e.g., iPhone®, tablets (e.g., iPad® (Apple Inc., Cupertino, California))) and their apps by dietitians in their professional practice. There was a survey study conducted in Oklahoma dietitians and dietetic interns published in 2008 that found 24% of participants used PDAs, and that these tools were primarily used for organizational purposes rather than dietitian-specific tasks (e.g., nutrition support, nutrition assessment) (176). However, with the high increase in smartphone and tablet ownership levels in the general population and the availability of relevant apps since this study was published, this data likely has limited relevance for the present situation. To date, most peer reviewed literature on adoption of current generation mobile devices and their apps by health professionals has concentrated on physicians. Although not all physicians may deal directly with the same professional situations as dietitians, findings from these studies provided important background for studying use of these tools by dietitians. Therefore, this section focused on reviewing peer reviewed literature on current generation mobile device and app use by physicians.

Since 2011, more than a dozen survey studies have emerged on current generation mobile device and app use by physicians (including residents) (177-192). These survey studies were published in various peer reviewed journals with variable sample sizes (range: n=36 to n=3,306). Many of these studies examined smartphone and app use by medical residents (or junior doctors). Studies have focused on both adoption across several different specialties (181, 182, 185-187, 190) and within specific specialties (e.g., orthopedic surgery (179, 191), colorectal surgery (189), general surgery (178), radiation oncology (177), anesthesia (180),

urology (184)).

Overall, these survey studies found very high smartphone ownership levels amongst physicians (range: 84% in an early 2011 study (191) to 100% in a more recent 2014 study (184)); most studies reported smartphone ownership levels >90%. The majority of smartphone owners used iPhones® (177, 178, 181, 184-187, 189-191). Smartphone ownership levels appeared to be higher in younger doctors as well. For example, Smart (189) found that younger physicians (i.e., 21-50 years of age) were more likely to own a smartphone compared to older physicians (i.e., 51-70 years of age) (88.8% vs. 72.7%, $p=0.02$). Franko (191) found in orthopedic surgeons that 86%, 88%, 91% and 75% of residents, attending physicians <5 years, attending physicians 5-15 years, and attending physicians >15 years, respectively, owned smartphones. A second study by Franko et al (181) conducted in physicians from a wide variety of specialties found that 88.4%, 88.8%, 86.8%, and 78.2% of residents, attending physicians <5 years, attending physicians 5-15 years, and attending physicians >15 years, respectively, used smartphones.

The percentage of physician smartphone owners who had downloaded medical apps was also high (178, 180, 184, 185, 187) (range: 75.5% (187) to 91.7% (185)). Some studies also found that smartphone owners had several medical apps installed on their device. For example, Payne et al (187) found that 32.4% of smartphone medical app users had ≥ 6 medical apps on their smartphone. In addition, O'Reilly et al (185) found that 38.3% of smartphone users had ≥ 4 medical apps installed on their device. Further, Nason et al (184) found that the average number of medical or urology apps downloaded was four (range: 1-12). Although medical app downloads do not necessarily equal use, some studies also revealed that apps were frequently used in practice. In two separate studies, Franko (191) and Franko et al (181) found

that 53% of orthopedic surgeons and 56% of physicians from several different specialties, respectively, used smartphone apps in their practice. Importantly, app use appeared to decrease with seniority. For example, in orthopedic surgeons, Franko (191) found that 59%, 48%, 35%, and 43% of residents, attending physicians <5 years, attending physicians 5-15 years, and attending physicians >15 years, respectively, who owned smartphones used smartphone apps in practice. A second study by Franko et al (181) also found similar results in a larger group of physicians from several different specialties. They found that 68.1%, 52.1%, 49.1%, and 39.2% of residents, attending physicians <5 years, attending physicians 5-15 years, and attending physicians >15 years, respectively, used smartphone apps in practice. Studies have also found that apps can be used quite frequently as well. For example, Payne et al (187) found that 29.6% of junior doctors who owned a smartphone used medical apps 1-2 times/day or more often. Nason et al (184) also found that 25% of doctors who had downloaded medical or urology smartphone apps reported daily use. Lastly, O'Reilly et al (185) found that 43.6% of respondents who had downloaded medical smartphone apps reported daily use at work.

Several studies have quantified the popularity of different types of smartphone apps both in terms of categories (178, 180, 187) and individual apps (181, 184, 191) amongst physicians. First, Carter et al (178) found that the most commonly downloaded apps among surgical residents were: clinical guidelines (70%); medical calculators (59%); anatomy guides and textbooks (50%); and other medical textbooks (50%). In anaesthetists, Dasari et al (180) found that medical calculators were the most commonly used type of iPhone® app. In urology residents who had downloaded medical or urology apps, Nason et al (184) found that 85.7% had used them for quick reference; 46.4% for patient management; 35.7% to document operation information; 28.6% for conferences; 21.4% to help make diagnoses; and 14.3% for

patient information storage. For specific apps, Franko et al (181) found in a large study of physicians from various specialties that the most commonly used smartphone app was Epocrates® (Epocrates Inc., San Mateo, California), followed by Medscape® (WebMD LLC, New York, New York) and MedCalc. Another study by Franko (191) in orthopedic surgeons found that Epocrates® was the most commonly mentioned smartphone app that was used followed by billing and coding apps, and Medscape®.

Tablet and tablet app adoption by physicians has also been studied (177, 179, 186, 188, 189). Tablets ownership levels amongst physicians were substantially lower compared to smartphone ownership levels (range: 32.8% (177) to 56% (179)); most tablet owners were iPad® users (177, 186, 188, 189). Tablet use by physicians at work also appeared to be less common than smartphone use. For example, Sclafani et al (188) found that 19%, 14%, 19%, and 19% of residents, attending physicians <5 years, attending physicians 5-15 years, and attending physicians >15 years, respectively, reported tablet use in the clinical setting. Bibault et al (177) found that 29.4% of radiation oncology residents who owned tablets used them in their department.

Sclafani et al (188) assessed the types of tablet apps used by physicians in their practice; primary resource apps were most commonly used followed by point of care apps, and electronic medical record apps. Like smartphone apps, this study also found that Epocrates® was the most common app used followed by electronic medical record apps, journal apps, and Medscape®. Although tablet adoption by physicians was substantially lower than smartphone adoption, this is a more recent innovation and market penetration has been climbing steadily over time.

Although these studies generally found that physicians were enthusiastic about mobile

devices and their apps, there were some issues revealed in this work. First, Katz-Sidlow et al (182) reported that use of mobile devices can be a distraction during hospital rounds. This study found that 37% and 12% of residents and faculty doctors, respectively, used devices for responding to personal emails/texts during hospital rounds; further, the authors reported that 19% and 12% of residents and faculty doctors, respectively, had reported missing important information during rounds because they were distracted by their mobile device. Second, concerning findings were also reported surrounding the use of apps for clinical decision making. Bibault et al (177) found that 67.2% of participants were using smartphone apps for patient treatment, however 39.7% of participants did not verify the quality of the apps that they used. In addition, Carter et al (178) found that 35% of residents had used a medical app to help them make a clinical decision about the care of their patients (e.g., drug dosing, lab reference values); however, 13% of participants had found errors with these apps (e.g., incorrect drug dosage) (178).

Qualitative information on current generation mobile device and app use by physicians has been captured in two studies (187, 190). A survey study conducted by Payne et al (187) found that junior doctors felt that the high costs of smartphones and their apps was a barrier to use. They also reported concerns about their appearance if they used devices in hospitals (e.g., may appear rude). A second study that collected qualitative data using a survey and one-on-one semi structured interviews in Canadian physicians and medical students (190) also revealed several important findings. Participants liked that mobile devices were: portable; provided easy access to information; made communication easier; and helped to better use their time (e.g., sharing schedules, calendars). They also frequently reported using these tools to look-up unfamiliar information. Despite the numerous positive aspects of mobile device and

app use, several concerns were reported which included: developing a dependence on the tool and not actually learning information; privacy and confidentiality; being a distraction; lack of separation between personal and professional life; finding quality apps and information; and costs.

In summary, previous research has found that mobile device and medical app use is very common amongst physicians, especially amongst younger physicians. Apps were used for various tasks in their practice including information look-up, medical calculators, and record keeping. Although apps provided benefits (e.g., easy information access), there were several concerns raised about use of these tools in practice (e.g., distraction, confidentiality, privacy, accuracy). To date, it remains unclear whether dietitians report similar or different findings about use of these tools in their practice.

3.3 Literature review summary

3.3.1 Website and mobile app use for nutrition and/or physical activity behaviour change

Several studies have investigated quantitative outcomes (e.g., behaviour change, weight loss) associated with website and mobile app use in research trial settings. Overall, this work finds that websites and mobile apps can result in more positive outcomes (e.g., behaviour change, weight loss) compared to different types of control groups (e.g., waitlist, minimal intervention, paper record self-monitoring). However, not all studies found better behaviour change or weight loss outcomes with these electronic approaches. High levels of website and mobile app non-use and dropouts, and decreases in use over time were seen as well. Although researchers have attempted to identify statistically significant predictors of non-use and dropout, there is substantial variability between studies.

Studies using quantitative methods to understand use of websites and mobile apps outside of a research trial setting are quite rare. The limited research available on this topic reveals that individuals using websites in naturalistic settings can see positive outcomes (e.g., weight loss); however, there are also substantial levels of non-use observed.

Qualitative studies have also been conducted to understand user experiences and perceptions of actual website and mobile app use; however, less emphasis has been placed on this type of work compared to quantitative studies. This finding is important as qualitative data from the perspective of those using these tools for a portion of time, especially outside of a research trial setting, has the potential to enhance use of these tools in public health and dietetic practice settings and to inform future development of higher quality websites and mobile apps. Further, qualitative studies conducted in research trial settings do not allow researchers to understand the entire user experience of adopting these tools into their normal lives because users are frequently presented with tools to use as part of the study. Unfortunately, qualitative studies conducted outside of a research trial setting are limited or have drawbacks that limit their usefulness.

3.3.2 Current generation mobile device and app use by health professionals

Most of the literature on use of current generation mobile devices and apps by health professionals has been conducted in physicians. Several survey studies conducted over the past few years have found high use of this technology by these health professionals.

Physicians also appear to be using this technology for different tasks in their practice. These studies have also uncovered information about the benefits and concerns with adoption of these tools in the practice of health professionals. Unfortunately, no studies have been conducted to

understand use of mobile devices and apps by dietitians in their practice or their clients.

CHAPTER 4: RATIONALE AND OBJECTIVES

4.1 Rationale

Websites and mobile apps offer huge potential to help support the nutrition and physical activity behaviour change process; however, to date, much of the published research in this emerging field has important limitations. Most studies that examined website and mobile app use for nutrition and physical activity behaviour change were conducted in research trial environments; with high interest in these tools for this purpose in the general population (e.g., millions of downloads of relevant publicly available mobile apps (e.g., MyFitnessPal®, Lose It!®)), there is a strong need to understand naturalistic use. In addition, although tools used in this published research included proven behaviour change techniques (e.g., goal setting, self-monitoring), mixed weight loss and behaviour change outcomes and high levels of non-use were observed. Qualitative approaches are well suited to study what works, with whom, and in what context and could be used to help explain these types of findings. However, use of qualitative approaches in this field of study is considerably rarer compared to quantitative approaches. Suggestions have been made that qualitative research is necessary (including as a supplement to quantitative research) to evaluate and develop more effective electronic interventions (19, 193). Furthermore, dietitians are key health professionals to help individuals make nutrition (and physical activity) behaviour change and mobile apps have the potential to help enhance their practice; however, there are few available data on use of these tools in their practice.

Dietitians of Canada (DC) (<http://www.dietitians.ca/>), the national professional organization that represents >5,000 dietitian members, has been active in providing publicly available electronic tools to support nutrition and physical activity behaviour change for

Canadians. This organization has also released several electronic tools to help enhance the practice of Canadian dietitians (e.g., “Learning on Demand” online continuing education modules, Practice-based Evidence in Nutrition® (PEN) database (Dietitians of Canada, Toronto, Ontario)).

More specifically, eaTracker® (Dietitians of Canada, Toronto, Ontario) is a publicly available Canadian website (<http://www.eaTracker.ca/>) first launched in 2005 that allows members of the general public to track their dietary intake and physical activity behaviours and compare them to national guidelines for healthy individuals. Self-reported information on age, sex, height, weight, physical activity level, pregnancy status, and breastfeeding status is also entered into the user’s account to individualize recommendations. The most recent eaTracker® website update was released in 2011 and included the addition of a goal setting and tracking feature (“My Goals”). EatRight Ontario (ERO) (<http://www.eatrightontario.ca/>), an organization run by DC that provides free nutrition resources and access to dietitian support by toll-free call or email, also added additional optional supports for Ontario My Goals users in December 2012. These supports included email and website delivered motivational messaging (usually weekly) and the opportunity for individuals from Ontario to interact with an ERO contact centre dietitian free of charge about their goals by toll-free call or email. In addition, an eaTracker® mobile app was also released for iOS™ (Apple Inc., Cupertino, California) and Android™ (Google Inc., Mountain View, California) in 2014. DC has also released other mobile apps over the past few years to help Canadians make positive nutrition choices which have included: eaTipster® (Dietitians of Canada, Toronto, Ontario), EatWise® (Dietitians of Canada, Toronto, Ontario), and Cookspiration® (Dietitians of Canada, Toronto, Ontario).

DC has a keen interest in gaining knowledge to develop quality electronic tools, both for dietitians and the general public, to help enhance the nutritional health of Canadians; therefore, they were an ideal organization to help support this thesis research. The author of this thesis is a DC member, was part of the advisory teams for the most recent eaTracker® website update (2010-2011) and the eaTracker® mobile app (2013-2014) which has helped to make this type of partnership possible.

This thesis encompasses five different studies. The first three studies involved conducting an evaluation of the eaTracker® My Goals feature and the two additional ERO supports available to Ontario My Goals users (i.e., email and website delivered motivational messages, free dietitian support by toll-free call or email). The fourth study examined user experiences with and perceptions of publicly available mobile apps to support nutrition behaviour change for weight management when used outside of a research trial setting. The fifth study investigated mobile device and app use in Canadian dietetic practice.

For the first three studies, participants from Alberta and Ontario were included as Alberta and Ontario users had access to a slightly different versions of the eaTracker® My Goals feature and only Ontario users had access to motivational messaging and the ERO dietitian support. Both Ontario and Alberta users were included to obtain perspectives on using the My Goals feature with and without the extra website features and ERO adjunct supports, and the Alberta group also acted as a non-intervention comparison.

4.2 Objectives

Guided by the Diffusion of Innovations framework (68), this thesis research provided insight into the processes of adoption and characteristics of innovations relevant to the use of

electronic tools to support nutrition and physical activity behaviour change in ‘naturalistic’ settings (i.e., tools were not used specifically for research study purposes) of dietitians and members of the public accessing tools available through DC and commercial app stores.

4.2.1 Studies #1, 2, and 3: Evaluation of the My Goals feature of eaTracker® and ERO supports

The purpose of these studies was to evaluate the eaTracker® My Goals feature (which includes goal setting and tracking capabilities) and the recently added ERO supports (i.e., motivational messaging, access to ERO contact centre dietitian assistance with goals). The objectives of this research are broken down by the three studies in the following section:

Study #1: Using available database data on eaTracker® My Goals activity from July 2, 2011 to April 28, 2014,

- to describe self-reported demographics (age, sex, BMI, physical activity level, pregnancy status, breastfeeding status) of individuals from: a) Ontario who were signed up for the My Goals feature and ERO motivational messaging, b) Ontario who were signed up for the My Goals feature, but not the ERO motivational messaging, and c) Alberta who were signed up for the My Goals feature and did not have access to the motivational messaging.
- to describe the quantity and types of goals set by individuals from the three My Goals user groups.
- to describe use of the goal tracking feature by individuals from the three My Goals user groups.

Study #2: Using qualitative one-on-one semi-structured interviews with volunteer Ontario My Goals users who were signed up for ERO motivational messaging, My Goal users from Alberta who did not have access to ERO motivational messaging, and ERO dietitians,

- to document experiences with and perceptions of goal setting, and the My Goals feature, and to obtain suggestions for modifying the feature to better support goal achievement.

Study #3: Using qualitative one-on-one semi-structured interviews with volunteer Ontario My Goals users who were signed up for ERO motivational messaging, My Goal users from Alberta who did not have access to ERO motivational messaging, and ERO dietitians,

- to document experiences with and perceptions of the ERO motivational messaging and the opportunity to speak with an ERO dietitian, and working with clients who are using the My Goal feature (dietitians only) and to obtain suggestions for modifying these adjunct supports to better support goal achievement.

4.2.2 Study #4: Experiences and perceptions of adults accessing publicly available nutrition behaviour change mobile apps for weight management

The purpose of this study was to use qualitative one-on-one semi-structured interviews to document experiences and perceptions of adult volunteers who have used publicly available mobile apps to support nutrition behaviour change for weight management with various levels of success. The objectives of this research were:

- to identify processes and influences involved in the decision to access apps and select

specific apps.

- to describe how apps are used by individuals in their normal environment.
- to describe factors associated with adherence and lack of adherence to use of different app features (e.g., behaviour self-monitoring, goal setting, social support).
- to describe factors that influence satisfaction and dissatisfaction with app use.
- to characterize experiences and perceptions by sex in order to explore potential differences.

4.2.3 Study #5: Use of mobile device applications in Canadian dietetic practice

The purpose of this study was to use a cross-sectional web-based survey of volunteer dietitians to explore various topics related to mobile devices and their apps in Canadian dietetic practice. The objectives of this research were:

- to describe dietitian use of mobile devices and apps in dietetic practice.
- to describe factors affecting dietitian use of apps in their dietetic practice.
- to describe through dietitian self-report, whether their clients are asking about or using nutrition/food apps and, if so, such client characteristics.
- to describe whether dietitians recommend nutrition/food apps to their clients and factors affecting their recommendation or non-recommendation.

CHAPTER 5: A RETROSPECTIVE ANALYSIS OF REAL-WORLD USE OF THE EATRACKER® MY GOALS WEBSITE FEATURE BY ADULTS FROM ONTARIO AND ALBERTA, CANADA

5.1 Introduction

Numerous techniques are available to help individuals improve their nutrition and/or physical activity behaviours (194) to help meet recommendations to both prevent and manage chronic diseases. Techniques surrounding goals, which are targets where individuals can direct efforts, including prompt goal setting and prompt review of goals, are frequently used (17) and recommended for this purpose (195, 196). Also, goal setting is also a key component of behavioural therapy for weight (197, 198), and diabetes (199) management, 5As for obesity treatment in primary care (195, 196), and many other behaviour change approaches described elsewhere (200). Published review articles have examined goal use in primary care (200), for weight management (201), and for nutrition and physical activity behaviour change in general (202, 203).

Much of what we know about how goals influence behaviours comes from Goal Setting Theory developed by Locke, Latham and colleagues (204, 205) which was adapted for healthcare by Stretcher et al (206). This theory suggests that specific and difficult (but possible) goals support better outcomes than vague “do your best” goals; that goals affect performance by directing efforts, being energizing, enhancing persistence, and promoting use and discovery of goal specific skills and knowledge; and that behaviours are moderated by goal commitment, goal importance, self-efficacy, feedback and task complexity (204, 205). The SMART acronym (“**S**pecific,” “**M**easurable,” “**A**chievable,” “**R**ealistic,” and “**T**ime-related”) (207) is frequently used in healthcare to bridge theory and goal setting practice (208-210). Importantly, when using goal setting in health-related situations (e.g., weight management), it

is generally recommended that goals that target behaviours are chosen to provide individuals with steps to meet their long term (or distal) goals (e.g., weight loss) (196).

Traditionally, goal setting for nutrition and/or physical activity behaviour change occurs in-person with health professionals. Unfortunately, this assistance may not be accessible or suitable for different reasons (e.g., remote areas, financial costs, time costs, and embarrassment). Although goals are a familiar concept to many individuals because of use in different settings (e.g., workplace, sports), previous studies have identified challenges when using goals in health situations in the absence of or with limited health professional support (e.g., individuals may set poor quality goals or long term distal goals only (e.g., lose 100lbs, live a long life) that are broad and non-specific, with no timeframe or achievement plan) (42-44). It has also been reported that adults may have unrealistic goals regarding weight loss (211).

Website-based tools have gained momentum for nutrition and physical activity behaviour change interventions (19-21, 23, 24, 50, 71-73) and have the potential to assist users with goal-setting and tracking both in the presence and absence of professional support. To date, research trials have studied such tools (34, 36, 37); however, use of publicly available tools outside of a research setting is largely unknown.

eaTracker® is a free, publically available Canadian nutrition and physical activity behaviour self-monitoring website; members of the general public may find out about eaTracker® through various channels including via their dietitian or other health professional (as the tool is well known amongst Canadian health professionals interested in nutrition), health and professional organizations (e.g., DC), Internet searchers, government, and school courses. “My Goals” was added to eaTracker® in 2011 which allows users to set: a) “ready-

made” SMART behaviour based goals (based on Canada’s Food Guide (212) and the Canadian Physical Activity and Sedentary Behaviour Guidelines (213)) to be completed weekly (choice of n=87 goals within n=13 categories [**Appendix 1**]; e.g., “Avoid all fried foods this week”) and b) “write your own” goals which includes the requirement that users choose a frequency for their goal (daily, weekly, monthly, once by an end-date) from a drop-down menu. The “My Goals Tracker” allows users to self-identify goal progress as “Met My Goal” or “Still Trying” (tracking is available at the beginning of the next day, week, month, or end-date for daily, weekly, monthly, and one-time goals, respectively). “My Goals” also contains goal progress logs (“Manage My Goals” and “My Success”). Ontario, Canada users were also provided information on writing SMART goals accessible via a hoverbox. My Goals screen shots are shown in **Appendix 2**. The “My Goals Tracker” is found on the eaTracker® Dashboard which appears upon website entry, and the goal setting and goal progress history sections are found on the eaTracker® “My Goals” webpage. In December 2012, ERO added optional free supports for Ontario My Goals users including: a) emailed and eaTracker® delivered motivational messages (~1/week) with tips, recipes, web-links usually specific to ready-made goals or general messages for write your own goals (e.g., reminders to log into eaTracker®) [screenshots shown in Appendix 2], and b) assistance with goals by phone or e-mail from contact centre dietitians.

Data obtained from users of the My Goals tool provided an ideal opportunity to study natural use of a publicly available website that allows users to set and track both website-provided and their own written goals. Analysis of user data from this feature provided a snapshot into the demographics of individuals who use such tools and types of goals that members of the general public are interested in setting. This information is relevant to

nutrition, public health and information technology professionals interested in incorporating goal setting and tracking tools as part of website-based interventions for nutrition and physical activity behaviour change. This type of analysis also provided insight into the needs of publicly available users of these types of tools. Using anonymous retrospective My Goals data, the objectives of this study were to describe self-reported demographics of Ontario My Goals users who were and were not signed up for ERO motivational messaging, and Alberta My Goals users who did not have access to the motivational messaging; to describe the goals set by individuals from the three user groups; and to describe use of the goal tracking feature by users from three user groups. Both Ontario and Alberta users were chosen because they had access to slightly different versions of the My Goals feature (e.g., only Ontario users had access to instructions on writing SMART goals) and only Ontario users had access to the additional ERO supports. Including users from two provinces with access to slightly different tools and supports helped to provide a more balanced perspective of the overall population of users.

5.2 Methods

The University of Waterloo Office of Research Ethics provided ethics approval [Appendix 3]. This project was a secondary analysis of anonymous data on all goals set from December 6, 2012-April 28, 2014 by active eaTracker® My Goals users as of April 28/2014, ≥ 19 years of age, from Alberta and Ontario, Canada. Anonymous self-reported user demographics (age, sex, height, weight, pregnancy status, breastfeeding status, physical activity level, province of residence) when goals were set were also acquired. Goals both set and deleted on the same day were excluded from all analyses. The eaTracker® website

privacy policy specifies to users that anonymous data may be provided to researchers to create reports and collect statistics which was the case for this project; additional written consent was not obtained for this anonymous retrospective data analysis.

Body mass index (BMI) (kg/m^2) was calculated using self-reported height and weight. Users with implausible height ($<1.22\text{m}$ or $>2.13\text{m}$) and/or weight ($<34\text{kg}$ or $>227\text{kg}$) values (214) were excluded from BMI analyses only. All statistics were completed using SPSS versions 22 and 23 (IBM Corp, Armonk, New York). All continuous variables are presented as mean \pm standard deviation. Chi-square tests (categorical variables) and one-way ANOVA with Bonferroni post-hoc comparisons (continuous variables) were used to compare user demographics, and types of goals set by the three user groups (i.e., Alberta users, Ontario users who signed up for ERO messaging, and Ontario users who did not sign up for ERO messaging). All p values were two tailed and p values were considered significant if <0.05 .

5.2.1 Write your own goal analysis

Related studies characterizing health-related goal content (215, 216) helped guide this analysis. Nutrition behaviour change goals (e.g., drink more milk) were categorized based on topic and specificity (usually quantity). When quantity did not fit with the goal topic (e.g., portion size, self-monitoring), a goal was considered specific when additional details were provided other than only behaviour identification (e.g., how or when the behaviour would be conducted e.g., “using portion controlled foods” vs. “portion control”). Goals to follow a specific diet (e.g., eat a vegetarian diet) were only categorized by topic area, not specificity. Physical activity goals were categorized by both activity type and amount; activity self-monitoring (e.g., track activity) was categorized as other-specific. Goals to use eaTracker®

were categorized under both nutrition and activity self-monitoring. Long term (distal) outcome goals (e.g., lose weight, manage diabetes, gain muscle) were categorized by topic area only.

Each goal was categorized once using the most relevant category (with the exception of goals to use eaTracker® as described above), and write your own goal statements with >1 goal (e.g., drink milk, eat more vegetables, and lose weight) were categorized as separate goals with a maximum of one occurrence of a specific category for each write your own goal statement. Time was not considered in this analysis because a frequency was chosen by the user for all write your own goals.

A codebook was created and used to categorize all write your own goals; the author of this thesis created the codebook and categorized all goals. Topic area categories were generated inductively from the data; however, Canada's Food Guide (212) was used to guide organization of goals relevant to this document. Goals that were identified as difficult to categorize by the author were discussed with her supervisor and consensus was achieved. In addition, two second researchers (dietitian PhD students) reviewed the codebook and re-categorized a subset of goals (10%); any discrepancies were discussed and consensus was achieved.

5.3 Results

In total, n=16,511 goal statements (75.4% (12,449/16,511) were ready-made; 24.6% (4,062/16,511) were write your own) set by n=8,067 users 19-85 years of age were included for analysis. A cut off of 85 years of age was chosen as only n=6 goal statements were written by users >85 years of age with the next youngest user being 96 years of age. Of note, there were ~n=29,685 eaTracker® accounts active between December 6, 2012 and April 28, 2014

belonging to users 19-85 years of age from Ontario and Alberta who last logged during and after that date range (this number was obtained on October 2, 2015). In total, $n=16,375$ and $n=136$ goal statements were in English and French, respectively.

Demographics when users set their first goal are presented in **Table 1** (note: all tables are presented at the end of each chapter); overall, the mean user BMI was over 25kg/m^2 , mean age was 41.1 ± 15.0 years and over 80% of users were female. Ontario users who had signed up for ERO messaging were more often female, less active, and on average were older and had a higher BMI versus Alberta users and Ontario users who had not signed up for ERO messaging (Table 1).

On average, users had set ~ 2 goals. In users who had set ≥ 2 goals ($n=4,485$), 91.1% set all goals the same day. Only $n=547$ ($n=323$ ready-made; $n=224$ write your own) included goal statements were ever deleted. Additional analyses on the association between user demographic variables (e.g., age, sex, BMI etc.) and goal topic areas chosen that was conducted after the thesis was submitted to the committee is available in **Appendix 4**.

5.3.1 Ready-Made goals

Descriptive statistics of ready-made goals organized by category are presented in **Table 2**. In total, 81.3% ($6,560/8,067$) of users had set ≥ 1 ready-made goal(s). Overall, these $n=6,560$ users set 1.9 ± 1.2 ready-made goals (range: 1-20) and 56.4% ($3,697/6,560$) chose ≥ 1 goal(s) from the “Managing your Weight” category; this category encompassed 33.1% ($4,116/12,449$) of all ready-made goals set. The most popular goals were: “Avoid snacking while reading, using the computer or watching TV every day this week” (9.4% of all ready-made goals set ($1,170/12,449$)), “Make a menu plan and shopping list and use it this week”

(6.5% (805/12,449)), and “Avoid second helpings during meals and snacks every day this week” (5.9% (734/12,449)).

Few ready-made goals were tracked with the My Goals Tracker. For ready-made goals that were active for ≥ 7 days (n=12,268) (note: active for ≥ 7 days means that goals were not deleted within the first seven days of being set, and were set at least seven days prior to data request date), only 7.0% (855/12,268) were tracked ≥ 1 time(s) (note: only 20.9% (179/855) of those goals were tracked more than once).

5.3.2 Write Your Own goals

Overall, 32.1% (2,587/8,067) of users had set ≥ 1 write your own goal(s) which usually encompassed distal, nutrition, and/or physical activity behaviour change goals. Further, some write your own goal statements encompassed related health behaviour change (e.g., sleep, smoking, anger, stress, taking time for one’s self, meditation, attitude, medication) (n=56), body measurement (usually weight), blood glucose, or medication self-monitoring (n=16), and general healthy living (sometimes to lose weight or be healthier) (n=19) goals. In addition, n=553 write your own goal statements contained >1 goal topic (e.g., included for example a goal to lose weight and a separate goal to eat more vegetables and fruit). Of note, n=95 full write your own goal entries were irrelevant to health or nonsense. **Table 3** provides sample write your own nutrition and physical activity behaviour change goals organized by topic and specificity (if applicable).

Overall, there were n=1,986, n=614, n=233, and n=1,134 daily, weekly, monthly, and one-time write your own goal statements, respectively (excluding irrelevant to health/nonsense goals); these goals were rarely tracked. For daily goals active for ≥ 7 days (n=1,944), 13.4%

(261/1,944) were tracked (39.1% (102/261) of those were tracked more than once). For weekly goals active for ≥ 7 days (n=605), 13.2% (80/605) were tracked (41.3% (33/80) of those were tracked more than once). For monthly goals active for ≥ 30 days (n=222), 6.3% (14/222) were tracked (35.7% (5/14) of those were tracked more than once). For one-time goals active 7 days after the end-date (n=911), 4.3% (39/911) were tracked once.

5.3.2.1 Distal goals

Overall, 42.3% (1,720/4,062) write your own goal entries were solely distal goals (e.g., weight loss) and n=639 users set only this goal type. An additional n=173 entries encompassed both distal and other goal types without forming a direct link (e.g., lose weight and eat healthier). This section will describe these n=1,893 entries set by n=1,621 users.

Several write your own goal entries (n=1,542) had weight management goals with n=1,382 addressing weight loss (n=1,042 of those specified a total weight loss amount (e.g., number of lb/kg, clothes size, BMI level) or rate). Weight gain goals were less common (n=49 entries), with n=25 formed by males ≤ 30 years of age.

Weight management (excluding weight gain) goals were rarely linked to a direct reason (e.g., lose weight to manage diabetes). When a direct reason was included, reasons included to manage health conditions (e.g., diabetes, hypertension, arthritis, back pain, surgery qualification, medication discontinuation) (n=15), be healthier, feel better, and/or increase energy (n=5), sports (n=3), conception, pregnancy, and/or post-partum (n=3), quitting smoking (n=2), and improving fitness (n=1). Weight management for special events (e.g., vacation, wedding, anniversary, holiday, birthday, and graduation) and fitting better into clothes was also mentioned. When weekly weight loss amounts were directly specified in the goal entry, most

were within a prudent 0.5-1.0kg/week, however, higher amounts were sometimes specified (e.g., lose 1.4kg/week). In addition, there were some users with BMIs in the low normal range who desired weight loss.

In total, n=186 write your own goal entries had body composition improvement goals (e.g., decrease body fat, decrease waist circumference, gain muscle, increase leanness, improve physique, wear certain clothes (e.g., bathing suit) well, be more “toned,” “ripped,” “bulky,” stronger bones, happy with body). These goals were frequently set by users ≤ 30 years of age (n=94).

Health issue prevention and/or management goals (excluding n=15 goals directly linked to weight management) were included as part of n=118 entries, n=88 which were set by users ≥ 50 years of age. Diabetes or blood glucose control was the most common (n=59), followed by blood lipid or heart disease (n=26), and hypertension (n=13) management; however, other conditions were also mentioned (e.g., pain, anemia, getting through surgery, irritable bowel syndrome, fatty liver, fluid retention, decreasing potassium, bone health, eating disorders).

Fitness improvement goals (e.g., more fit, flexible, stronger, stamina, run 5km or marathon, improve posture) were present in n=112 entries. Lastly, n=79 entries had goals to be healthier, increase energy, and feel better, improve self-esteem in general, and n=4 entries had goals to conceive and/or have a healthy pregnancy.

5.3.2.2 Physical activity behaviour change goals

Overall, n=550 write your own goal entries were solely physical activity behaviour change goals; an additional n=184 entries encompassed both physical activity and other goal types without forming a direct link. This section will discuss these n=734 entries set by n=642

users.

Table 4 classifies physical activity behaviour improvement goals by activity type and specificity. Overall, 47.3% (347/734) of these entries had a goal to increase activity without specifying amount (e.g., minutes, repetitions) and type; a further 12.1% (89/734) of entries specified activity amount without type. Entries with goals to increase aerobic activities (e.g., walking, running, swimming, dancing, biking, elliptical, stairs, jumping jacks, boxing) (n=149 specific; n=85 less specific) outnumbered those to increase strength and flexibility activities (e.g., weights, yoga, Pilates, stretching, core) (n=24 specific; n=52 less specific).

Topics included as part of these goals not covered in the ready-made goals included: stretching, core exercises, CrossFit®, tai chi, sports (e.g., hockey), step count goals (e.g., 10,000 steps/day), walking a certain distance by a specific date, walking dogs, being active during TV commercials, high-intensity interval training, elliptical, exercise videos, activity tracking, and exergaming. Some entries included “or,” “/,” or “e.g.,” suggesting substitutions could take place.

Few goals (n=40) for improving activity behaviours were directly linked to a reason (e.g., become active to lose weight). Weight management (usually weight loss) (n=24) was the most common reason. Other reasons included improving: fitness (n=8), body composition (n=7), diabetes/blood sugar control (n=2), blood cholesterol (n=1), and health/energy levels (n=1). Importantly, n=26 of these goals had unspecific activity type and duration.

5.3.2.3 Nutrition behaviour change goals

Overall, n=1,349 entries were solely nutrition behaviour change goals; an additional n=219 entries encompassed both nutrition behaviour change and other goal types without

forming a direct link. This section will discuss these n=1,568 entries set by n=1,179 users.

Table 4 classifies nutrition behaviour change goals by topic and specificity. The most common goals were to make general healthy eating improvements (n=71 entries more specific; n=261 entries less specific, e.g., re amount), followed by decreasing sodium, sugar, and fat (n=140 more specific; n=91 less specific), increasing vegetables and fruit (n=42 more specific; n=80 less specific) and increasing water (n=62 more specific, n=53 less specific). Importantly, some goals especially those for decreasing sodium, fat, or sugar were potentially unrealistic (e.g., no sugar). Some goals also specified wanting to learn about nutrition.

These write your own goals generally had similar topics to ready-made goals. Additional topics included: limiting nighttime eating, decreasing alcohol, and psychological aspects of eating. Several goals also focused on specific nutrients (e.g., fibre, protein, carbohydrates), and caloric goals. In general, these goals followed healthy eating recommendations; however, this was not true for all goals (e.g., follow fad diets).

Few nutrition goals (n=139) were directly linked to a reason for improving behaviours. When reason(s) were directly specified, weight management was the most popular (n=75) (note: only n=2 goals were for weight gain), followed by diabetes (n=22), other conditions (e.g., cholesterol/heart healthy, surgery preparation, arthritis, cancer, uric acid, acid reflux, irritable bowel syndrome, gas, bloating, uric acid, hypertension, anemia, kidney stones, pancreatitis, arthritis) (n=22), sports nutrition/improving fitness (n=12), body composition (n=8), conception, pregnancy, and/or breastfeeding (n=8), and health, energy or sleep improvements (n=5).

5.4 Discussion

To my knowledge, this is the first study that retrospectively analyzed data from a large group of natural users of a publicly available website-based nutrition and physical activity behaviour change goal setting and tracking feature. Overall, eaTracker® users showed interest in the My Goals feature (i.e., n=16,511 goal statements were written by n=8,067 users in ~17 months which was ~27.2% of all users from Ontario and Alberta). This interest suggests further research on these types of features as well as how to strengthen them for use as part of publically available electronic nutrition and physical activity behaviour change tools is warranted.

My Goals users generally shared similar demographics to those reported in other studies that examined naturalistic use of public weight management websites (e.g., females <50 years of age with overweight and/or obesity) (65, 66, 135, 136). Although reasons for using the My Goals feature were not directly captured, there was evidence that users often set weight management goals (i.e., 33.1% of ready-made goals and 40.0% write your own goals made reference to weight management). This finding is not surprising given the high prevalence of overweight and obesity in Canadian adults (5). However, other types of goals were also set which suggests that publicly available tools should accommodate varied needs and goal topics.

Many users capitalized on the opportunity to write their own goals with the My Goals feature (i.e., n=2,587 users set n=4,067 goals). Although several users took advantage of this feature, there were some issues that were uncovered from the analysis of these goals that are useful for future advancement the My Goals feature and the development other similar types of tools. For example, several write your own goals in this dataset did not adhere to health

guidelines (e.g., fad diets, weight loss amounts >1kg/week, very low calorie diets), were non-specific (e.g., missing amount), possibly unrealistic (e.g., no sugar) and were poor quality according to Goal Setting Theory and SMART criteria. Some goals would also not generally follow standards about how goals are to be used for behavioural therapy for obesity (197, 198) and other chronic diseases (199). Some users also appeared to have some difficulties choosing appropriate frequencies for their goals (e.g., lose 5kg; frequency: daily); it is unclear whether this finding is due to a lack of understanding how to use the frequency tool or about what is realistic or both. These findings regarding poor quality goals are not entirely surprising based on previous work that has provided data on the types of goals individuals set. Findings from these studies have found that individuals may set: a) weight loss goals that are unrealistic or want to lose weight quickly via dieting (211, 217), b) non-specific goals (215), and c) poor quality goals in general (e.g., non-specific, vague, broad, not behaviour based) (42, 43). In addition, instructions on how to write SMART goals available for Ontario users only may not have been used often, as may have also occurred with an online epilepsy management goal setting program (215). Upon scanning the write your own goals, poor quality goals were roughly proportionately as common in Ontario users as Alberta users who were not provided with instructions. Although providing individuals the option to write in their own goals is important, resources and checkpoints (preferably automated) are needed to ensure quality goals are set that adhere both to guidelines (e.g., SMART, safe), and are also appropriate for the individual user when health professional support is unavailable.

Ready-made goals were very popular amongst users of the My Goals feature; in fact ~75% of all goals set with the My Goals feature by users in this dataset were ready-made. This finding is promising in the sense that users appeared to be interested as a whole in this type of

goal setting which helps them to set SMART behaviour based goals which follow Canadian nutrition and physical activity guidelines. Analysis of the write your own and ready-made goals also provides important insight on topic areas for goals that users were interested in setting and guidance on content areas that should be considered for future ready-made goals. For example, when examining the write your own goals, users had interests in goals surrounding water intake and alcohol which were not extensively covered as part of the ready-made goals, and there was less interest in ready-made goals for choosing healthier meat and alternatives and milk and alternatives. Also, having places in the feature where users can set distal goals as well as behaviour based goals is important and may help them to understand that smaller behaviour based goals will help them reach a long term (distal) goal (e.g., weight management) (196). In addition, several users had goals related to disease management (e.g., diabetes); having ready-made targeted for specific patient populations would also be something to consider in the future as goal setting is a common method used for chronic disease management (199).

Previous work has shown that engagement with website-based tools for nutrition and physical activity behaviour change is associated with positive outcomes (e.g., weight loss) (65, 136-138). However, this study and previous studies (135, 136) have found that non-use of website features are common. For example, in this study, users seemed motivated to set goals, but <10% of goals were tracked. Previous studies have found linkages between various demographic and behavioural variables (e.g., age, sex, diet variables, health behaviours) and website use (66, 67, 141), however, they do not provide insight from users into reasons for non-use. Relevant qualitative research has provided some insight into factors that may affect use including limited time (47, 157), and challenges with self-monitoring (including website-

based self-monitoring) in general (161, 162, 218) (which could affect overall eaTracker® website use); unfortunately, qualitative research on website-based goal setting and tracking tools outside of a research trial setting is virtually non-existent. A qualitative study on wearables (e.g., Fitbit®) (165) found that some users like virtual rewards for goal achievement which is something that My Goals did not provide. Also, users in our study may not have used the tool optimally. Qualitative research on naturalistic users of the My Goals tool or similar tools may provide insight into non-use and desired features. In addition, another possible reason that users may not have followed through with their goals is that the My Goals feature does not have any online component that helps users work through facilitators and barriers that may affect their goal achievement (although Ontario users would have had the option to contact an ERO contact centre dietitian for this support and the motivational messages do provide tips) which is a commonly used technique in behavioural management for obesity (197). Because they did not have this type of personalized support, it is possible users may have given up on their goals more quickly. Incorporating this type of assistance through the online tool in future iterations may help users to be more adherent.

This study had some important strengths. First, it is only one of a handful of studies that have examined naturalistic use of publically available websites for nutrition and physical activity behaviour change; most studies are conducted in research trial settings with motivated participants. Second, to my knowledge, this is also the first study that has assessed naturalistic use of a nutrition and physical activity behaviour goal setting and tracking tool. Although this study had some important strengths, there are also some limitations that should be noted. First, demographic data, including height and weight, was self-reported. Second, a sense of user commitment to behaviour change could not be obtained; it was unclear whether users were just

trialing the website or were really interested in changing their behaviours. Third, when assessing the quality of the goals, a sense of whether goals were realistic and appropriate for individual users could not be obtained. Fourth, this study did not capture how use of My Goals compared with use of other aspects of the eaTracker® website, and as well how these Alberta and Ontario My Goals users compared with the larger Canadian population of My Goals users. Lastly, I was not able to obtain data on outcomes of using this tool for the following reasons: a) high levels of non-use of the My Goals Tracker which is a well described problem with electronic tools in general (56), and b) as described further in Chapter 6, participants reported difficulties and concerns with the My Goals Tracker which suggested this data would not be reliable to use to capture goal achievement outcomes.

5.5 Conclusion

Understanding use of website-based tools for nutrition and physical activity behaviour change (specifically goal setting and tracking tools) in a natural environment is essential. Substantial interest exists in the My Goals feature as part of the broader eaTracker® nutrition and physical activity self-monitoring website however, there were high levels of non-use after initial goal setting. In addition, many of the write your own goals were poor quality and may not set users up for success. With the popularity of website-based tools to facilitate nutrition and behaviour change, goal setting, and limited access to professional support for assistance with this process, website-based tools represent an important future direction to assist individuals with use of goals for nutrition and physical activity behaviour change. Future research needs to determine how to help individuals write better quality goals using website-based tools (instructions may not be enough) and how to help users to follow-up with their

goals; qualitative research with naturalistic users of these tools may provide important insight, which was the topic of the next thesis chapter.

Table 1: eaTracker® My Goals feature user demographics

	All users (n=8,067)	Ontario ERO users (n=2,195)	Ontario non ERO users (n=4,499)	Alberta users (n=1,373)	P value†
Sex (n (%))					
Female	6,717 (83.3%)	1,938 (88.3%)	3,628 (80.6%)	1,151 (83.8%)	<0.001
Male	1,350 (16.7%)	257 (11.7%)	871 (19.4%)	222 (16.2%)	
Age (years)	41.1±15.0	45.4±13.7 ^b	39.4±15.2 ^a	39.9±15.0 ^a	<0.001
Age Category (years)					
19-30	2,521 (31.3%)	401 (18.3%)	1,633 (36.3%)	487 (35.5%)	<0.001
31-50	2,981 (37.0%)	911 (41.5%)	1,594 (35.4%)	476 (34.7%)	
51-70	2,436 (30.2%)	841 (38.3%)	1,204 (26.8%)	391 (28.5%)	
71-85	129 (1.6%)	42 (1.9%)	68 (1.5%)	19 (1.4%)	
BMI (kg/m²)*	28.8±7.6	30.4±7.7 ^b	28.1±7.3 ^a	28.6±8.0 ^a	<0.001
BMI Category (n (%))*					
<18.5 kg/m ²	162 (2.0%)	29 (1.3%)	107 (2.4%)	26 (1.9%)	<0.001
18.5 kg/m ² -24.9 kg/m ²	2,684 (33.5%)	521 (23.9%)	1,658 (37.1%)	504 (37.1%)	
25.0 kg/m ² -29.9 kg/m ²	2,289 (28.6%)	637 (29.3%)	1,279 (28.6%)	375 (27.6%)	
≥30 kg/m ²	2,874 (35.9%)	990 (45.5%)	1,431 (32.0%)	452 (33.3%)	
Activity Level (n (%))					
Sedentary	1,242 (15.4%)	388 (17.7%)	644 (14.3%)	209 (15.2%)	<0.001
Low Active	4,106 (50.9%)	1,213 (55.3%)	2,245 (49.9%)	649 (47.3%)	
Active	2,345 (29.1%)	534 (24.3%)	1,380 (30.7%)	431 (31.4%)	
Very Active	344 (4.3%)	48 (2.2%)	215 (4.8%)	81 (5.9%)	
Not Specified	30 (0.4%)	12 (0.5%)	15 (0.3%)	3 (0.2%)	
Pregnant (n (% of women))					
No	6,594 (98.2%)	1,914 (98.8%)	3,558 (98.1%)	1,122 (97.5%)	0.030
Yes	123 (1.8%)	24 (1.2%)	70 (1.9%)	29 (2.5%)	
Breastfeeding (n (% of women))					
No	6,585 (98.0%)	1,898 (97.9%)	3,559 (98.1%)	1,127 (97.9%)	0.882
Yes	132 (2.0%)	40 (2.1%)	69 (1.9%)	24 (2.1%)	
Types of Goals Set (n (%))					
Ready-made only	5,480 (67.9%)	1,477 (67.3%)	3,095 (68.8%)	908 (66.1%)	<0.001
Write your own only	1,507 (18.7%)	345 (15.7%)	873 (19.4%)	289 (21.0%)	
Both	1,080 (13.4%)	373 (17.0%)	531 (11.8%)	176 (12.8%)	
Average Number of Goals Set	2.0±1.3 Median: 2.0 Range: 1-20	2.3±1.4 ^b Median: 2.0 Range: 1-17	1.9±1.2 ^a Median: 2.0 Range: 1-19	2.0±1.2 ^a Median: 2.0 Range: 1-20	<0.001
Ready-made goals	1.5±1.3	1.8±1.3 ^b	1.5±1.2 ^a	1.4±1.2 ^a	<0.001
Write your own goals	0.50±1.0	0.58±1.1 ^a	0.46±0.89 ^b	0.54±1.0 ^a	<0.001

Age, sex, BMI, activity level, pregnancy status, and breastfeeding status were self-reported

*BMI data were based on self-reported height and weight and available for n=8,009 users.

†P-value for chi-square test for categorical variables, and one-way ANOVA for continuous variables. Means in the same row with different superscript letters are significantly different from one another (p<0.05 - one-way ANOVA with Bonferroni post-hoc comparisons).

Table 2: Types of ready-made goals set and tracked by users of the eaTracker® My Goals feature organized using the different ready-made goal categories

	Total number of goals set from the specified goal category (% of all ready-made goals set)*	Total number of users who had set a goal from the specified goal category (% all users who set ready-made goals)**	Total number of goals tracked from the specified goal category (% of all goals tracked from the specified goal category)***
Goal Category			
Managing your weight	4,116 (33.1%)	3,697 (56.4%)	277 (6.8%)
Getting active	1,634 (13.1%)	1,527 (23.3%)	131 (8.1%)
Choosing more vegetables and fruit	1,622 (13.0%)	1,555 (23.7%)	104 (6.5%)
Eating less fat, sugar, and sodium	1,380 (11.1%)	1,306 (19.9%)	86 (6.3%)
Planning and preparing food	1,291 (10.4%)	1,235 (18.8%)	72 (5.7%)
Eating a healthy breakfast	643 (5.2%)	629 (9.6%)	60 (9.4%)
Getting more fibre	411 (3.3%)	390 (5.9%)	28 (6.9%)
Eating a healthy dinner	295 (2.4%)	287 (4.4%)	17 (5.8%)
Eating a healthy lunch	284 (2.3%)	280 (4.3%)	23 (8.2%)
Choosing healthier beverages	254 (2.0%)	247 (3.8%)	22 (8.9%)
Choosing healthier grain products	223 (1.8%)	220 (3.4%)	14 (6.4%)
Choosing healthier meat and alternatives	215 (1.7%)	199 (3.0%)	13 (6.2%)
Choosing healthier milk and alternatives	81 (0.7%)	77 (1.2%)	8 (10.3%)

*n=12,449 ready-made goals were set in total; n=12,449 was the denominator used to calculate all percentages in this column.

**n=6,560 users in total had set ready-made goals; n=6,560 was the denominator used to calculate all percentages in this column.

***Because the My Goals Tracker was only available to track goals at the start of the next week for ready-made goals, only goals that were active for ≥ 7 days were included as part of the denominator for the percentage of goals all goals tracked from the specified goal category.

Table 3: Examples of write your own nutrition and physical activity behaviour change goals written by users of the eaTracker® My Goals feature organized by topic and specificity

	Specific (e.g., with amount)	Less specific (e.g., with amount)
Physical Activity Behaviour Change Goals		
Aerobic, cardio, swimming	Get 10,000 steps a day, Run 30 min 6 times this week	Moderate to vigorous activity 3 times per week, Run daily
Strength, flexibility, yoga, Pilates etc.	Do 15 minutes of activity 1 time this week in the Weight room (weights, resistance training), Go to one yoga class per week,	I would like to start weight training 2-3 times a week, do resistant training
Unknown exercise	Workout 30 minutes a day, Get active during TV commercials, Exercise 150min per week	Exercise more, Be more active, Exercise daily
Nutrition Behaviour Change Goals		
Eating Well With Canada's Food Guide Food Group Goals		
↑/specific serving number amounts	Consume four servings of vegetables daily	Eat more fruit and vegetables
Limit food group foods	No dairy	Eat less bread
Improving quality of food group foods	Two servings fish each week	To eat more beans and legumes instead of meat this month
Limiting unhealthy foods/beverages and/or fat, cholesterol, sodium, and sugar in general	No sugar, Avoid junk food, Limit sodium to <1500 mg/d, Give up diet Pepsi	Eat less sodium and fat and sugar, low salt diet, Cut down on eating sweets
Alcohol (limit or specific amount)	Cut alcohol use to a glass of wine/day, Cut out beer	Reduce alcohol intake
Water (increase or specific amount)	Drink 8 cups of water per day	Drink more water
Limit coffee and/or caffeine	Limit my coffee intake to 2 cups/day	Drink less coffee
Eat more/specific amounts of certain nutrients (e.g., protein, fibre, calcium, vitamins D, C, E, iron, unsaturated fats)	Consume sufficient iron daily, Drink or eat 1000 mg calcium each day	Increase my fibre intake, Increase protein intake at lunch time
Eat less/limit certain nutrients (e.g., carbohydrates) (except fat, sodium, sugar)	Eat only 1/2 cup of starch at supper	Eat less carbs
Caloric/food intake amounts	Consume <1500kcal, No over-eating and no eating my kids left overs!	Eat more calories, Eat less, Limit extra desserts/snacks
Portion control	Weigh and measure my portions, To eat portion controlled foods	Eat smaller portions
Self-monitor diet and/or ↑ awareness	Keep a food diary daily	Be aware of what I am eating.
Eating out less/Eat at home more	I want to only dine out for 1 meal a week	Eat more at home
Evening/nighttime eating (e.g., healthier and/or restricting)	No eating after 8:00pm	Limit snacks at night
Canada's Food Guide	Follow Canada's food guide	
Vegetarian/vegan diets	Eat mostly vegan	
Fad diets (not gluten free)	More alkaline and less acidic foods	
Gluten free (includes wheat free)	Follow Celiac diet	
Other plans (includes FODMAP guidelines, heart healthy, diabetes, Optifast, Weight Watchers, DASH, dietitian meal plans, weight lifting, pregnancy diet, unspecified diet plans)	Following the dietitian's plan, Eat only my shakes this week, Follow diet, Follow Diabetes diet	
Glycemic index	Keep a low glycemic index diet	
Clean eating (includes unprocessed, whole, fresh, raw, natural foods)	Eating cleaner, Eat as much raw as possible, To eat fresh food	
Supplements	Take 600-800 IU vitamin D daily	
Planning and preparing food †	Cook dinner from scratch a minimum of 3 times per week, Plan 4-5 smaller meals per day	Better planning and preparing of food, Plan healthy meals, Plan Meals
Goals describing when food is eaten or not eaten/eating patterns	Eat Breakfast, Lunch, Dinner & Snack every day, Not to eat in between meals	Eat more regularly, Try not to snack so much throughout the day
Breakfast	Eating healthy breakfast (daily)	Incorporate cereal or smoothies more often for breakfast
Psychological aspects of eating	Don't binge, Drink water or 0 cal drink when hungry, Stop emotional eating	To control food intake, Respect food as a means of nutrition and to satisfy hunger
General eating improvements	Eat healthy meals and snacks, Eat the recommended DV of minerals and vitamins, Eat a variety of foods	Eat healthy, eat a balanced diet, eat right to avoid IBS symptoms

Table 4: Types of write your own physical activity and nutrition behaviour change goals set by users of the eaTracker® My Goals feature organized by topic and specificity

		Specific (e.g., with amount) (n=number of goal statements with specified goal type)	Less specific (e.g., with amount) (n=number of goal statements with specified goal type)	
PHYSICAL ACTIVITY BEHAVIOUR CHANGE GOALS (n=734 entries)				
Aerobic, cardio, swimming		n=149	n=85	
Strength, flexibility, yoga, Pilates etc.		n=24	n=52	
Unknown exercise		n=89	n=347	
Other (e.g., fitness classes, exergaming, activity tracking)		n=27	n=4	
NUTRITION BEHAVIOUR CHANGE GOALS (n=1,568 entries)				
Canada's Food Guide Goals	Vegetables and Fruit	↑/specific serving number amounts	n=42	n=80
		Limit certain vegetables and fruit	n=3	-
		Improving vegetable and fruit quality	n=2	n=4
	Grain Products	↑/specific serving number amounts	n=1	n=2
		Limit grain products (e.g., bread) or specific grain products	n=7	n=9
		↑ whole grains/try new grains	n=5	n=2
	Milk and Alternatives	↑/specific serving number amount	n=2	n=1
		Limit milk and alternatives	n=8	n=3
		Choose healthier milk and alternatives (e.g., low fat products)	n=3	-
	Meat and Alternatives	↑/specific serving number amount	n=1	n=1
		Limit meat and alt (inc limit red meat)	n=6	n=4
		Choose fish, lean meats, or meat alt	n=12	n=15
	Limiting unhealthy foods/beverages and/or fat, cholesterol, sodium, and sugar in general		n=140	n=91
Alcohol		n=22	n=12	
Water		n=62	n=53	
Limit coffee and/or caffeine		n=10	n=2	
Eat more/specific amounts of certain nutrients		n=32	n=57	
Eat less/limit certain nutrients (except fat, sodium, and sugar)		n=12	n=31	
Caloric/food intake amounts		n=69	n=28	
Portion control		n=10	n=42	
Self-monitor diet and/or ↑ awareness		n=74	n=19	
Eating out less/Eat at home more		n=8	n=7	
Evening/nighttime eating		n=60	n=10	
Canada's Food Guide		n=36		
Vegetarian/vegan diets		n=12		
Fad diets		n=16		
Gluten free (includes wheat free)		n=21		
Other plans		n=37		
Glycemic index		n=4		
Clean eating		n=15		
Supplements		n=7		
Planning and preparing food		n=29	n=38	
Goals describing when food is eaten or not eaten/eating patterns		n=46	n=31	
Breakfast		n=24	n=1	
Psychological aspects of eating		n=31	n=16	
General eating improvements*		n=71	n=261	
Other**		n=9	n=6	

*Goals making reference to unspecific eating for a specific outcomes (e.g., disease management) were coded as General Healthy Eating (lacks specificity) (n=57 entries)

**Includes alternate/natural sweeteners, organic eating, adding/removing miscellaneous foods, avoiding allergens, eating as normal.

CHAPTER 6: THE WEBSITE-BASED EATRACKER® MY GOALS FEATURE: A QUALITATIVE EVALUATION

6.1 Introduction

Website-based approaches offer promise for supporting goal setting and tracking; however, few data are available. Research trials have examined the effectiveness of websites incorporating such features in research settings. For example, Moutappa et al (37) found that in adults who desired weight loss, those assigned to a five week website intervention that included short- and long-term goal setting as a component, lost statistically significantly more self-reported weight compared with waitlist controls. However, in a different nine month intervention, Duncan et al (34) found no statistically significant differences in nutrition and physical activity behaviour change in middle-aged males randomized to a website/mobile based intervention with a goal setting and tracking component vs. those assigned to a similar paper-based intervention; this study also found high levels of non-use of the challenge (or goal setting) feature. With both research trials as well as the work presented in Chapter 5 reporting high levels of non-use of goal related features, more investigation into reasons for this phenomena is warranted. Qualitative data may provide insight on this topic.

Unfortunately, to date, few qualitative data on user experiences with these types of features is available. Frensham et al (160) examined perceptions of a step count goal setting and tracking website in a small sample of cancer survivors (n=8). Although this study found users can have positive experiences with these types of features, reflections based on the small sample of cancer survivors, research setting and limited focus (step count goals only) may not apply to other circumstances. Another qualitative study on goal setting with mobile apps found that users liked having opportunities to set their own goals with this feature (171). Qualitative data capturing experiences and perceptions of individuals using goal setting and

tracking tools outside of a research setting is even more limited; in addition, dietitian perspectives with these supports is limited.

“My Goals” is a feature that was added to DC’s reputable and freely available nutrition and physical activity self-monitoring website, eaTracker® (<http://www.eatracker.ca/>), in 2011 (described in Chapter 5). Overall, “My Goals” provides guidance on specific, achievable behaviour-based goals, while allowing users the flexibility to set their own goals; it also allows users to track goal progress.

Using qualitative one-on-one semi-structured interviews with volunteer Ontario My Goals users who were signed up for ERO motivational messaging, My Goal users from Alberta who did not have access to ERO motivational messaging, and ERO dietitians, the objective of this study was to document experiences and perceptions of goal setting, and the My Goals feature, and obtain suggestions for modifying the feature to better support goal achievement. Because Ontario users had access to a slightly different website compared to other users (e.g., access to instructions on how to write SMART goals), to provide a more balanced perspective on the My Goals feature, both users from Ontario and Alberta were included.

6.2 Methods

The University of Waterloo Office of Research Ethics provided approval [Appendix 3]; all participants provided written (in-person interviews) or verbal (telephone or online interviews) informed consent [**Appendix 5**]. The COREQ checklist (219) was used to guide study reporting.

A convenience sampling technique that was purposeful was used for this study (220). For this thesis, purposeful sampling was defined as choosing individuals who met the inclusion

criteria for this study. Between June and December, 2013, My Goals users were invited to participate in a one-on-one semi-structured interview via a pop-up box on the eaTracker® website [**Appendix 6**] that provided study information and fields to leave contact information, if interested. Users were shown the pop-up box if they were: a) ≥ 19 years of age, and b) had set a goal in My Goals at least one month prior and had been subscribed to ERO messaging for more than one month (Ontario users) or b) had set a goal in My Goals at least one month prior (Alberta users). Interested users were then contacted by the author of this thesis via email or phone. Dietitians who worked at ERO were recruited from November 2013-December 2013 via email or phone.

Ontario My Goals users, Alberta My Goals users, and ERO dietitians were interviewed one-on-one (in-person, by telephone, or online (e.g., Skype® (Microsoft Corp, Redmond, Washington), FaceTime® (Apple Inc., Cupertino, California)) using a semi-structured interview protocol (similar, but separate for the three different groups) with open-ended questions designed to address the study objectives [**Appendix 7**]. Clarifying and elaborating probes were used to gather additional data (220). Various methods were used to conduct the one-on-one semi-structured interviews. In-person interviews were done when possible, however, phone or online interviews were used when individuals were located in geographical areas far from the researcher, or were desired by the participant. Although phone interviews cannot capture participant body language like in-person interviews (221), these type of interviews provide other advantages (e.g., help to relax participants, allow broader geographic representation, possibly facilitate comfort for individuals with stigmatizing conditions (e.g., morbid obesity)) which are outlined in depth elsewhere (222, 223). Further, previous work has suggested that phone interviews provide quality data with similar results compared to in-person

interviews (222, 223). My Goals users were interviewed from June 2013-December 2013, and dietitians in December 2013. The project advisory team (ERO dietitians) provided feedback on draft interview protocols prior to the study and subsequent changes were made. The first few user participants were pilot tests; these participants were included in the study as no changes were made to the interview protocol at this point. Interviews continued until data saturation was reached; saturation was considered reached when no new information was obtained from interviewing additional participants (224) that would contribute to forming new categories or subcategories. All participants were provided with a study feedback letter following interview completion [**Appendix 8**]; user participants were also provided with a DC cookbook as a thank you gift.

All interviews were conducted by the author of this thesis, a female MSc dietitian and PhD student with research interests in electronic tools for nutrition and physical activity behaviour change who had taken a graduate qualitative research methods course and had no relationship with participants prior to the interview. The author was also very comfortable with websites and the Internet. The author had also not previously used the My Goals feature or eaTracker® for personal reasons to ensure that no personal biases were included. Participants did not know anything about the researcher except information presented in the study invitation letter; the researcher did mention to participants that she was conducting an independent evaluation of the feature. In-person interviews were conducted in local coffee shops, university buildings, and libraries; no other individuals were present at interviews except unrelated individuals patronizing those locations. All interviews were audio recorded with two digital voice recorders and notes were taken during the interview on the interview protocol form (220); no repeat interviews were conducted. Both descriptive and reflective

field notes were taken following interviews (220, 225). Interviews were transcribed verbatim by a transcriptionist. The thesis author verified transcript content against audio recordings and made necessary corrections. Transcripts were not returned to participants and they were not offered the opportunity to provide feedback, but they were advised to contact researchers if they were interested in obtaining study results.

Content analysis (226, 227) was used to analyze interview transcripts. NVivo Version 10 (QSR International, Doncaster, Australia) was used for data analysis. Sections of pertinent data were identified and coded inductively (i.e., without using any preconceived theory) by a single coder (the author of this thesis) using the constant comparative method (220). Briefly, this method involves identifying pieces of relevant data and labeling them (i.e., coding), comparing these pieces to one another to find patterns, and sorting the codes into larger and fewer categories and sub-categories (228). Memos were taken during the analysis process (220). Codes from a subset of the data (~10% of transcripts), and categories were reviewed by a second researcher (health informatics professor) to discuss any variations and come to consensus (221).

6.3 Results

As of December 18, 2013, n=351 My Goals users had completed the recruitment pop-up box. Of those users, n=207 (n=103 from Ontario, n=104 from Alberta) were not interested in participating, n=109 wanted to be asked again later, and n=32 (n=20 from Ontario, n=12 from Alberta) were interested. In total, n=18 and n=5 users from Ontario and Alberta, respectively, were successfully recruited and completed the interview; none of these participants withdrew from the study following interview completion. Most user participants

(n=21) were recruited via the pop-up box; however, n=2 emailed the researcher directly. On average, these interviews were 49 minutes:52 seconds (range: 27 minutes:4 seconds to 81 minutes:31 seconds) and 44 minutes:46 seconds (range: 37 minutes:2 seconds to 52 minutes:52 seconds) for Ontario and Alberta users, respectively. Nine female ERO dietitians were approached to participate, and n=5 were successfully recruited and interviewed. On average, these interviews were 83 minutes:10 seconds (range: 58 minutes:49 seconds to 124 minutes:17 seconds).

Table 5 shows My Goals user demographics and interview methods; overall, 91.3% were female and 56.5% were 51-70 years of age. Most participants had weight management goals. Among those participants, some reported weight-related comorbidities (e.g., type 2 diabetes, knee replacements, hypertension, high cholesterol), while others reported wanting to “shape up” for a special event (e.g., wedding). Still others reported the goals of weight management following breastfeeding discontinuation or maintaining healthy aging; one participant mentioned her husband had diabetes. However, other participants were interested in managing different conditions (e.g., irritable bowel syndrome, osteoporosis), sports nutrition or general eating and physical activity behaviour improvements.

Alberta and Ontario users reported learning about eaTracker® via diverse channels including health professional recommendation (e.g., dietitian, nurse practitioner), Internet searches, DC website, and other websites/newsletters/materials (e.g., Health Canada). Others found it through school, workplace, word-of-mouth, and a pre-diabetes/diabetes group. Participants were usually initially attracted to eaTracker® for food and activity tracking.

Over 50% of Ontario users reported eaTracker® use for ≥ 1 year; others reported use for a few months, 2-3 months and ≤ 6 weeks. Over 50% of Alberta users reported eaTracker® use

for >1 year. Most participants reported that food and activity data entry and feedback was the main reason for use. Nevertheless, motivation to use eaTracker® was sometimes difficult and having the time to enter information was sometimes a barrier. Most users described intermittent use of eaTracker®. Some participants spoke about using the program for a specific purpose (e.g., get a general idea of dietary intake, preparation for a special event) and then stopping. However, a few users were diligent about recording all food and activity data for extended periods (e.g., 2.5 months, ~2 years).

Most Ontario and Alberta participants who remembered how they found out about the My Goals feature indicated they discovered it via exploring the eaTracker® website. For Ontario users, the amount of time that had passed since setting their first goal in My Goals varied; just under 50% these participants had been using it for ~1-3 months; others had been using it for various amounts of time (i.e., 1 year, ~9-10 months, 6 months, ~5 months, and <1 month). For Alberta users, this amount of time also varied (i.e., ~18 months, ~5 months, ~2 months, few weeks). One Alberta user did not recall having used the My Goals feature before. Of note, obtaining concrete information about the time users first set goals with this feature was difficult. Most Ontario and Alberta users mentioned that they did not use the My Goals feature frequently and it appeared to be used far less often than the food and activity tracking feature. Many users also mentioned that they wanted to use, or should be using, the My Goals feature more often.

6.3.1 Experiences and perceptions with goal setting and the My Goals feature

Categories describing user experiences and perceptions with goal setting and the My Goals feature are described below which include: Goal setting for nutrition and physical

activity behaviour change: a beneficial yet challenging process, and My Goals feature: a positive concept that needs functional improvements, which had sub-categories including goal setting and goal progress tracking. Findings from the three participant types (Ontario users, Alberta users, and dietitians) were grouped together as they were similar.

6.3.1.1 Goal setting for nutrition and physical activity behaviour change: a beneficial yet challenging process

Both users and dietitians felt that goal use was beneficial and important, yet very challenging. Some users had previous knowledge of goals and SMART goals from other settings (e.g., workplace, coaching hockey, school, professional background); however, others had less knowledge.

In terms of benefits, users mentioned that goals provided focus and targets to work towards. Dietitians also mentioned goals provided focus, were useful for helping individuals in different situations, and were evidence-based. User quotes describing these findings are presented below:

I'm absolutely convinced you need to set goals and uh if you don't uh you basically wander aimlessly so I, uh, an old adage about plan your work and work your plan uh I've always believed in. [Ontario user #1, Male 51-70y]

I'm a big believer in goal setting and that helps people keep on the right track and, and helps them figure out where they're going and um so if they start wandering, they came come back and all that so I think it's instrumental for any, to achieve anything. [Alberta user #3, Female 51-70y]

Despite the benefits, several challenges were described. Difficulty sticking to goals (including dealing with roadblocks and difficulties along the way) was the most frequent challenge mentioned by users. They also identified fear of failure, setting goals that were too

big, and needing to balance their goals with a family member's need (e.g., husband with diabetes). The following user quotes describe some of these challenges:

I know I have to be practical and goal setting is only as good as it's applied. And my problem is I know what I want but I don't apply it. [Ontario user #10, Female 51-70y]

I know that goal-setting is good and it helps you reach your goal, but then, for me I know that like I don't want to set myself up for failure so that sometimes I won't really like try to make a goal because I don't want to like fail at it. [Ontario user #12, Female 19-30y]

Dietitians also felt goal use was challenging for clients. Some dietitians felt that many people had limited knowledge of quality goal setting (including SMART goals), and while they knew what the desired outcomes were (e.g., weight loss), they did not know how to get there.

The following quote illustrates these findings:

...people have big, high expectations or they say, oh I just want to lose weight and okay well that's great, but they don't understand that there's you know, what are the smaller steps to get you to that big goal. [Dietitian]

6.3.1.2 My Goals feature: a positive concept that needs functional improvements

6.3.1.2.1 Goal setting

Users generally began using the My Goals feature with some pre-determined ideas about their goals of interest (e.g., weight and/or disease management, targeting problematic behaviours). For some users, this was their first time setting these types of goals. Both users and dietitians were happy that both ready-made and write-your-own goal setting options were available.

Overall, users felt positively about ready-made goals (e.g., relevant content, provided a starting point, achievable, practical, appropriate selection, goals already SMART) and found them easy to set with the My Goals feature. Users frequently browsed ready-made goals;

many reported these goals provided them with ideas and were helpful for choosing goals. The following user describes her positive experience with the ready-made goals:

Well, actually, reading through [*the ready-made goals*], the one about not skipping meals, I was really bad for that. And it didn't even occur to me that that was really an important thing to change but it is. But when I read through the [*ready-made*] goals and saw it, I thought, I added it to my goals thinking that is something that I need to address. [Alberta user #1, Female 31-50y]

Users also commented that ready-made goals were useful for helping them write their own goals. A few users also mentioned ready-made goals helped them choose smaller and manageable starting goals (e.g., avoiding second helpings) instead of setting larger weight loss goals, and liked this focus. This finding is described in the following user quote:

So with the [*ready*]-made goals, things like um "I'll avoid eating out of the container" vs. "I'm going to lose 5 pounds". I think the approach is really good. Um. And and without behavioral goals, I don't think people reach their end um like what they need to achieve. [Ontario user #3, Female, 31-50y]

Dietitians also felt positively about such goals. For instance, they mentioned that ready-made goals provided guidance for users who may not know where to begin, covered relevant topics, and provided action-oriented goal setting guidance.

However, users reported some limitations of ready-made goals, such as being restricted to a fixed weekly goal frequency (i.e., no goals with a daily completion timeframe), lack of reference to specific nutrient amounts (e.g., 1000mg calcium/day), not being right for their situation, and not including goals for specific conditions (e.g., diabetes). In addition, one user reported not looking at ready-made goals because there were too many choices available. Further, a dietitian mentioned some ready-made goals were possibly too difficult for some users. However, one user reported that the ready-made goals were not hard enough.

Although some users found the ability to write their own goals positive, they also reported difficulties in setting these goals (e.g., goals not registering in the feature). Ontario user #1 describes this difficulty below:

I found [*the write-your-own goal*] feature difficult to use and uh, and uh, um I didn't persist with it. It's probably easier than uh what I'm making it out but I uh I found it easier just to go to the ready-mades... [Ontario user #1, Male, 51-70y]

Dietitians reported that the goal “frequency” and “specific date end” may be confusing for users. Poor quality write your own goals (e.g., not healthy, such as aiming to lose 20lbs in one month; being too general; and not SMART), having too many goals, and having multiple goals in one statement were also concerns reported in dietitian interviews.

Ontario users had access to SMART goal instructions via a hoverbox, however, they did not report direct use of this information when writing their own goals. However, in general, users felt that having instructions (or hypothetical instructions in the case for Alberta users) was positive. Dietitians also felt positively about the content of these instructions. Although, most dietitians reported concerns about the visibility of instructions, one dietitian felt that hiding instructions this way decreased webpage clutter.

Users also reported some other concerns with goal setting using My Goals. One user in particular expected My Goals would be able to use already entered eaTracker® data (e.g., food, activity, body weight) to provide goal setting guidance. In addition, concerns such as the current feature not allowing users to establish a baseline value, or to set a series of smaller progressive goals to achieve a larger goal (e.g., weight loss) were also reported. Some of these concerns are outlined in the following user quotes:

Um, I thought maybe [*My Goals*] would tell me more of like uh where I, what weight I want to be at. How do I get there? Um, is that kind of realistic? [Alberta user #4, Female 31-50y]

... there's no feature on there to say, well here's how I'm going to do it or what I'm going to do to achieve that particular goal so. The steps aren't there. And and that's something I do when I'm setting a goal is. Here's my goal, here's how, what I'm going to going to do to achieve that particular goal and here's my little, deliverables, or milestones as I go along. [Alberta user #3, Female, 51-70y]

6.3.1.2.2 Goal progress tracking

Most users were not tracking their goals with the My Goals Tracker. A major reason for limited goal tracking was that users were unsure how to track goal progress and many had never previously seen the My Goals Tracker. One reason users did not see the My Goals Tracker was because a website introduction video (which can be removed by the user if desired) placed the tracker further down the Dashboard webpage. Users also reported difficulties in finding goal tracking instructions, being uncertain about how the tracker works, and technical glitches. However, some users reported viewing their goals in My Goals periodically (range: every log in to every few weeks) which worked as a reminder and provided opportunities for reflection, and/or accountability checking. User quotes describing their lack of familiarity with the My Goals Tracker are presented below:

So it's almost as though I can do something [*laughs*] to record something, but I'm not really sure what that is. [Ontario user #17, Female, 51-70y]

I had only really noticed [*My Goals Tracker*] when uh chatting with you today. [Ontario user #14, Female, 31-50y]

I've been looking at the My Goals and like reminding myself of my goals and stuff but I didn't even notice the [*My Goals Tracker*] before was there. [Ontario user #6, Female, 19-30y]

Users also expressed concerns about tracking categories, buttons, and function. They felt that the current My Goals Tracker categories (“Met My Goal,” “Still Trying”) had limited usefulness as the numerical degree of goal achievement was not captured. Another concern was that goal tracking timing was limiting and difficult to use (e.g., capturing information

infrequently, such as weekly; the tracker being available before the relevant time period was finished and the user not being ready to record). They also disliked that goals disappeared from the My Goals Tracker after tracking. Tracker location preferences were mixed; some users felt it was fine on the Dashboard, while others felt it should be on the My Goals webpage. Dietitians also reported concerns surrounding tracking options (e.g., no option to revise goals if inappropriate), tracker aesthetics (e.g., goal progress tracking buttons are currently larger than the goal text itself in the tracker), goals disappearing from the My Goals Tracker after logging tracking information, and a disconnect between the My Goals webpage (where users set goals and view history), and My Goals Tracker (which is located on the Dashboard webpage).

Lack of feedback or interactivity provided following My Goals Tracker use (e.g., no personalized feedback, no encouragement provided for tracking data) was also a mentioned concern by users. The following quote explains this finding:

Well, I don't know if I, personally, well I I do see the point of it, because if you met it, I'm hoping if I clicked on Met Goal that something's going to come up and say, "High five, [*first name of participant*]. uh Way to go! Look at that! You wanted to lose 40 pounds, you lost 40 pounds. [Ontario user #13, Female, 51-70y]

The topic of data entry and tracking was also mentioned by users and dietitians.

Although one dietitian and one user felt that goal tracking with the My Goals feature was easier than completing food records, challenges, such as having too many places to enter data in eaTracker®, and difficulty/forgetting to enter data in the My Goals feature itself were reported by users. Quotes for both of these perspectives are presented below:

Well, I, personally I find it a bit onerous to do tracking of food intake, but I think that the goals are important and it may not be as onerous; it might be choose a breakfast that has three food groups. Well, that's [*recording goals without having to complete a food record*] a lot easier than typing in everything that you had for breakfast. [Dietitian]

But I'm finding now it's getting to me a lot here. You've got to be careful. You know we like the easy quiz, let's go, bang, put your food in and count your calories so I'm a little concerned how, you know how many things I have to do here as far as entering data. [Ontario user #7, Female, 51-70y]

Users reported limited use and experience with the My Success and Manage My Goals sections of the feature (note: these sections are linked to the My Goals tracker and allows goal progress history to be viewed if tracked using the My Goals Tracker), although some reported liking the concept. Like the My Goals Tracker, many users had not noticed or explored this section of the website; Ontario user #4 describes this finding:

I guess I just noticed it when I was like when you pointed it out. I didn't even know there was like the history feature. [Ontario user #4, Female, 19-30y]

Users reported technical concerns and feeling confused about data presented in these sections. Some dietitians also mentioned that they thought it may be confusing for users to go to these sections to view goal progress information; however, they liked the concept. They also felt these sections could present historical data more clearly and effectively than it currently did.

6.3.2 Participant recommendations for future tools

Overall, both users and dietitians felt My Goals would be more helpful if it were revised and addressed the identified limitations. Findings from all three participant types were grouped together because they were similar. Participant recommendations for the My Goals feature and other future goal setting and tracking tools are summarized in **Table 6**.

Some users suggested having a more prominent presence of My Goals on the eaTracker® website. Pop-ups or prompts (e.g., upon website entry, following food and activity data entry), less segregation of My Goals from other eaTracker® components, and

enhancing visibility of My Goals within eaTracker® were suggested. The following quotes illustrate this finding:

Something that brings those goals to the forefront; you know remember, you know these are some of the things that you want to do, [*first name of participant*], you want achieve this. You know something connecting, pulling it out ah instead of keeping it in the background because you've got it all segregated in different categories and so on and just thinking about it that way. [Ontario user #7, Female 51-70y]

Um, use, use of prompts would be good. Yeah and that would be like my number one thing. Kinda have to force you with answers. So.... They can skip if they want to but like, you know how you kind of get that pop up or that thing saying. "Have you done this today?" That would be really useful for actually check listing stuff. Yeah. [Ontario user #4, Female, 19-30y]

Goal setting enhancements were also suggested by both users and dietitians. These enhancements were recommended at the time of first setting goals and later to help make goal adjustments. They suggested: a) providing automatic goal suggestions based on user entered data (e.g., food, physical activity, age, sex, weight, goals); b) providing more information on proper goal setting to help avoid common errors made by individuals new to this process, including emphasizing the selection of realistic goals, giving information about what constitutes a healthy beverage or meal, and presenting goal setting guidance for different circumstances (e.g., diabetes, heart healthy, individuals already eating healthy); c) offering more ready-made goals, including those for special circumstances and allowing the ability to edit ready-made goal quantities (e.g., the target serving number to make the goal easier or more difficult) and frequency (e.g., choose daily, weekly etc.); d) making available more assistance with setting SMART goals, e.g., incorporating SMART goal detectors, fillable forms to document each individual SMART component, and more visible presence of SMART goal instructions (e.g., pop-up boxes); e) linking proximal goals and distal goals (including more direct linkages with eaTracker® My Motivations); e) having options to revise or defer goals;

and f) clarifying the frequency aspect. Another suggestion was making the goal setting area more exciting and fun (e.g., adding pictures). The following quotes describe some of these goal setting enhancement suggestions:

...if it suggested another related goal, right, so um, I'm just thinking here, you know, I ate a dark green vegetable every day this week, right, so that was my thing, that was my goal. Um, you know, maybe my next goal would be [*pause*] uh just if there was a suggestion of another related goal, right? Because one of the things – and I think this is part of what would happen if I was working with a dietitian coach – is that um he or she would be able to help me decide what might be a next um appropriate goal, right. [Ontario user #17, Female, 51-70y]

Just thinking, I'm 55. Um, that maybe there would be some, um, benefit in having some of those goals age-targeted? Um, that, you know, as a woman in menopause, that you know maybe, there is a recommendation based on my age that certain other goals might come up. [Ontario user #18, Female, 51-70y]

But what really kind of cool would be able to do a, a quick, let's say, almost like an analyzer so that you can push a button, put the, hit this button and it says, your goal's too vague or you don't have this on there. Is this really measurable? Um, you know, how are you going to measure this and does that make sense like. [Alberta user #3, Female, 51-70y]

It would be nice if there was something built in you know like a message based on what kind of text that they put in or components of the text that was missing so they'd know before submitting it otherwise it defeats the purpose of trying to help people learn what a SMART goal is. [Dietitian]

Users and dietitians also suggested enhancements to goal progress tracking and reporting, such as a) documenting the degree of goal achievement, b) enabling view of goal progress (including long term) graphically, c) adding a comments log to explain goal progress, d) allowing export of goal progress data (e.g., to spreadsheet software, blogs), and e) permitting progress tracking via emailed ERO motivational messages. Users also expressed interest in using entered food and activity data to automatically track goal progress. Quotes describing suggestions for goal tracking are presented below:

Just maybe set it up so we can instead of just saying “in progress”, we can actually mark what our progress is. I think that would be really really motivational for me to see that vs. just kind of arbitrarily saying “I’m doing it”. [Ontario user #5, Female, 31-50y]

And, and and then comment section. Why did you not keep yourself to your goal or why did it, did it go well, but you can make your own little mem- memos. You know, it doesn’t have to be a long, it it can be, you know. Uh just, just a sentence long even, you know. To make a comment why, why things happened. [Ontario user #9, Female, 51-70y]

...if there was some way of generating a a yearly graph or something that mapped progress over a longer period of time that would be great. [Ontario user #1, Male, 51-70y]

In addition, goal achievement rewards were also suggested by users and a dietitian; for instance, virtual rewards (e.g., gold and silver stars, icons to celebrate success), and reward coupons (e.g., for sports activities). Ontario user #9 describes this suggestion:

I mean the games that people play on computers and how that works and why they get addicted to it is these little rewards. So if there are little rewards in there. Even with the stupid star system. I mean, it’s strange but it will do something to people, you know. [Ontario user #9, Female, 51-70y]

Automated personalized feedback based on entered progress data was another suggestion put forward by users. Some suggestions for this feedback included tips, ideas for what to do tomorrow, encouragement messages, prompts to call ERO for assistance or to re-evaluate goals when there was poor achievement, and reminders to set new goals when a current goal has been achieved. User quotes highlight this finding:

Yeah, I guess because of the business of my lifestyle, um, I don’t always have time to go and look at, ‘Okay, what have I been doing’, um, ‘Where are my errors here’ um, so to be able to have that [*pause*] spoon-fed to me would be lovely [*laughs*] [Ontario 18, Female, 51-70y]

Let’s say I put in five chocolate bars and so eaTracker is going to pop... but something was automatically like ‘Do you recognize what you’ve done here? Let’s really think about it for tomorrow because your goal is not conducive to this.’ But not a not a lecture; not a... it’s just factual point – remember your goal. Um, you know for tomorrow this is what we recommend. [Ontario user #7, Female, 51-70y]

Further users and dietitians suggested that having access to such tools via a mobile app would be something desired and important to consider in the future.

6.4 Discussion

This research was timely as goal setting is commonly recommended for helping individuals improve nutrition and activity behaviours (195-198); websites are commonly used to support behaviour change; and there is a current emphasis within public health to improve these behaviours to decrease chronic disease burden. Although users in this study reported some challenges with the studied feature, this work provided valuable insight into user needs and also suggestions for future directions that could be pursued to improve use of and adherence to website-based goal setting and tracking features. Eysenbach (56) suggested in his classic paper on the “Law of Attrition” that understanding reasons for attrition from ehealth tool use is important to help move this area forward. This study adds to the body of literature on this topic.

In general, interviewed users were enthusiastic about goal setting and felt this was an important technique to facilitate nutrition and physical activity behaviour change. Participants from this study also liked the flexibility to choose their own goals, a finding supported by the research of Fukuoka et al (53), in which some users did not like fixed system set goals. However, even these enthusiastic volunteers frequently reported difficulties sticking with their goals and challenges writing quality goals. User difficulty setting quality goals is consistent with previous research (42-44, 167). Users did however find the ready-made goals helpful which is promising as these goals are behaviour based, follow the SMART criteria and help encourage users to set quality goals. Continuing to use these types of goals in future online

goal setting tools would therefore be recommended, as well as offering safeguards and checkpoints (e.g., SMART goal detectors) to ensure that appropriate goals are chosen by individuals, including those who may prefer to write their own. In addition, as mentioned in the previous chapter, adding an online component that would allow users to work through facilitators and barriers to meeting their goals following goal setting would be a possible useful addition to these types of features.

Users in this study reported that the My Goals feature was used less often and less confidently than food and activity tracking. Limited and variable use of website features for nutrition and physical activity behaviour change in naturalistic settings has been reported elsewhere. For example, Binks et al (135) found that only small fractions of users had interacted with different SparkPeople® (a United States based healthy living website with several features including diet tracking and social support via the user community) website components and that this varied depending on the feature. Verheijden et al (141) found that only ~10% of users accessed their module based healthy-weight and lifestyle website intervention more than once. Kaipainen et al (139) also found that only 25% of users had used an online Mindless Eating Challenge beyond registration. Also, Neve et al (136), found that only 35% and 30% of users who signed up for 12 and 52 week subscriptions for a weight loss website, respectively, were active users at the end of their subscription time. User characteristics can statistically significantly predict website use as mentioned previously in this thesis, but results have varied; limited time available is another important barrier to use (25, 47, 157). Further, perceived attributes of innovations from the Diffusion of Innovations (68) framework are another factor can also explain user decisions to adopt an innovation and Eysenbach (56) has suggested that these attributes can also affect an individual's decision to

continue or discontinue use of ehealth innovations in the confirmation stage of the Innovation-Decision Process. Further each component of the website has different attributes which could also differentially affect adoption as well as continuance or discontinuance of use. Three attributes in particular, *relative advantage*, *compatibility* and *complexity* (all defined in Chapter 2), appeared to be factors affecting My Goals feature use. For *relative advantage*, although some participants did feel this tool provided an advantage as it helped them to set goals and was something they did not have before, the benefits from using this tool did not appear to be obvious for some and was a reason for limited use. For *compatibility*, although the My Goals feature was compatible with user beliefs that goals are important for nutrition and physical activity behaviour change, some users felt that the innovation did not provide them with adequate assistance with goals to meet their needs and therefore affected use. For *complexity*, goal tracking was something that was particularly complex for My Goals users and strongly affected use. In naturalistic settings without extensive in-person user training and support, *complexity* may be especially important as users may not have the motivation, patience, background, and support (or may give up more easily) to continue attempting to use an innovation perceived to be complex compared to use of the same innovation in a supportive research setting.

To enhance website-based goal setting and tracking features for use outside of a research trial setting, several suggestions were provided by participants to consider in the future. Of note, users frequently emphasized that these features should be more interactive by including aspects such as prompting users to set goals, providing goal choice guidance based on user information (e.g., food, exercise, goal, weight, demographics, activity, health condition), prompting goal tracking, and giving feedback based on goal progress. Automation

also seemed important. Including these types of features to help motivate and engage individuals and may be especially important in naturalistic settings. Similar results have also been found in other studies. For example, Fukuoka et al (53) found in users of a pedometer mobile phone-based intervention, that receiving instant feedback on step counts motivated them to keep using the program and change behaviour. Website-based features that have more prompting may encourage use of any different website features present such as the goal-related options with eaTracker®. Also, having prompts may be especially helpful in addressing challenges, like sticking to goals.

Participants from this and other studies have indicated a desire for data progress presentation in a visual graphical format (53, 166, 170, 174). As well, a few participants mentioned that rewards for goal achievement would be motivational, though in one study of mobile apps, virtual rewards (e.g., ribbons) were motivating for physical activity behaviour change in some users, but not others (168). One possible reason for the poor response was that users knew when they were getting a reward and were not surprised (168).

A strength of this research was that I was able to recruit a variety of participants from Ontario and Alberta. Another strength was recruiting users outside of a research trial setting, since user experiences, perspectives, and feedback in naturalistic settings may differ from research trial participants with substantial support and this is how ultimately such tools would be used. In addition, rigorous qualitative methodologies were used (e.g., sampling to data saturation, review of coding and results by a second researcher, interviewing different groups including users and dietitians). Lastly, this study extended research of user experiences with websites through the focus on in-depth understanding of the goal setting/tracking component.

Limitations include the use of volunteer participants who were perhaps more motivated about eaTracker® compared to other users. Indeed, eaTracker® users who had not used the My Goals feature were not interviewed, yet their input would help to understand reasons for not accessing this feature. In addition, participants were primarily female and all were less than 71 years of age; males and older adults may have different needs. This study also focused on a website version of the My Goals feature which was all that was available when the study occurred. However, recently, an eaTracker® mobile app for iOS™ and Android™ encompassing a mobile version of the My Goals feature was released. Interviewed participants had expressed a desire for an eaTracker® mobile app; evaluation should now extend to this mobile platform.

6.5 Conclusion

Website-based goal setting and tracking features represent important adjuncts to food and activity self-monitoring to help facilitate behaviour improvements. This unique research captured naturalistic user and dietitian experiences, perspectives and recommendations for goal setting and tracking features within website-based tools. These findings have implications for professionals looking to develop, and support individuals using these types of features. For future tools, it is essential that end-users, health professionals, and information technology professionals are involved throughout the development and evaluation process.

Table 5: eaTracker® My Goals feature user participant demographics and interview method

	Ontario (n=18)	Alberta (n=5)
Sex		
Female	16 (88.9%)	5 (100%)
Male	2 (11.1%)	0 (0%)
Age (years)		
19-30	3 (16.7%)	0 (0%)
31-50	5 (27.8%)	2 (40.0%)
51-70	10 (55.6%)	3 (60.0%)
Interview method		
In-person	8 (44.4%)	3 (60.0%)
Telephone	8 (44.4%)	1 (20.0%)
Online voice only (Skype®)	2 (11.1%)	0 (0%)
Online video (FaceTime®)	0 (0%)	1 (20.0%)

Table 6: Participant recommendations for the eaTracker® My Goals feature and future goal setting and tracking tools

<p>More prominent presence of My Goals on the eaTracker® website</p> <ul style="list-style-type: none"> • Pop-ups or prompts • Less segregation of My Goals from other eaTracker® components • Enhance visibility of My Goals within eaTracker®
<p>Goal setting enhancements</p> <ul style="list-style-type: none"> • Automatic goal suggestions based on user entered data (e.g., food, activity, demographics) • More information on proper goal setting (e.g., choosing realistic goals) • Goal setting guidance for different circumstances (e.g., diabetes, heart healthy, individuals already eating healthy) • More ready-made goals • Ability to edit ready-made goals (e.g., the target serving number to make the goal easier or more difficult, frequency (e.g., ability to choose daily, weekly etc.)) • More assistance with setting SMART goals (e.g., incorporating SMART goal detectors, fillable forms to document each individual SMART component, increase visibility of SMART goal instructions) • Link proximal and distal goals • Options to revise or defer goals • Clarify the frequency aspect • Fun and exciting goal setting area (e.g., adding pictures)
<p>Goal progress tracking enhancements</p> <ul style="list-style-type: none"> • Ability to document the degree of goal achievement • Allow users to view goal progress graphically • Allow users to add comments to document reasons for goal progress • Allow goal progress data to be exported (e.g., to spreadsheet software, blogs) • Ability to track goals via emailed ERO motivational messages • Use entered food and activity data to automatically track goal progress
<p>Rewards</p> <ul style="list-style-type: none"> • Virtual rewards (e.g., gold and silver stars, icons to celebrate success) • Reward coupons (e.g., for sports activities)
<p>Automated personalized feedback based on entered progress data</p> <ul style="list-style-type: none"> • Tips • Ideas for what to do tomorrow • Encouragement messages • Prompts to call ERO for assistance when progress is poor • Reminders to set new goals when current goal has been achieved
<p>Mobile app access</p>

CHAPTER 7: A QUALITATIVE EVALUATION OF MESSAGING AND CONTACT CENTRE DIETITIAN ACCESS AS ADJUNCT SUPPORTS FOR USERS OF THE WEBSITE-BASED ETRACKER® MY GOALS FEATURE

7.1 Introduction

Although website-based interventions have been shown to support positive change (20, 24, 72), poor adherence has been found to be common when these tools are used as part of research trials (34, 86, 87, 90) and when used outside of a research environment (135, 136, 139, 141). Adding adjunct supports to website-based interventions, specifically messaging (e.g., emails) (96-98, 229, 230) and professional assistance (59, 84, 100-102), to increase their effectiveness has generated interest.

Despite the simplicity of adding email messaging to website-based interventions, previous studies have seen disappointing outcomes including only modest increases in website visits/logins (96-98), and limited impact on behaviours (230). Message content, timing (97), and high email volumes (96, 98) have previously been noted as concerns and/or factors that may affect use; however, few data are available. Qualitative data from the user perspective has the potential to provide insight into reasons for limited response and effectiveness of these types of messages; however, to date, few data are available.

Previous studies of adding professional support, whether in-person, by telephone or electronically, have found this may increase intervention effectiveness (59, 100, 101) and website use (84), though problems have again been reported. Issues include non-participation (102), higher study withdrawal rates and no better weight loss outcomes (84). Previous qualitative work has examined user perspectives of nurse support calls alongside use of an online weight loss tool (231); however, use of professional support alongside website interventions used outside of research trial environments has not been studied in-depth using

qualitative methods.

eaTracker® is a popular freely available nutrition and physical activity behaviour self-monitoring website; in 2011, the “My Goals” feature was added (described in Chapter 5). With knowledge that setting and working towards goals can be tough (42-44), in late 2012, additional optional free adjunct supports were provided by ERO for Ontario, Canada residents for use alongside the My Goals feature. The two optional supports provided by ERO included: a) opportunity to interact with ERO contact centre dietitians via toll-free call/email to obtain goal-related assistance (either setting or working towards goals) and, b) brief (1-2 sentence) email and eaTracker® delivered motivational messages (~weekly) regarding goals subscribable via eaTracker® [Appendix 2]. Messages were usually goal specific (e.g., tips, recipes, website links) for ready-made goals and generic (e.g., reminders to login to eaTracker®, contact ERO) for write your own goals. These supports were advertised on the eaTracker® website for Ontario users as well as on the ERO website; users could sign up for messaging via the eaTracker® website.

Conducting qualitative interviews with users of the My Goals feature on such adjunct supports (i.e., ERO motivational messaging, ERO contact centre dietitian support) provided an ideal opportunity to understand user experiences and perceptions of such supports when used outside of a research trial environment. Qualitative research can provide information on what works, what does not work, explain reasons for use or non-use, and to provide suggestions to strengthen these types of supports in the future so that users can have more success with meeting their goals. This type of information cannot be obtained using other research methods. Using qualitative one-on-one semi-structured interviews with Ontario My Goals users who were signed up for ERO motivational messaging, My Goal users from Alberta without access

to ERO motivational messaging, and ERO dietitians, the objective of this research was to document experiences with and perceptions of the ERO motivational messaging and the opportunity to speak with an ERO dietitian, and working with clients who are using the My Goal feature (dietitians only) as well as to obtain suggestions for modifying these supports to better support goal achievement. Users from Alberta were also chosen to provide perspective on whether these types of supports would be helpful for them to better achieve their goals with the My Goals feature. They also acted as a non-intervention comparison group.

7.2 Methods

The methods for this study are the same as those presented in Chapter 6. Please refer to section 6.2 for the methods used for this study.

7.3 Results

Information about recruitment, participant demographics and characteristics, and interview length is presented in section 6.3. Since there were similar qualitative findings across the three participant types (Ontario users, Alberta users, and ERO dietitians) they were grouped together.

7.3.1 ERO messaging

7.3.1.1 Experiences and perceptions of ERO messaging

7.3.1.1.1 Current message content

In general, participants (both users and dietitians) felt the brief current message length was appropriate and one message/goal/week was found to be satisfactory. They were also

generally enthusiastic about goal-specific messaging (e.g., goal-specific tips); the following user describes this finding:

I think that um some of them are very um easily attainable um tips. Um. Like instead of doing 30 minutes at a time, do 10 minute walk intervals three times a day. I think that is that is really, really smart. Um. Great ways to make someone re-think about different ways to achieve their goals. [Ontario user #5, Female, 31-50y]

However, sometimes content was considered inappropriate (e.g., tip to eat a food they avoid) or felt to be boring if they already had healthy eating knowledge. For non-goal-specific messages, a few participants mentioned they were positive, provided reminders of goals, and pointed them where to obtain further assistance; however, generally participants felt these non-goal specific messages were too general, and unhelpful. The following user quote describes this finding:

Like I got some in, that was one of my first ones [*Call EatRight Ontario toll-free at...*] and some of them I just haven't opened all of them up because I thought oh, this isn't really useful. I didn't, guess I thought that it would be better as far as tips are concerned. [Ontario user #14, Female, 31-50y]

Also, users disliked repeatedly receiving messages with the similar content. Finally, in dietitian interviews only, a concern was raised about sending messages with positive content for poor quality write your own goals.

7.3.1.1.2 Current message delivery

Most interviewed Ontario users reported receiving emailed motivational messages. Several Ontario users found emailed messages to be good reminders (e.g., of goals, to log into eaTracker®) and allowed them to obtain content, if and when they did not log into eaTracker®. The following Ontario user was very happy about email motivational message delivery:

I mean, that is a valuable tool [*referring to email message*] to me. Being reminded, saying oh, yeah here's the eaTracker reminding me of a goal I set. Not setting, not setting goals for me. Not interfering in my existence but allow, just reminding me of something I said I'd do. [Ontario user #2, Male, 51-70y]

However, concerns were reported, including high email volumes in general, having to make a conscious effort to open messages, not having enough time to interact with messages, and messages being easy to delete without awareness of content. Of note, Ontario users sometimes reported not reading messages and not recalling email message content or design, no longer opening messages after finding them not useful (especially for generic messages), and message discontinuation due to high email volumes in general. Some of these thoughts are described in the following user quote:

I just get so many emails that, and I don't have time to read them all. Not just from from eaTracker, but from in general, I don't end up, half the time I end up deleting most of them. [Ontario user #16, Female, 31-50y]

Further, a dietitian mentioned messages could become lost via Gmail™ (Google Inc., Mountain View, California) inbox tabs.

Opinions on the email message layout itself varied. Some participants were satisfied with message design as is, the clear email message subject line (i.e., "EatRight Ontario and Your Goals - We are here to help!") and some reported liking "quick links" embedded in the email message (e.g., to access more information, log into eaTracker®). Concerns about format included small font size, repetition of the tip in other email sections, including excess white space, and messages not being mobile device friendly. Participants also had difficulties finding the goal and tip within the content of some messages. There were also mixed comments on a specific motivational image depicting a group cheering individuals embedded in all emailed motivational messages; although well-liked by some participants, others did not

understand/like the image and felt that the process of incorporating images in emails may not be appropriate for all users.

A few Ontario users reported message access via eaTracker® and some users preferred this access route over email. However, during the interview, some users had to be guided on how to access messages via eaTracker®. In addition, some users found eaTracker® message access cumbersome (e.g., hidden location, conscious effort needed to retrieve messages). Some users were also unclear regarding when the message service ends, message frequency and timing.

7.3.1.2 Suggestions for improvement

7.3.1.2.1 Message content

Some participants (especially write your own goal message users) suggested moving away from generic messages towards those that are varied and contain practical goal-specific content (e.g., recipes, new ideas to meet goals). Other suggestions were numerous, such as tips from real-life relatable people, content about psychological aspects of eating, general motivational tips (e.g., “every little bit counts”), inserting relevant pictures and videos (e.g., recipes), and changing messages periodically. The following user quote describes wanting messages from relatable people:

...I think if there was like a motivational person, so like someone like that's um, for example like who's, has a similar lifestyle and like how they're, like a person thing, like how they reach their goal kind of thing to motivate people. [Ontario user #12, Female, 19-30y]

Participants also suggested providing messages with tailored personalized feedback (including those based on entered eaTracker® data) (e.g., suggesting next goal, congratulatory messages for goal achievement, identifying how far they have made it towards their goal).

Some felt this information would be more useful than current targeted ready-made goal messages. The following user quote describes this suggestion:

So for example, if I put in a goal that um I want to lose ah ten pounds or five pounds or however many pounds for uh my niece's wedding on [*date of wedding*]; a very specific goal with you know a specific amount of weight, a specific timeframe um I I think I can put that in as a custom goal but it would be great if the messaging said you know, uh you've got two more weeks, you know, you can do it, keep going, you're halfway there; like that kind of very specific feedback I think would be helpful. [Ontario user #11, Female, 31-50y]

In addition, one user proposed putting the client's name in messages. Some participants also suggested having reminder messages, e.g., to complete different tasks (e.g., "Have you been tracking?," "Have you done your exercises?") or ask if they have met their goal. It was also suggested that write your own goal messages could provide personalized education surrounding goal setting (e.g., emphasizing choosing realistic goals if the goal was unrealistic, suggesting breaking a single goal statement with several goals into multiple single goals, emphasize using smaller goals to reach an end goal, such as a weight loss target). The following dietitian quote describes this suggestion:

...goals that aren't healthy... Like 'I want to lose 20 pounds this month' and we're sending them [*messages*] like [*pause*] you know, 'let us know how we can help you' and ... and it's [*pause*] like 'okay well maybe you shouldn't be... This is not a good goal to start with...' you know, there's some sort of way to give them that feedback and say like you might want to [*pause*] try a more realistic goal... [Dietitian]

7.3.1.2.2 Message delivery

Participants provided several suggestions to improve message delivery. Variable preferences surrounding ideal message frequency that ranged from one message total/week (to decrease email volume, less overwhelming) to one message/day, to letting the user to choose message frequency were reported. Participants also suggested more clarity surrounding

message delivery and frequency, random message delivery times, and options to easily stop email messages.

Enhancing eaTracker® message delivery was another suggestion. Such enhancements included more obvious message delivery at eaTracker® point of entry (i.e., Dashboard), such as having message corners, message bands, blinking messages, positioning messages at the top of the webpage. The following Ontario user describes this finding:

So it would be nice to have, if there is a message really there that would blink or so at you. Yeah, just. On the [*webpage the user first sees after logging into eaTracker*] so it blinks you have a message. Because, because the, now you have to go through to it and sort of it it depends on your choice to, to go there, right. So, so a little blink would be nice. [Ontario user #9, Female, 51-70y]

In addition, some participants desired having goal-related personalized feedback messaging immediately available following data entry.

Email message enhancements were also desired, including making the goal and the tip stand out more clearly in the email (e.g., bigger text size), putting the date the goal was set in the email, having links to relevant commodity groups (e.g., dairy producers), having the goal included in the email subject line, and providing options for goal tracking directly in the email. Mobile device messaging and friendly emails were also suggested; the following participant quote describes this suggestion:

Now, I don't have a Smartphone, so I think if I was using uh technology like that, a Smartphone, an iPad, whatever, having that come to me a few times of the day [*pause*] as a reminder of what I'm striving for, for example, you know, my goal may be uh, to lose 40 pounds and uh eaTracker has this little motivational message that comes across... But if I had something come in to me all the time, frequently throughout the day as a reminder, so if you had a Smartphone, popping up, I think that would be great. [Ontario user #13, Female, 51-70y]

In addition, several participants suggested including relevant images (e.g., recipes, foods related to the goal, logos) in emailed messages, while appreciating that not everyone may be able to access them.

7.3.2 ERO dietitian assistance

7.3.2.1 Experiences and perceptions of ERO dietitian assistance and suggestions for improvement

In spite of having access to ERO dietitian services by phone and email identified in both the motivational messaging and on the eaTracker® website, none of the interviewed participants from Ontario who had set goals using My Goals reported accessing this assistance. Further, dietitians reported few to no encounters with individuals seeking this assistance, but noted such data is not formally captured. Despite enthusiasm about goal setting, and frequent use of this technique with clients, even ERO dietitians reported infrequently recommending My Goals to clients, ranging from none, to a handful of callers over the past year, to one time/week. Explanations for this choice reported by some dietitian participants was that My Goals was out of their normal routine and not on top of mind.

Although some interviewed individuals from Ontario who had set goals using the My Goals feature were aware that ERO dietitians could provide goal assistance, they showed lack of knowledge, and/or confusion about this service. This encompassed uncertainty about how this service works, how often they can call, cost, whether referrals are required, whether ERO is open in the evening, who can access the service; there was also uncertainty about whether ERO dietitians could provide goal-related assistance or were available for assistance with nutrition questions only. The following user quotes illustrate this finding:

Yeah, I haven't used [*ERO dietitian service*] within the context of My Goals. But I like, I contacted a dietitian through Eat Right Ontario if that makes sense. Like, I didn't actually know that, that you could talk with them regarding your goals. [Ontario user #4, Female, 19-30y]

I think that it wasn't clear to me that I could use a dietitian service without a referral or without being charged for it. [Ontario user #11, Female, 31-50y]

Further, they also mentioned being unsure of how to ask dietitians for this assistance (as mentioned by the following Ontario user: "I like that I can ask questions, but then I don't know really what I would say." [Ontario user #12, Female, 19-30y]), what type of assistance dietitians can provide with goals, and whether dietitians can provide assistance with physical activity goals.

Dietitians were also asked for their thoughts on the apparent lack of use. Some of the reasons mentioned were users not knowing what to ask or the possible benefits. Further, user confusion between different DC channels to access dietitian support (e.g., "Find a Dietitian," eaTracker® "My Coach," ERO) was also evident. Both Ontario users and dietitians suggested there were limitations with eaTracker® website advertisement for this service (e.g., vague, type of support provided not mentioned, lack of explanation about linkage between dietitian support and the My Goals feature, notice of service not prominently displayed) and inadequate advertisement of this service in motivational messaging. The following user quote describes concerns about service advertising:

...when you go onto My Goal page, it doesn't really tell you that anywhere. It tells you on the left-hand side, get answers to your nutrition and healthy eating, call the people, blah, blah, blah, website, but nowhere is this website really telling you how you can tie everything in... [Ontario user #13, Female, 31-50y]

Participants recommended addressing these concerns and also provided specific suggestions such as displaying advertisements about the ERO dietitian service in prominent website areas. Other suggested venues to advertise eaTracker® and the range of service

options included social media, grocery stores, media campaigns, and health professional conferences. Of interest, many, but not all, Ontario users were enthusiastic about future use of this service once they understood it better and Alberta users were enthusiastic about accessing a similar service when told about it. The following user quotes illustrate these findings:

I like that because yet again, you're bringing a personal, a personal touch to to this program. I think it's really, really very important for um a live body to speak to another live body. Um. Things are far too automated nowadays and you lose that personal engagement. So to be able to have that personal engagement, I I I think would assist people, or does assist people, in moving moving forward. [Ontario user #13, Female, 31-50y]

I would love that. If just to answer questions about, you know, I read in a paper or I read in a magazine about bananas or something. You know, is this true? Anything like that or if they're able to look at your goals and kind of see what your goals are. If they have any tips on how best to meet them. And I'd be thrilled hear them. [Alberta user #2, Female, 31-50y]

Despite the overall enthusiasm, some users were uninterested in this assistance. Their reasons included not needing this type of help, preferring to find information for themselves, not being at a stage of readiness to seek this assistance, no knowing what questions to ask, being "just not that type of person," feeling shy, and having access to professional support through other channels. The following quotes from users describe this point:

I've got to do the work...I know what I have to do. I don't, the dietitian isn't going to be able to do it for me. Other than sort of pat me on the back and say, you know, you were a good kid. Keep going. [Ontario user #10, Female, 51-70y]

How do I not eat seconds and how do I not eat out of the container? That. I don't need a professional for that right. So so I it's not that I don't think that the service is good, it's that I don't think that there's a need whatsoever for this for me. It's a waste of resources. [Ontario user #3, Female 31-50y]

I think I just, because I I'm so used to, I just Google everything. It's faster. I don't know if I would. [Ontario user #16, Female, 31-50y]

Dietitians mentioned some concerns about promoting the My Goals feature to clients.

These concerns included sometimes encountering callers using other diet/activity tracking

software similar to eaTracker®, not having a way to follow-up with callers who received this assistance, and lack of sufficient promotion of the My Goals feature on relevant handouts distributed to clients. They mentioned that it may be useful to have a stronger link between their services and eaTracker® (e.g., distributing electronic handouts with direct links to eaTracker® which could enable them to track whether clients followed through with their advice about trying eaTracker®).

7.4 Discussion

Messaging and dietitian assistance have gained momentum as adjunct supports to help enhance the effectiveness of website-based tools for nutrition and physical activity behaviour change. This study provided valuable qualitative data on naturalistic use of these types of supports. Not only does it provide specific direction for enhancing the publicly available adjunct supports studied, but will be useful to those developing related supports and to professionals supporting individuals using such electronic tools in general.

Participants in this study were all users of an electronic diet and physical activity goal setting and tracking feature, yet they had differing thoughts on motivational messages. These thoughts ran the full range from being helpful supports to not being useful or desired. Similar to our study, Heesch et al (44) found that participants in a minimally invasive pedometer intervention generally considered email messages to be a good way to deliver reminders. However, some participants in this study also mentioned that some messages were not helpful because the information contained in them was already known. Additional qualitative studies also point to varied preferences for content and delivery of electronic messaging (53, 173). Personalization on multiple dimensions including both delivery and content should be

considered for future tools. For message content, preferences and suggestions included reminders, new ideas to help achieve goals, and personalized feedback. For message delivery, users had also varied preferences, such as through email, website, and mobile devices. Practitioners and researchers should know their audience to determine the types of support that would be most effective. However, in all cases, messaging needs to be clear, to the point, and obvious, such that users can easily identify salient content. Pilot testing and ongoing evaluation and updating are recommended.

Although there was substantial enthusiasm about the availability of contact centre dietitian support, the current study found little uptake of this service alongside the My Goals feature. This was unfortunate as contact centre dietitians could have worked collaboratively with users to help them choose appropriate SMART behaviour based goals for their situation, and could have also provided coaching on how to deal with barriers while trying to reach their goals. Other work described in-depth in Chapter 3 found that receiving professional support as part of online interventions can result in better outcomes (59, 100, 101). However, limited use of professional support alongside similar website-based interventions has been previously reported in research trials (84, 102) so this finding is not entirely surprising. Specifically for the research described in this chapter, lack of knowledge about this service generally, and specifically about how dietitians could help with goals was the major reason for not using the service. Interestingly, limited knowledge about dietitians and their services has also been previously reported (232). In the Diffusion of Innovations (68) framework, the Innovation-Decision Process encompasses five steps that outline the how an individual proceeds from finding out about an innovation, to deciding to use it, and to whether to continue use (described in Chapter 2). In the *knowledge* stage, three types of knowledge are identified: *awareness*

knowledge (knowledge that there is such an innovation), *how-to knowledge* (knowledge about how to appropriately use the innovation), and *principles knowledge* (knowledge about how the innovation functions which is sometimes not necessary for innovation adoption) (68). Users in this study had varied and frequently limited *awareness knowledge* (e.g., that they could speak to dietitians about their goals) and *how-to knowledge* (e.g., cost, hours of operation, whether a referral is needed) levels. These findings suggest that clear marketing of such services is essential and focusing on providing information so that individuals develop different types of knowledge (e.g., *awareness knowledge*, *how to knowledge*) about these types of services is important. This is especially crucial when members of the public access such sites and services independent of health care professional or research involvement.

Study strengths included recruiting different participant types (e.g., users, dietitians) with varied perspectives. In addition, obtaining information on experiences with these adjunct supports from individuals accessing them from outside of a research trial environment is a strength as this is how such publically-available supports are intended to be used and yet has not been well studied. A limitation of this study may be that the volunteer participants are especially motivated about eaTracker® and may have contributed different suggestions for improvements than individuals who did not participate; in addition, interviewed users were predominantly female, and none were over 70 years of age. A second limitation of this research was that the Ontario users interviewed only encompassed those who had subscribed to receive motivational messaging and therefore this study did not capture reasons why some Ontario users may not have subscribed to these messages. Third, since no interviewed Ontario My Goals users were in contact with ERO dietitians about their goals, user experiences on working with a contact centre dietitian about their goals could not be captured.

7.5 Conclusion

Websites have gained substantial momentum to help individuals improve nutrition and physical activity behaviours, although adherence has not been optimal. Emailed and website delivered messaging has the potential to assist individuals; however personal preferences for message content and delivery vary and they may not work for everyone. Further, many (but not all) users were interested in ERO contact centre dietitian support as an adjunct to My Goals feature use, however, poor knowledge and confusion about this service was common. To improve this situation, strong marketing and promotion to the public about such services is recommended.

CHAPTER 8: EXPERIENCES AND PERCEPTIONS OF ADULTS ACCESSING PUBLICLY AVAILABLE NUTRITION BEHAVIOUR CHANGE MOBILE APPS FOR WEIGHT MANAGEMENT

8.1 Introduction

Smartphones and other mobile technologies have become popular over the last several years, perhaps most notably since the release of the iPhone® in 2007, and have become an important part of the lives of many individuals. Of particular relevance to dietitians and other health professionals is the recent increase in public availability and popularity of apps to help individuals improve their nutrition behaviours in support of weight management. For example, as of March 2016, MyFitnessPal® and Lose It!® have reached >5 million installs each as reported by the Google Play Store™. It is not surprising that there is this interest in these tools as weight related concerns are common in the general population (5). Moreover, apps have many attractive features: they have become very familiar and comfortable to a growing body of mobile device users; are generally low/no cost; are easily accessible from commercial app stores; app-based supports are available to users anytime they have access to their device; and apps can provide different types of assistance (e.g., behaviour self-monitoring, nutrition information look-up, goal setting, and social support) (31).

However, despite these features, research is limited and available studies assessing weight loss outcomes and adherence to self-monitoring have found mixed results as described in Chapter 3. Qualitative research on the experiences of actual users of these tools has the potential to help explain some of these mixed findings; however, to date, existing qualitative research has been limited by methodological limitations (e.g., not sampling individuals until data saturation was reached), has sometimes focused on individuals, e.g., nutrition students, who may not represent the general population (175), has sometimes combined results for

different types of electronic approaches for behaviour change (174), and has sometimes had participants use the app for the purpose of a study which may not represent natural use (170, 175). A previous study examined user experiences with wearables for physical activity behaviour change outside of a research trial setting (165), however, to the authors knowledge, there has been no study on user experiences with nutrition apps outside of a research trial setting. Qualitative data from the perspective of users interacting with these tools outside of a research trial setting have the potential to provide practical information to guide professionals on how to better support users of these tools as well as future development of higher quality apps.

The purpose of this study was to use one-on-one semi-structured interviews to understand experiences and perceptions of adult volunteers who have used publicly available mobile apps to support nutrition behaviour change for weight management with various levels of success. The objectives of this research were to: identify processes and influences involved in the decision to access apps and select specific apps; describe how apps are used by individuals in their normal environment; describe factors associated with adherence and lack of adherence to use of different app features (e.g., behaviour self-monitoring, goal setting, social support); describe factors that influence satisfaction and dissatisfaction with app use; and characterize experiences and perceptions by sex to explore potential differences.

8.2 Methods

The University of Waterloo Office of Research Ethics provided approval [**Appendix 9**]. All participants provided written informed consent. The COREQ checklist (219) was used to guide study reporting.

Participants were eligible for the study if they: a) were ≥ 18 years of age, b) had used a publicly available nutrition mobile app downloaded from a commercial app store (e.g., Google Play Store™, Apple App Store®) for at least one week within the past three months for weight management, c) self-reported being free from diabetes, cardiovascular disease, renal disease or cancer, d) had not undergone bariatric surgery, and e) could speak, read, and write in English.

Community-based advertising was used to recruit participants in both southern Ontario (mainly Kitchener-Waterloo, Ontario), and the Edmonton, Alberta area; posters with information about the study and researcher contact information [**Appendix 10**] were placed in public locations (e.g., community college, libraries, recreation centres), and advertisements about the study were made in Facebook® groups, and in online classified websites (e.g., Kijiji® (eBay International AG, San Jose, California), craigslist® (Craigslist Inc., San Francisco, California)). Information about the study was also spread via a listserv for Waterloo Region dietitians and through different channels at the University of Waterloo (e.g., posters in public locations, Facebook® group posts, Weight Watchers® group, graduate student e-newsletter). Word of mouth advertising was also used.

Recruitment and interviews took place from February 2015-November 2015. The sampling strategy for this study was convenience sample that was both purposeful and had elements of maximal variation sampling (220). For the purposes of this thesis, purposeful sampling and maximal variation sampling meant choosing participants who both met the inclusion criteria and who had diverse experiences with these tools. Interviews took place until data saturation was attained; saturation was considered to have occurred when the same stories were heard over and over again and no new information was obtained from interviewing additional participants (224) that would change categories or subcategories.

The author of this thesis e-mailed interested individuals the study information letter [Appendix 11] and a list of screening questions [Appendix 12]. If an eligible individual was still interested in the study following reading the information letter and completing the screening questions, a one-on-one in-person semi-structured interview was scheduled. Participants were asked to bring their mobile device with the nutrition apps that they used to the interview to permit examination and to help facilitate discussion. Prior to the interviews, the author of the thesis also familiarized herself with the apps used by participants.

All participants were interviewed one-on-one and face-to-face using semi-structured interviews by the author of this thesis, a female dietitian PhD student trained in qualitative methods, who had not previously personally used any nutrition or physical activity mobile apps for weight management to ensure that not personal biases were included but had research interests in these tools. She also used mobile devices and apps on a daily basis herself. Interviews were conducted at a place and time that was appropriate, comfortable, and without disturbance; most interviews took place in busy public locations (e.g., coffee shops, public locations on the University of Waterloo campus), however, a few interviews were conducted in quiet rooms (e.g., meeting rooms) with just the interviewer and participant. The semi-structured interviews were guided by an interview protocol (220, 221) with open-ended questions designed to address the research objectives [Appendix 13]. Additional data were collected using clarifying and elaborating probes (220). The Diffusion of Innovations (68) framework, and in particular the Innovation-Decision process, was also used to inform the interview protocol. A checklist that was used to prompt the researcher at the end of the interview to ask about any additional key factors about user experiences and perceptions with these tools was informed by the Diffusion of Innovations (68) framework (especially the

attributes of innovations) as well as a review article by Holden and Karsh on the Technology Acceptance Model (233) [Appendix 13]. The project advisory team (author's PhD thesis supervisor, a professor with expertise in mobile health technologies, and a representative from DC) reviewed the interview protocol in January-February 2015 prior to the first interview and provided suggestions to improve the document. Following this review, the protocol was pilot tested (221) with two volunteers; these participants were included in the analysis since no changes to the protocol were made at this stage.

All interviews were audio recorded using two digital voice recorders and notes were taken during the interview on the interview protocol form (220); no repeat interviews were conducted. Descriptive and reflective field notes were taken immediately following interviews (220, 225). All interviews were transcribed verbatim, and transcripts were verified against recordings. Any names or identifying locations mentioned in the interview were made anonymous in the transcripts. Transcripts were not returned to participants and they were not offered the opportunity to provide feedback, but they were advised to contact researchers if they were interested in obtaining study results. Participants received a DC cookbook as a thank you gift for participating in the study. They were also provided with a study feedback letter following interview completion [**Appendix 14**].

Data were analyzed using content analysis in the same way as described in Chapter 6. Also as described in Chapter 6, codes from ~10% of transcripts, and categories were reviewed by a second researcher (dietitian with graduate research experience in qualitative methods) to discuss any variations and come to consensus (221).

8.3 Results

At the end of November 2015, n=24 participants had been successfully recruited to the study; interviews were on average 58 minutes and 28 seconds (range: 34 minutes and 51 seconds to 102 minutes and 2 seconds). The author of this thesis was in touch with an additional n=18 individuals during the recruitment process; n=10 were provided information about the study and did not complete the screening questions for unspecified reasons. Of an additional n=8 participants who completed the screening questions, n=4 were ineligible (n=1 had diabetes, n=3 did not use nutrition apps), n=3 did not respond to subsequent email messages and it was assumed that they were uninterested, and n=1 cancelled their interview due to illness.

Demographics of recruited participants are shown in **Table 7**. Participants were primarily female (79.2%), and 18-30 years of age (62.5%); several mentioned they were university students. At the time of the interview, n=14 and n=9 participants reported currently using Android™ (i.e., Samsung Galaxy™ S3/S4/S5 (Samsung Group, Seoul, South Korea), Motorola Moto E (Motorola Mobility LLC, Chicago Illinois), Google Nexus™ 4/5 (Google Inc., Mountain View, California)) and iOS™ (i.e., iPhone® 4/4S/5/5S/6) smartphones, respectively. One additional participant reported use of an iPad® tablet. Most participants reported use of a smartphone for one year or more and had been using some type of mobile device (e.g., other cell phone type/iPod® (Apple Inc., Cupertino, California)) for many years prior. General mobile app use reported by participants varied; many but not all participants reported using mobile apps numerous times a day (i.e., >10 times) and a couple mentioned that they were very attached their device. Social media (e.g., Facebook®, Twitter® (Twitter Inc., San Francisco, California), reddit® (reddit Inc., San Francisco, California), Pinterest®

(Pinterest, San Francisco, California)) apps were used very frequently by most participants, however, many other types of apps were also used (e.g., Google apps, weather, banking, music, games, baby monitoring).

Most participants were interested in weight loss, both in general and for different types of reasons (e.g., triathlon/half-IRONMAN, Freshmen 15, disease prevention, following pregnancy); however, there were a couple who were interested in weight gain/building muscle and weight maintenance/following a healthy diet in general. Most participants were not using these tools in conjunction with health professional assistance; however, exceptions included one participant who used the Weight Watchers® (Weight Watchers International Inc., New York, New York) app at meetings with her leader, another who shared MyFitnessPal® food records with dietitians at a diabetes prevention clinic, and another who mentioned that she was able to better recall her foods eaten when going to see a dietitian, although the app was not used at these appointments. Of note, there were a couple of participants who reported nutrition app use to undo harm as a result of other weight management methods including excessive exercise as a result of using a separate exercise mobile app, and severe calorie restriction to lose weight.

Participants reported following many different types of eating patterns while using these apps. Several participants mentioned using the app to increase awareness of what they were eating, towards a more balanced/healthier diet in general (e.g., more fruits and vegetables, whole grains, less sugar, sensible portion sizes). However, there were others who were following more structured plans ranging from following calorie goals without consideration of other nutrients, to the Paleo diet, to trying to adhere to certain macronutrient distributions (note: a couple of participants followed a higher protein and lower carbohydrate diet and one

participant reported following a ketogenic diet), to the Weight Watchers® PointsPlus™ program. Of interest, participants reported varied levels of nutrition knowledge (sometimes mentioning their knowledge was poor) and many reported trying to learn more about nutrition and weight management through the Internet and social media websites (e.g., reddit®). There were also a few participants who reported using social media alongside apps (e.g., Facebook® support group, reddit®) to promote behaviour change.

Many participants also reported that using the mobile app was their first experience with any formal weight management method and their first time with diet tracking; however, some reported using other weight management methods in the past including diet self-monitoring using other methods (e.g., paper records, websites, computer spreadsheets), following other diet programs (e.g., Weight Watchers®), and cutting food intake drastically without any professional assistance.

At the time of the interview, n=18 participants were still actively using apps to monitor their diet behaviours; however, n=2 of these individuals indicated that they were going to stop very soon/had just stopped within the past few days of the interview as they felt they no longer needed to monitor. These participants were actively using the following apps at the time of the interview: MyFitnessPal® (n=11), Map My Ride® (MapMyFitness Inc., Austin, Texas) (n=3), Fitbit® (n=2), Weight Watchers® (n=1), and Calorie Counter Pro by MyNetDiary® (MyNetDiary Inc., Cherry Hill, New Jersey) (n=1); these apps had been used for various amounts of time ranging from one week to four years both consistently and on and off. In addition, some of these participants (n=9) had reported using/exploring other nutrition apps in the past for various amounts of time but were no longer using them including: MyFitnessPal® (n=3), Map My Fitness® (MapMyFitness Inc., Austin, Texas) (n=1), Lose It!® (n=1), Fitbit®

(n=1), Calorie Counter by FatSecret® (Fatsecret, Melbourne, Australia) (n=1), Up® (Jawbone, San Francisco, California) (n=1), Get Enough Helper App® (n=1), restaurant apps (e.g., Tim Hortons) (n=1) and Cookspiration® (n=1). The remaining n=6 participants were no longer using apps at the time of the interview but reported last use within the past 3-4 months; the most recent dietary recording apps these participants reported using were: MyFitnessPal® (n=3), Fitocracy Macros® (Fitocracy Inc., New York, New York) (n=1) and S Health® (Samsung Group, Seoul, South Korea) (n=2). Again these participants reported using these apps for various amounts of time ranging from ~one to five months. In addition, some of these participants (n=4) had reported using/exploring other nutrition apps including: MyFitnessPal® (n=2), Lose It! ® (n=2), Fitbit® (n=1) a food photography app (name unknown) (n=1), Calorie Count® (About Inc., New York, New York) (n=1), and recipe apps (n=2) for various amounts of time (range: one week to a few months). Many participants including both those still using and those who had stopped use of nutrition apps also reported using separate physical activity tracking apps alongside these apps including Fitbit®, Bilogates® (Veam Inc.), Fitocracy® (Fitocracy Inc., New York, New York), Fitnotes® (James Gay), Strava® (Strava Inc., San Francisco, California), Nike Running® (Nike Inc., Beaverton, Oregon), Map My Ride®, and StrongLifts® (StrongLifts Limited).

Various outcomes were reported from using these apps (e.g., make better and more consistent dietary choices, higher awareness of their food, loss and maintenance of body weight, changes in body composition). Of note, only a couple of participants reported losing substantial amounts of weight while using these apps (e.g., >10 pounds). In general, participants felt their progress would be worse if they did not have the app. A couple of participants mentioned having better results with exercise behaviour change with automatic

exercise tracking apps vs. dietary behavior change with diet tracking apps. Most participants were interested in continuing or re-initiating dietary tracking with apps if the situation was right. There were, however, a couple who were less interested – mostly because it was too difficult.

8.3.1 Experiences and perceptions with nutrition mobile apps

8.3.1.1 Finding out about and choosing apps

Participants reported finding out about nutrition apps (both in general and specific ones) in various ways; recommendations from friends/family, app stores, and Internet/media (e.g., searches, advertisements, social media) were the most common way participants reported learning about these types of apps and/or which ones to choose. Less common ways were school courses (e.g., high school personal fitness, university courses), work, personal trainer, Weight Watchers® program, app already installed on phone, diet tracking part of an exercise app already in use, and receiving a fitness/diet tracker as a gift. Many participants reported knowing about these tools for a few years prior to the interview; however, some were newer to this concept (e.g., within the past few weeks to months).

In terms of nutrition apps, participants did not report trying many different ones. In total, n=11 participants had not really tried any other nutrition apps except the ones that they used (n=7 used MyFitnessPal®, n=3 used Map My Ride®, and n=1 used Fitocracy Macros®). There were also n=3 participants who used ≥ 2 apps for ≥ 2 months each and did not reported trying any other nutrition apps out. However, there were some participants (n=10) who reported trying at least 2 apps (range: 2-4) (one used for longer period of time (i.e., >2 months), and the others used for <1 month (sometimes just trying)).

Participants mentioned several factors that they considered when deciding which app to use. These factors included recommendations from others (e.g., friends, family, trainer), ease of use (note: participants appeared to especially like apps containing a food database with a large number of foods that was accurate), nutrition variables that are able to be tracked (e.g., calories, Weight Watchers® points, other nutrients), cost, online reviews, feature availability (e.g., automatic exercise tracking), name of the app, and compatibility with their device.

8.3.1.2 Using apps

Participant experiences with and perspectives of using nutrition mobile apps aligned with the categories below. These categories are summarized in **Table 8**.

8.3.1.2.1 Data entry

8.3.1.2.1.1 Food data entry

Several participants spoke about mobile device food data entry being convenient because their device is always with them, and this was less work and time consuming vs. other methods (e.g., paper records, computer). Entering data after each eating occasion also meant they did not forget what they ate and could receive feedback allowing them the opportunity to make adjustments to the rest of their day. The following quotes describe the convenience of these tools:

Like I've seen people use journals and write down and write by hand all the calories and all the foods they eat, and I thought that looked really tedious. Like I couldn't carry it around with me all day and just whip it out and start using it. So the app was really convenient because it's always with me and, you know, if I want to use it.
[Participant #1, Female, 18-30y]

The reason why I want to use apps, since I always have my phone with me, it is something that I can always easily check. If I have a quick bite to eat and then I go out,

I can update it whenever I'm free, just 'cause I always have my phone with me. It makes it a lot more convenient than using something like just paper and trying to track it that way. [Participant #2, Male, 18-30y]

...apps are...something that you carry with you all the time. So, like, over other weight loss methods like going to a meeting or logging on to only a desktop, these programs, for me, like, the app based is much more convenient and accessible. [Participant #15, Female, 18-30y]

Before, I bought a calorie counter book. I used to carry that around with me like a bible all the time and I would sit there and go through everything and I'd religiously write everything down on paper and stuff like that where...where now, it's just push/click and it's...it's...it's kind of mindless. It's...it's just hunt and peck. [Participant #16, Male, 31-50y]

I mean, I have tracked before and I've been successful with Weight Watchers before without an app but now that I have the app, it's...imagining life without it is very difficult. [Participant #8, Female, 31-50y]

So I was like one of those people who, when I consume something, I put it in and I didn't wait to the end of the day. So it was something that was quick, but my phone is always on me and so I could just pull it out, submit what I wanted to add to diary and then move on with life and then I didn't have to think about it anymore. And then I also knew how many calories I had left for the rest of my day. [Participant #4, Female, 31-50y)]

Like whenever I stopped having meal, if it would be like at a restaurant or something, I could just quickly add into my phone, rather than having to remember it, get home, go to my computer. So it's definitely handy having an easy access to something that's tracking how much you eat or what you're eating. [Participant #6, Male, 18-30y]

Moreover, a couple of participants reported trying to enter their dietary intake data into the app prior to their eating occasion and using the mobile app to help pre-plan their intake. The following quote from Participant #1 describes this process:

So I kind of prepare all my food for the day ahead of time and then just throughout the day I'll like, oh, you know, check, like 'okay, I ate that' or 'I forgot this', or 'maybe I don't want that anymore' so like I'll make changes throughout the day if I want to or if I don't feel like eating something. [Participant #1, Female, 18-30y]

Despite the portability and 'anytime availability' of these tools, there were multiple participants who reported entering diet data at the end of the day (e.g., after work or school)

usually at home. The following quote from Participant #3 describes data entry at the end of the day:

So I usually like... I don't usually start inputting my food from the day until probably after work, just 'cause, you know, breakfast and lunch – like I usually eat very similar things. It's not hard to remember and I just don't feel like doing it. [Participant #3, Female, 18-30y]

Participants reported making efforts to enter in data everyday or on weekdays only. They mentioned it usually took a few weeks for it to become habit/part of their normal routine. Data entry was sometimes harder at the beginning when it was not yet part of a routine; however, being more excited and more motivated about data entry and logging it more frequently at the beginning of app use was also reported.

Participants reported entering data in numerous different locations including home (e.g., before going to bed, on the couch, while cooking), work (e.g., desk, cafeteria), on campus, at the gym, and while on the go (e.g., in line-ups, on the bus, car). Participants also sometimes talked about data entry during their “down time” or whenever they had a spare moment. Participants #17 and #18 describe some instances where they log their data:

So I would usually do it during my down down time if I'm bussing or if I'm doing something else. Have some time I'll just log in and just input the stuff. So that's why I think apps are really helpful in that way. [Participant #17, Female, 18-30y]

I usually do it actually like if I'm making if I'm making pasta or something like that as like you're still cooking it, cause you know you're making stuff there's still down time while you're like frying chicken or something like that, you can still enter it while it's still cooking. So it doesn't delay you from sitting down and eating and it doesn't delay you like after you're done because you've already done it beforehand, it's part of like kitchen prep I think so. [Participant #18, Male, 18-30y]

Despite many participants feeling that these apps were convenient, some felt that they were time consuming and difficult to use and that this was a reason to stop their use. Eating

less so that information did not have to be recorded was also mentioned. More elaboration on aspects of the data entry process appears in the following sub-categories.

8.3.1.2.1.1.1 Food database

The food database accessible via the mobile app was one of the most discussed topics in the interviews. Participants described two different topics surrounding the food database: size and accuracy.

For database size, in general, participants referred to the number of foods; however, the number of nutrients that could be monitored with the app was also mentioned. Participants desired access to databases with large numbers of foods and strongly preferred apps with larger food databases over those that were smaller and/or focused on processed/fast foods. Several participants spoke positively about MyFitnessPal®'s large food database and reported choosing this app or switching from another app to this app (e.g., Lose It!® to MyFitnessPal®, Map My Fitness® to MyFitnessPal®) for this reason. Another participant mentioned that when she used Up!® for food entry, she had to add a lot of foods in herself which was annoying and was not the case once she switched to Calorie Counter Pro by MyNetDiary®. In addition, another participant chose MyFitnessPal® for both the large nutrient database and food database. In general, they felt large food databases were convenient, easier to use, saved them time from having to enter in things manually or finding substitutions if their food was not available, and there was no longer a need to use individual restaurant apps to look up foods if they wanted to learn about nutrition information. Although participants had the option to enter in foods into the database from food labels, this was rarely done (sometimes reported to be

time consuming); however, having this option was well liked by some participants.

Participants #13, #16 and #2 describe liking the large food database in MyFitnessPal® as:

I found that, in the beginning, I downloaded all the restaurant apps and I stopped using them because I...they keep...this, like, one...if one [*i.e.*, *MyFitnessPal*] caters to what I need and then I have no reason to go and continue to use Tim Horton's or Starbucks apps. [Participant #13, Female, 18-30y]

...like, I mean, it has virtually everything on it and so you can find what you want and you're not guessing whereas I found, sometimes, in the [*calorie counting*] book I would be looking for something comparable; I wouldn't find 'it'. [Participant #16, Male, 31-50y]

...the fact that they have a lot of the big name food stuff, just in the search makes it really easy to find exactly what I'm eating. And there's almost never been a time where I'm like I don't know exactly what to add. [Participant #2, Male, 18-30y]

Despite the large food database being well liked by many participants, limitations with these large food databases and food databases in general were reported. For example, some reported missing foods (e.g., those from restaurants, especially smaller restaurants, new products), and felt it was sometimes time consuming, confusing, and a lot of work to identify the correct item from lists of possible choices after searching for a specific food. This is described in the following quotes:

I'm trying to put what I eat and I put, for example, like, bread and it turn out like, a huge list of bread and I...it took me a long time to figure out which one I...I eat so I find it's not very convenient... [Participant #14, Female, 31-50y]

...if you have a cup of coffee with cream it will give you 4 or 5 choices and it's all different values for calories it's like okay, it's too many options without saying... So you sort of have to know your calories already to make the right choice. [Participant #11, Female, 51-70y]

Other limitations with these large databases also included: duplicates, difficulties identifying American vs. Canadian oriented data and limited Canadian or ethnic foods. Participant #19 mentioned one possible reason why she may have had difficulties finding Asian foods in mobile app food databases:

Like I eat a lot of like a lot of Chinese, Japanese, and Korean food right. And none of, like the native scripts of these languages is in like characters so you have to pick a way to like write those characters in English and it's not always consistent. Yeah. And like a lot of times there's, just like the way you spell something is, has like an impact on what you get so that's really like for Japanese the problem is really not that bad. For like Korean and Chinese it can be worse especially like Chi- China used to have a completely different romanization system before the People's Republic of China. So a lot of the stuff like Kung Pow Chicken or I don't know General Tso or whatever, like these classic dishes will be romanized typically like in the old way. And it's like, but sometimes like a more obscure stuff I'm like how would I romanize it. I don't know. [Participant #19, Female, 18-30y]

The following quote from Participant #17 describes encountering several duplicates in the MyFitnessPal® database:

And I think the [*MyFitnessPal*] database is getting bigger and bigger but people are logging the same thing, sometimes I would see duplicates of ok let's say Tim Hortons Coffee two milk one sugar whatever and there would be several of those same calories. [Participant #17, Female, 18-30y]

Participants reported mixed feelings on database accuracy. Many participants felt the food database was accurate, trusted it, and did not have any major concerns. Some apps have the ability to mark foods as verified to contain correct information and a couple of participants mentioned this feature was helpful. The following quote from Participant #1 discusses positive feelings about database accuracy:

I think it's really accurate, yeah. Sometimes, like just to be sure, I'll Google first what the calorie values for something is and then I search it up on the database for the app, and it's usually really similar. [Participant #1, Female, 18-30y]

However, others expressed concerns surrounding database accuracy, currency of information, and missing information (e.g., only has information on calories), and some reported encountering issues. One participant also mentioned that it took her some time to learn how to distinguish a good and poor food entry. Some were also unsure about accuracy. The following quotes describe these findings surrounding accuracy:

...because sometimes you have one food, and they have that certain amount of calories, and the same type of food is just really really different and you wonder what's how how can it be. [Participant #17, Female, 18-30y]

I mean, like there's some really funny entries on [*MyFitnessPal*]. Just like, "oh, 300 grams of meat is only 50 calories." Of course not, right? You know, so like you have to go in with like already a sense of what you're eating. And there's a lot of false information in the database. [Participant #5, Female, 18-30y]

...sometimes I wonder if like they're actually accurate, like sometimes people wouldn't, like they enter in a nutrition label but they failed to notice nutrition labels for like I dunno like 1/3 of the package or something like that. [Participant #19, Female, 18-30y]

Sometimes I don't know if they're up to date. Like sometimes restaurants like they change the formulations of things. And I just don't know... [Participant #19, Female, 18-30y]

Well that's where I guess cause I don't know a lot about nutrition so I'm I'm just guessing that it's [*Fitbit food database*] correct. Yeah, I don't know if it's 100 percent or not. [Participant #23, Female, 31-50y]

Although most participants were interested in calories and sometimes macronutrients, some were also very interested in obtaining information for other nutrients. A few also mentioned experiences encountering poor quality micronutrient data (e.g., poor accuracy, missing information), especially in crowdsourced food databases (e.g., MyFitnessPal®). The following quotes from Participants #15 and #5 describe these concerns with MyFitnessPal®:

The only problem with sodium is, because [*MyFitnessPal is*] a crowd-sourced app, often the sodium is incorrect. And so it looks like, you've eaten like, 7,000 milligrams of sodium in a day and I just simply know that that's not true. [Participant #15, Female, 18-30y]

...a lot of the foods really don't have calcium content. Like, they'll put "not applicable" or something when I know there's calcium in there. [Participant #5, Female, 18-30y]

8.3.1.2.1.1.2 Food data entry methods

Participants mentioned several ways of locating foods to enter into their mobile apps.

Searching for foods was a common way to locate foods, and some mentioned locating inputted

foods via the recipe feature (which will be described in more detail below). However, one method of locating foods that was very common and well liked was short-cut pathways (e.g., favourites, frequents, recents, multi-add). This method was convenient and saved time as they often ate the same foods, and this type of feature made the app easier to use over time. Of interest, many participants spoke about this route of data entry for breakfast. The following quotes describe these findings:

multi-add is super useful, or else it would be really annoying [Participant #3, Female 18-30y]

...it probably gets easier over time because like for a period of time, you're probably eating similar things, right? So it's just like, "oh, it's right there, I don't have to search it up again, I don't have to do anything, just go 'Multi-Add', bam, bam, bam, there's what I'm eating." So it's actually like - it makes it easier to use... [Participant #5, Female, 18-30y]

But I do eat kind of like a lot of similar things for breakfast like for example for the past couple of days I've kinda been cheating myself, and going to Williams and getting a breakfast wrap and a coffee so uh those, those you know the recents are pretty nice for that. Uhm so you just kind of tap it and the the commonly paired foods come up as well so you know like coffee and a like a breakfast wrap are always like right next to each other, it's easy to put in. Not that big a deal. [Participant #18, Male, 18-30y]

Like, once you sort of have searched for something, it's easy to search for again because it remembers what you input before. [Participant #15, Female, 18-30y]

I like it because then I don't have to type it in every time, I can just go cause like for myself I do have a salad every day and typically it's the same salad, right it has the same ingredients in it cause that's what I've bought for the week for groceries. I only like one salad dressing so I don't have to go searching for it every time, I can just say yup had it, had it, had it done. Right like I can almost input my whole lunch for the week in one day. [Participant #20, Female, 31-50y]

And the cool thing...this is what I like about this app is that it'll, like, pull up the things that you eat the most. [Participant #9, Female, 18-30y]

The barcode scanner was also commonly used and very well-liked by most as it helped to increase the efficiency of data entry for packaged foods and allowed the correct food to be

easily pinpointed (i.e., avoids a search, makes difficult foods to search for easier to find).

Participants #14 and #2 spoke highly about the barcode scanner:

Yeah, this is very convenient to pick up the food information and it can tell like, protein, sugar, salt, all the nutrition factors that...that is included in the food so, yeah. I find [*barcode scanner*] very helpful. [Participant #14, Female, 31-50y]

So if I have some almonds or if I have a pop sometime throughout the day or a juice, I always make sure to put that in almost immediately after since it has a barcode. So just before I throw it out, it's just easy for me to go in and do that. [Participant #2, Male, 18-30y]

Despite most participants feeling positively about the barcode scanner, issues with use were identified including only being useful for packaged foods, certain types of packaged foods not being available (e.g., in-store baked goods) and sometimes incorrect information was provided after scanning the barcode (e.g., wrong food or serving size, out of date information). Foods that were less popular were also sometimes missing from the barcode scanner database.

Concerns about this feature are presented in the following quotes:

...whenever I get anything from the Italian store or any product that is not, I would say, very popular, sometimes you enter and it's like, that's not what I entered... [Participant #13, Female, 18-30y]

The bar code scanner is pretty helpful. But there's a lot of times I found it's not accurate, it'll be close or it'll get something that someone else has put in that maybe you know the product has changed a little bit since then. [Participant #18, Male, 18-30y]

Like I was at the grocery store on Sunday night, and I wanted to buy – they didn't have any of the bread that I like to buy, because of the low calorie count on the bread – they didn't have any of it, and so I was trying to find something else, and there were lots of things that they had just baked. And I was thinking those are probably better than some of the processed stuff I was looking at, which were huge on calories, not something I was willing to do. And so I took out my phone and opened it up to the 'scan the barcode' app to see if I could find something that I would be okay with using. And I couldn't find anything or the one wasn't scanning, so I was like forget it, I'm not taking that, so. [Participant #4, Female, 31-50y]

Of note, there were also a few participants who reported not finding the barcode scanner compatible with their device (e.g., tablet, smartphone with a poor quality camera) and some did not use it often for different reasons (e.g., eating residence cafeteria foods). Participants also mentioned that the barcode scanner was not used often or every time because the search function was able to easily access the food of interest, and foods already scanned would remain in favourites. The quick calorie addition (only adding calories, not food) was very rarely used.

8.3.1.2.1.1.3 Portion size

Portion size was another common topic mentioned by interviewed participants which can be divided into two subtopics: limited units available in the food database to quantify portion size, and difficulties estimating portion sizes. First, expressed were challenges about the limited number of units available to choose when entering foods into their app such that units that individuals use on a frequent basis were sometimes unavailable. These participants appeared to be especially frustrated when only weight based units were available for entering their data. In addition, one participant was frustrated when he encountered ‘count’ units that had no measurable weight or volume. The following quotes illustrate some of the challenges encountered with portion size unit availability in these apps:

And sometimes it’s only limited to explicitly just like one kinda serving size which is a little annoying. [Participant #18, Male, 18-30y]

...sometimes it’s in milliliters and like, I think more in cups. Or like, and then I’ll be like look up the thing and it’s like all things are in milliliters and like I don’t know how much that many milliliters is and so like that is difficult sometimes. [Participant #3, 18-30y]

...like it will often say 3 ounces, and like I have no idea of what 3 ounces of chicken looks like, it should there should be other units like a half a chicken breast or something like that, or at least give tips, like I ended up buying a kitchen scale, just so I could like because I have no idea what that is. [Participant #21, Female, 18-30y]

Grams is really hard. Grams and ounces. [Participant #22, Female, 18-30y]

Participant 5 also described confusing terminology about portion size in the food database:

I had that problem earlier this week; well, actually, it's been a problem for a while now. What is a chicken wing, right? Is it a chicken wing section? Is it the whole wing? You don't know that. People are like, "Oh, 10 chicken wings." What does that mean? [Participant #5, Female, 18-30y]

Some participants felt that estimating portion sizes was a significant challenge with mobile app use. They described assessing portion size precisely as requiring lots of effort, difficult, time consuming, and a possible reason to stop use. They were also concerned about the accuracy of their estimations, and a couple of participants reported purchasing a food scale to assist them to precisely measure portions. Participants #12, #17, #14, and #20 describe some of these challenges:

And, I mean, we went out for dinner at a restaurant and I had a pretty high caloric pasta/seafood dish and I had no idea how many grams that was and I thought...so I put in 500 grams and I thought well, it's probably a pretty big portion. [Participant #12, Female, 51-70y]

Even though I tried to still be approximate in things I do but you still want to be in that ballpark and uh so I would find that it takes more work and if I treat that, that's what I think pulled me out of it because I just didn't want to put that much effort in it... [Participant #17, Female, 18-30y]

...some of them using grams and I have no idea, for example, I have this much of food, and I don't know how much...how many grams there. It's hard to estimate. [Participant #14, Female, 31-50]

I eat salad every day for lunch, I don't physically measure out my lettuce so it's an approximation so I don't know if it's accurate or not right so that's when I start getting bored of it, when I think you know what is it really accurate, am I really achieving the goals by doing it by doing this? [Participant #20, Female, 31-50]

8.3.1.2.1.1.4 Entry of complex foods

Users often encountered challenges entering foods prepared at home or mixed dishes with several ingredients (e.g., lasagna). Entering all of the ingredients for recipes and mixed dishes was described as a tedious, time consuming, and difficult process; however, one participant mentioned that she liked the accuracy that she could get with home cooked foods as she knew exactly what went into the dishes. In addition, entry of foods prepared away from home (e.g., residence cafeteria foods, food prepared by others, restaurant food) was challenging from not knowing what was in the food and quantities of different ingredients. Participants sometimes did not record these foods. These challenges are described in the following participant quotes:

...when I cook my food because you getting several ingredients putting them together, I'm find, it's easier to find a fast food, or something already prepared on that app than to log in my meal that I've prepared. So it was more like, it's easier to eat out than to you know and that defeats the purpose of the app because you're trying to eat healthier so you know. [Participant #17, Female, 18-30y]

...the second you get something that's been like cooked or baked you have to input all the ingredients manually and then it's just, it takes so much longer and it completely demotivates you to record that food. [Participant #22, Female, 18-30y]

One thing that I can also complain about is when I go home and my mom would make like, ethnic Chinese food; it's like, how do I log that? It's not in the [*Fitbit food*] database and it's just finding it online...like, the nutritional value online and then logging in custom...I just feel like there's no point to doing that for a mobile device I paid money for. [Participant #7, Female, 18-30y]

If you go to a restaurant it's it's hard to find the food so you kinda just if you have a salad, or chicken breast you kinda just have to estimate, like I would just punch in chicken breast. [Participant #23, Female, 31-50y]

A couple of participants found the recipe features of apps useful for entering in mixed dishes and reported having entered several recipes for future use; some participants also liked the automatic recipe import feature of MyFitnessPal® (provide URL and recipe is automatically

imported into the app). Participants #4 and #5 describe positive experiences with recipe features:

So I can make an African chicken peanut soup, so I just put in all the ingredients one day, divided it by the number of portions I had and so then I just use that one every time I have that meal. So it just makes it really easy; it just stores it there and I don't have to worry about it. [Participant #4, Female, 31-50y]

...if I decide to cook, I usually cook like on Sunday nights and I make a giant batch and then I like portion it and freeze it. So what I do, is I use like the recipe, and then I basically create a new recipe, add it all in. Sometimes it'll be like - I name it really funny things. But when I make these things, I put in all the ingredients and then I say it serves however many...So and then when I'm logging it, it makes it so much easier because like, I'm not putting in individual ingredients, like guesstimating how much. I know how much I cooked for the entire batch, it's not really going to be too off. It could be off by maybe like 50 or so or 100 even, but like it's really not a big deal to me. So, yeah, just throw a portion of it in there and then I'm good. [Participant #5, Female, 18-30y]

However, despite some participants finding recipe features helpful, challenges were reported which included some participants not knowing about them, finding it hard to enter recipes on the mobile app vs. website, and their recipes/portion sizes changing over time meaning they would have to create new recipe entries; this is described in the following quotes:

You do have the option of creating your own recipes and items and putting that in but every small tweak to that you make would be a new, like, nutritional value; you have to redo the whole thing. [Participant #7, Female, 18-30y]

Like, I think I have "coconut cauliflower curry" like three times in here. Like, I got tired of writing "cheesecake", so it was just like "cheesecake again". Think I got "cheesecake v4", then "cheesecake again", so that's five times. Oh, and "blueberry cheesecake", so that's six. [Participant #5, Female, 18-30y]

Adding mixed dishes already in the database was an option sometimes used for data entry by a few participants instead of using the recipe feature or entering individual ingredients because it was faster, however, accuracy was questioned. Participants #21 and #13 describe this challenge:

Like if I'm making Pad Thai at home, I won't input what kind of oil I used and how many peanuts I put in, I'll just pick a recipe that's already on there for Pad Thai and hope that it's close to what I made, so that's another way probably be inaccurate. [Participant #21, Female, 18-30y]

Sometimes I'm lazy and I made shepherd's pie at home and instead of entering my home recipe, I just go and find the average calorie and nutrition information that I find there for whoever has shepherd's pie there. [Participant #13, Female, 18-30y]

8.3.1.2.1.2 Other data entry

These apps also frequently contained capabilities to track other variables which included water, notes, weight, and exercise. When water tracking tools were available on these apps, participants were divided regarding whether they used them or not. Those who did use water tracking tools felt they were useful and easy for monitoring their intake. The following participant quote illustrates these findings:

The water tracking tool I found that way easier to use than the food tracking tool just cause it's like add a cup of water, I can do this, I can push one button. It was much more straightforward, and I wish that it was like that when to track your food intake. [Participant #22, Female, 18-30y]

Participants who did not use water recording features noted that they used other methods to track their consumption (e.g., by monitoring consumption via their water bottle), and/or were not concerned about their water intake.

The notes section is available so that users can journal information that is relevant to their day. This tool was rarely used by study participants for different reasons including: spending too much time with the app already, not knowing about it, not needed, not interested, and no time to use. One participant did access the notes tool occasionally to record blood sugar values.

Participants who provided information about body weight recording in the mobile app, were more likely than not to track their weight with this tool. Those who did not do so

reported tracking it in other ways, not owning a scale, not feeling like it was important to track/measure, or being uncomfortable with the process of tracking weight.

Many, but not all, participants reported entering exercise data into mobile apps, either manually or automatically (e.g., via Fitbit® wristband, S Health® pedometer on smartphone). For manual tracking, exercise was either tracked using the same app as was used for dietary intake monitoring (e.g., MyFitnessPal®), or via a separate app, paper record, or a computer spreadsheet. Manual exercise data entry using the same mobile apps as for food recording was frequently reported to be challenging (e.g., difficult, and time consuming to add in own exercises, difficult to determine intensity, difficulties tracking strength based activities), and there were some uncertainties and concerns about accuracy when calories burned were predicted with these apps; a couple of participants added exercise data manually into MyFitnessPal® using caloric information obtained from other devices (e.g., heart rate monitor, rowing machine) and felt more comfortable the accuracy of these sources. Paper records and exercise specific apps seemed more popular for tracking strength based activities.

When exercise was tracked automatically, participants used different types of devices including wristbands (e.g., Fitbit®), GPS watch, or smartphone apps that logged steps or running routes. This was very well liked as it required very little effort on the user's part, and for some was the key motivator to use health and fitness apps. Indeed, a few participants were much more excited to talk about automated exercise tracking features in mobile apps compared to the manual nutrition tracking components. Sometimes exercise information collected via these devices was transferred to the nutrition tracking app (e.g., Fitbit® used to track exercise which was then integrated to MyFitnessPal®) and other times it was not. Despite this tracking being well liked, a few concerns about accuracy of wearable technologies were reported and

one participant in particular mentioned that her wristband did not integrate with MyFitnessPal®.

8.3.1.2.2 Accountability, feedback, and progress

8.3.1.2.2.1 Goal setting

In general, participants liked the idea of goal setting in nutrition apps for weight management. Some used mobile app provided calorie and nutrition goals and felt this helped them to be more successful; however, many reported being unsure about or unsatisfied with these goals (e.g., felt caloric goals were too low (e.g., 1,200 kcals), unsure about accuracy of the prediction), and/or decided to follow other goals (sometimes found via Internet searches) or continue with their normal diet instead. The following quotes describe these findings:

I tweaked [*the app provided goal*] a bit from my own personal knowledge like it was telling me that I needed to eat like 1,200 calories a day and like that is the bare minimum to be alive pretty much so and it's like I'm not looking to lose like a ton of weight, I don't want to eat that little...I don't think that's healthy. [Participant #21, Female, 18-30y]

I'm like okay let's say lose 5 pounds, that's a nice number. And then [*MyFitnessPal*] cut me back from my 2,100 calories that I'm supposed to be getting everyday to 1,200 calories. And that's a lot and I I know a little bit about nutrition and I think I should be eating a little bit more than that. [Participant #22, Female, 18-30y]

I don't trust their calculations. I think, for me, twelve hundred calories is not enough. [Participant #13, Female, 18-30y]

Although these apps sometimes had the capability to customize calorie and nutrient goals, several participants did not make use of this feature for reasons including: not knowing they could or just knowing their goals in their head. A couple of participants mentioned the goal setting tool in their app was not in a prominent location. Having a goal setting feature that was

only tailored to one type of dietary plan was described as a limitation in some apps. Participant #8 also mentioned a limitation with goal setting she experienced with MyFitnessPal®:

For example, if you're nursing, you're breastfeeding, and that, for me, was a huge one because I tried it when I was. I'm still breastfeeding but I tried it a few months ago and it didn't give me any guidance as to how much I should be having... So that, for me, was one of the disadvantages of that app. [Participant #8, Female, 31-50y]

8.3.1.2.2 Accountability, monitoring, and feedback

Several participants mentioned that nutrition mobile apps were helpful for monitoring dietary behaviours and personal accountability. Some participants also mentioned feeling similarly about exercise behaviours and apps, although this will not be the focus of this section. When Participant #23 was asked about what she thought made her successful with the app, she said:

The accountability. Like physically seeing it and making me accountable to do it. [Participant #23, Female, 31-50y]

Participants commonly described that these tools helped them to develop more awareness and consciousness of their behaviours and the foods they ate, including linkages with outcomes (e.g., how they feel); allowed them to reflect on behaviours; and provided feedback that motivated them to adjust and improve their subsequent food choices (and exercise behaviours).

The following quotes illustrate these findings:

I kind of like it, it's a pain in the neck but I kind of like it because it doesn't take long to use up all of your calories and I don't think I was really all that aware of that. [Participant #11, Female, 51-70y]

I was getting to see what I was eating and I would start to make changes to my diet like uhm I I used to munch on crackers when I got home from school just cause I was starving. But then I realized, like oh jeez my sodium levels, I can do better than this. So I started to eat like celery or carrots instead. And I was making changes and I was heading in a better direction... [Participant #22, Female, 18-30y]

I think it's really good because you actually see... like if you put if you're completely honest with the app, it'll see like where you're food is going from and like I'll actually like see oh this week I've eaten all this stuff like I've had this all this candy, and like maybe I need more vegetables, maybe I need more protein or something. [Participant #24, Female, 18-30y]

I need to keep track by using the...the app because it...it works for me, also, as a little reflection tool, right?...if I am at least within the calorie goal that I think would give me the optimum results because I'm eating well and I know exactly what I should be meeting, that is what I'm looking for. So that's how the app helps. It's really more about helping to insert things and the portions and looking...if it's something that I have, like, it's a not normal or it's not something that is regular in my diet... [Participant #13, Female, 18-30y]

...I just see it as a way to help me monitor what I'm doing and maybe give me a little kick in the pants every now again to be like, "By the way, that donut had five hundred calories in it. Maybe make a better choice at dinner." [Participant #15, Female, 18-30y]

...they're good self-motivators because you get a track you get an idea of what your progress is like so it's easy to see you know how you or what you ate say one day has an effect on you know your weight average or something for the week kind of thing. So there have been a few days where you know like family barbeques and that long weekend was kind of a good example, it was it's kind of hard to shy away from from all the food and that but it makes sure that you know, you can if you have a day like that you kind of motivates yourself to get back onto a regular schedule and that kind of thing so... [Participant #18, Male, 18-30y]

So I discovered my eating was pretty disordered and very like emotional. And I discovered I ate a lot of like empty calories uhm where it's like oh I dunno I ate like a handful of chips, and that's like so many calories when I could have had I dunno fruit and that would have been more filling and less calories and then like when I see it laid out like that uhm I guess it's easier to make a wiser choice... [Participant #19, Female, 18-30y]

I think it gave me an idea like some things I don't that I didn't measure prior it gave me an idea like I'm I'm a chocolate freak so it is easy for me to go into my freezer and grab like a handful of chocolate chips but when I entering it on MyFitnessPal and I actually took my handful that I would normally shove into my mouth and put it into a measuring cup and realize, my god that's not like 15 calories, that's like 1500 calories, and a whole meal for some people maybe I should stop doing that. So it kind of gave me some ideas of more maybe nutritionally sound choices that I could be making or the image in my head that I hadn't thought, you know it's only a small handful of chocolate chips, how much can it really be, well here's how much it actually is. [Participant #20, Female, 31-50y]

...my first time, I was amazed how much calories I eat every day because if I didn't track it...I eat a lot...I tend to eat a lot...and I don't feel it and up until I use the app and I input the information and, "Oh my God, I'm eating too much." So I think this is a...this is something helpful. [Participant #14, Female, 31-50y]

Feedback kept some interested in using the apps over a period of time, as described by

Participant #23:

And then seeing like like I said, it it tells you how many calories you have left for the day so that what keeps me interested because I want to know. It's like can I go home and have that big chicken breast and salad or am I going to have a bowl of soup? [Participant #23, Female, 31-50y]

Participants reported using various progress indicators including: a) numbers, graphs, and rewards, and b) messaging (feedback and reminders). These will be described in the following paragraphs.

For viewing progress related to dietary intake with mobile apps, participants used a variety of indicators ranging from the number of calories consumed to graphs and charts outlining micronutrient and macronutrient consumption (which were frequently well liked); these indicators were used with varied frequency (e.g., every time they logged into the app, daily, weekly). While most participants were primarily interested in their caloric intake, several were also interested in other nutritional variables (e.g., macronutrients, fibre, micronutrients), and sometimes the variables of interest changed over time. In MyFitnessPal®, there is a section seen upon app entry that indicates positive energy balance in red numbers and negative energy balance in green; some, but not all, participants found this colour coding was effective. Participant #24 also mentioned:

I feel that [*this colour coding*] can lead to some really bad like obsessions, it's like negative whatever. [Participant #24, Female, 18-30y]

Weight progress graphs were also mentioned as important to visualize progress and motivate continued app use. Participant #13 said:

[*weight progress graph*] has helped me to see my season variability and also to reflect on what...yeah, what I could do to not fluctuate my weight and have a more consistent eating pattern as well.” [Participant 13, Female, 18-30y]

Some participants also spoke positively about visual indicators for their exercise progress (e.g., maps with running/biking routes, information on distance, pace, and elevation) especially when recorded automatically, whether with the same apps where they recorded their dietary intake behaviours or separate exercise apps/wearables. Participant #7, who used the Fitbit®, describes seeing exercise progress as a game in the following quote:

... it was like, playing a game and, I don't know, I really like seeing the numbers pop up so it felt like playing some kind of computer game where you're just like, logging levels. [Participant #7, Female, 18-30y]

Rewards (e.g., wristband vibration/light up, virtual rewards) were also another progress indicator for exercise performance that was well liked and motivational. Participant experiences with rewards obtained for exercise performance are described in the following quotes:

...the Fitbit, it'll light up and give you lights and stuff like that so you're motivated knowing each...each light is two thousand steps and...and then when you do hit 10,000, it will vibrate and shake and you're like, “Ooohh!” You do get all excited so. [Participant 16, Male, 31-50y]

I know I like it when my watch vibrates to tell me I've met my 8,000 steps goal and I like it when I look at my 8000 steps goal and then I see that I've gone way over and above that, I'd say that's a motivator. Like last night for example, I was at 7,600 steps and I was like man, I've already gone a walk but I'm going to walk a little bit further because I want my watch to vibrate. Right. Dumb. [Participant #20, Female, 31-50y]

...in the Fitbit you get emails with these badges, like like, ‘You have walked the length of Italy,’ or ‘You've walked from Toronto to Hawaii.’ And they're super-cheesy but I kind of like them. So it's just kind of like, it's just...yeah, I think those kind of things are...people recognize how cheesy they are. I don't really feel like sharing them with anybody but it's kind of like, ‘Oh, pat on the back! That's cute.’ [Participant #15, Female, 18-30y]

I liked the points [*from the Fitocracy app*]; points definitely motivated me. I always wanted to get more points, stuff like that. [Participant #6, Male, 18-30y]

Some issues were noted with tracking exercise in the same apps as dietary intake which included perceived incorrect exercise calorie information and exercise caloric information influencing them to eat more food to compensate and countering their effort to lose weight.

The following quote illustrates this finding:

Uhm I had, using MyFitnessPal you can add in like the exercise things because it can be paired with Map My Run. Which seems like a great idea until you're like oh I have all this extra food I can eat, let's eat all of it and more. So I turned that off because it just, I'd like do so much exercise, eat really well and then eat like, like treat yourself but not really treating yourself by eating more like bingeing almost, yeah. [Participant #24, Female, 18-30y]

...so that it'll track...track my food and then, like I said, where I do fall into trouble sometimes is when I look into the...the exercise going, 'You have 880...' and then you look over, 'Oh, I still have fifteen hundred I can eat for the day,' and...and that's not good. [Participant #16, Male, 31-50y]

Data recording streaks were another visual indicator that encouraged ongoing monitoring. A couple of participants spoke proudly about their streaks (including one participant being upset when she lost her 600+ day recording streak) and they appeared to be a significant motivator. The following quote describes this finding:

...for your streak of a hundred and ninety-five days...they do track it...and then they know around near the middle of the day or end of the day, it's like, "Hey," you know, "you haven't logged anything in. You don't want to lose your streak," or whatever so that was...that was a little bit of...sort of draws a little bit of your competitive nature and going, "Oh yeah, I'm not losing this. I'll take the...the three minutes and plug it all in." [Participant #16, Male, 31-50y]

Many participants also experienced periodic messaging in apps (especially MyFitnessPal®) that flagged the nutritional quality of their food choice (e.g., this food is high in salt), or predicted their body weight at a future date if they followed their recorded diet for a period of time. Most felt positively about these messages and found them interesting and

helpful. In addition, some participants mentioned preferring those messages with positive content vs. those with negative content. Participant #2 mentioned:

The thing that's probably worked well for me is that the fact that it breaks down everything for me. Like if I add a food it says, "Hey, this is high in protein", or "this is high in this" and it makes me know, "alright I should keep taking this food", like, chocolate milk. [Participant #2, Male, 18-30y]

Despite participants feeling positively about these messages, some concerns about inappropriate message content were reported such as stating something obvious (e.g., protein powder is high in protein), flagging a poor food choice despite it being a small amount of their overall daily intake, messaging outside of their health, diet or nutrient interests, and messaging that predicts a long term weight outcome based on the current day's intake. Some quotes describing these concerns are presented below:

...on something like coconut oil, like, if I use one tablespoon of coconut oil it will give me a popup message that says, "This food has a lot of saturated fat." Which is true but it's not taking into account that it's only one tablespoon in greater day's worth of food. [Participant #15, Female, 18-30y]

Like I've looked at [message] and I gone ok well, so what does that mean to me? Nothing. Like I'm not looking to track my Vitamin C, I'm extremely low in my blood pressure so I'm encouraged to eat salt. That app doesn't know that right so if I had inputted that on there I don't care right like it makes no difference to me that there's a high salt content, because I'm encouraged to eat more than the average person would. [Participant #20, Female, 31-50y]

Like, one of the things that I hate is how it will estimate how much you will be weighing four weeks if you eat, like, that day. 'Cause I'm like, I'm probably not going to be the same...eat the same every day and I find that estimation ridiculous. [Participant #13, Female, 18-30y]

In addition, these messages (as well as receiving feedback from the app that was less than positive) had the potential to evoke some negative emotions as described by the following participant:

Sometimes...sometimes if you've eaten something, you know, if you've hit something like, a McDonald's fry or something and it jumps up and goes, you know, "This is high

in fat,' or whatever, there's a...a small, like, it's...it's very quick, like, you read it, there's a small bit of shame with it and you're like, 'yeah,' and then you quickly scroll out of it and it's like, "Oh yeah, I feel...I feel okay." So yeah, the praise, I find you hold on to the praise a little bit longer than you do with the shame, though, I find. It's like, yeah, when that pops up, it's like, "Yeah, I know. I chose it," so...but it's interesting but yeah, no you...it does render an emotion. There is an emotional connection to it. It's...it's like...it's...it's just...yeah, you just sort of feel like, "Oh, yeah. I did bad and it's telling me I did bad." [Participant #16, Male, 31-50y]

Participants reported having mixed feelings about reminder messages (both app and email delivered) for lapses in recording. While some found them useful and acted on reminders, others sometimes ignored or did not want them (e.g., depending on their mood), but liked them nonetheless. The following quotes describe this finding:

I'll admit, sometimes I just input it all when the reminder comes on. I'm like, okay, I've eaten this, this and this for the day. [Participant #5, Female, 18-30y]

So they have an app or a feature you can set reminders if you haven't logged say meals by certain times it'll just say "hey like you know don't forget to put it in." So that's actually very useful, because sometimes it will slip my mind. [Participant #18, Male, 18-30y]

Still other participants did not find reminders helpful at all (e.g., eating reminds them to enter, do not feel that they forget), and one participant reported being unaware that their app provided reminders. Others also reported concerns about receiving reminders at inappropriate times, finding them annoying (e.g., if they are not using the app religiously, messages were sent too often), uncomfortable content (e.g., reminders to weigh in), being inconsistent, and not wanting others to see the notification. Inappropriate reminding for some participants was a reason to stop using certain apps. The following quotes explain some concerns about reminders:

...it can get a little bit uh irritating especially when you're when you're already off doing something else, like sometimes they'd notify me at like one o'clock in the afternoon and by that point I'm not even thinking breakfast, if they got if they got me while I was eating breakfast which changes day to day I probably would have entered it... [Participant #22, Female, 18-30y]

And [*FatSecret app*] kept on sending me like notifications on my email. Like “you didn’t remember to weigh in” and like... I just didn’t really feel like doing that cause I’m also very muscular and that was kinda just touchy for me as well. [Participant #24, Female, 18-30y]

8.3.1.2.3 Technical and app-related factors

Technical factors that affected app use were mentioned by some participants. Some participants described technical concerns with the nutrition app including crashing, freezing, and being slow (e.g., to load the app itself, to search and add foods) and sometimes blamed their smartphone for these issues (e.g., older, memory is full). For some participants, technical concerns caused them to end use of the app. Quotes describing technical concerns with these apps are provided below:

I think optimization is very, very important. That’s ultimately the reason why I uninstalled like the other apps I had so like you know as you use your phone like as months pass it gets more sluggish and I just don’t want to wait for like the foods to load while I’m searching. [Participant #19 Female, 18-30y]

I’ve kind of stopped tracking my nutrition – which I probably shouldn’t have, but, yeah – when I stopped using it was just getting too slow, too glitchy. That could very much have been my phone. It’s really full right now; a lot of music, lot of useless stuff on my phone that made it slow, but yeah, I was getting frustrated with it. [Participant #6, Male, 18-30y]

On my older phone like, just like adding things like sometimes I’d like freeze a bit or like whatever, and then I’d just be really slow to add stuff on. [Participant #24, Female, 18-30y]

It’s a little slow sometimes, but I think that could just be my phone or like, because it is – like it’s not the most recent phone. [Participant #3, Female, 18-30y]

Broken hardware caused use of nutrition apps to end for some participants. In addition, not having access to Wi-Fi or cellular data and uncharged devices were reported as affecting use. For example,

...if I go to like, my parents place who live in the country and they don’t have Wi-Fi then all of a sudden, everything I do is suddenly...doesn’t go in there and, yeah, the

iPad becomes useless. I...yeah, I can't do anything with my current setup. [Participant #16, Male, 31-50y]

In general, participants felt their nutrition apps were easy to use; however, some mentioned concerns including too many screens to pass through, too much material, and ads; moreover, a few participants were disappointed that some nutrition apps had poor integration with fitness apps. A couple of participants also indicated that mobile apps “lagged” behind the desktop versions of these tools, more so for apps with exercise components (e.g., features available on websites/desktop version not available on the app).

8.3.1.2.4 Personal factors

There was substantial variation in personal preferences for specific apps, opinions on different app related factors (e.g., presence of ads, design, features (e.g., counting calories vs. points)), willingness to pay for apps, and comfort level with these tools. Participants also varied widely in their use, interest, awareness and acceptance of different features (e.g., reminders, emails, blogs posts accessible via the app). Some reported that they may be more suitable for a younger generation. Subcategories that warrant additional discussion include self-motivation, privacy, and knowledge.

8.3.1.2.4.1 Self-motivation

Participants described two types of personal self-motivation that were required to use apps: motivation to make the behaviour change itself, and motivation to use apps for this purpose. Some participants mentioned that behaviour changes needed to come from within the person themselves, that they had to feel motivated to make the change and put in effort to make these changes; they mentioned the app was only a tool or accessory available to assist, support,

and motivate them with this process (e.g., provide knowledge about behaviours) and was not capable of making lifestyle changes for them. If motivation to make behaviour change was not present within the individual, behaviour change using apps would not be successful; some participants had experienced this phenomena. Patterns of use appeared to vary with motivations; some used apps intermittently when they needed assistance to make changes (i.e., when they noticed behaviours were poor or needed to lose weight) and stopped when back on track. Others reported using apps more consistently. The following quotes describe this finding:

I think you can't use them in isolation. Like, no one app is going to make you change your lifestyle. You have to already want to do it and then you use it as a tool to support what you're already doing. [Participant #15, Female, 18-30y]

I find that like when I first started using it it was mostly because I didn't know what I was doing kinda thing and I didn't spend the time, I thought it would just be like oh this app will solve all my problems and make me know everything about you know you still have to do some work on your own and figure out what you know what you should be eating, what you should be doing. [Participant #18, Male, 18-30y]

I think this goes back to like the expectations that I'd be super healthy. I eat a lot of candy and chocolate. There's I'm no shame here like, I eat junk food a lot now and I guess what my primary expectation of is the app was that I was going to be able to like stop that but that has to come from myself rather than the app and if I'm willing to change that, that takes a lot of work. And that's not going to come from the app... [Participant #24, Female, 18-30y]

...the app isn't going to make you lose the weight, you're going to make yourself lose the weight, and the app is just going to help you in the process of doing that, but you have to be committed to it. I mean you can cheat the system, you can use the app and say like. "Yup, I was really good today" and not track, you know, half of the snacks you ate. Well the app doesn't care; all you're doing is hurting yourself. And so if you're going to use an app, and you want to use it to the best of its ability, then you need to just be true to yourself and be okay with the fact that you messed up one day, but again, tomorrow is a new day. And so that's the best thing to think about, is that it's a new day; it starts over again. [Participant #4, Female, 31-50y]

Using apps for dietary tracking was felt to require personal self-motivation, effort, and organization as use was a lot of work; adherence was sometimes affected by their situation

(e.g., schedule, time availability, types of foods eaten, eating context). Some participants mentioned moving away from nutrition tracking apps to other methods to help them make healthy choices (e.g., using hands to determine appropriate portion size, using healthy recipes) because the app required too much effort to use. The following quotes illustrate these findings:

And in some instances it has but I have found in a lot of cases it goes well for like a week and then I'm just, I'm bored of it or it's too much trouble or it's over and above what I have the availability to do in a work day to track it. [Participant #20, Female, 31-50y]

...it takes time. You really have to find time and really think about what you're eating. [Participant #17, Female, 18-30y]

Whenever I got more busy I would use the app less just cause it took time to input everything. [Participant #22, Female, 18-30y]

It's really hard to track cafeteria food. So I'm, I'm just been more reliant on what the nutritionist told me to use [*which is using the hand to estimate proper portion sizes*]. [Participant #22, Female, 18-30y]

Participants frequently compared automatic exercise tracking apps to manual diet recording and said they wished that there was much less effort required for the diet tracking process.

One participant was motivated to use her Fitbit® because she had paid money for it.

A different dimension described by participants was positive self-motivation for dietary tracking in response to seeing positive outcomes (e.g., changes in body weight). The following quotes describe this finding:

Like I have been seeing results using the app, so that makes me want to use it more and more and more. [Participant #1, Female, 18-30y]

I think the thing that's really keeping me motivated to use it is, myself and the goals I want to get to. Since I've seen results and I've seen what's happened so far it makes me want to keep continue focusing on it. [Participant #2, Male, 18-30y]

I've seen the result, so that's what kept me motivated because I lost the 14 pounds so because you can actually see it uhm yeah, no I still really enjoy using it and enjoy entering the foods in it and stuff, so I haven't lost interest in it yet. [Participant #23, Female, 31-50]

I was seeing results, so that made it even easier to continually access the app.
[Participant #4, Female, 31-50y]

...I do feel like a sense of accomplishment at the end of the day where my, “Yes! I got my three servings of vegetables. I got enough protein. Look at this...these ratios.” Like, it is like, really exciting...and I do feel like even if it’s just like a placebo effect, like, I feel it, energizes better like, the next day like so I can sleep better. So it’s that rewards that keeps me on track, I guess. [Participant #9, Female, 19-30]

Moreover, many participants were self-motivated to keep using these apps because they still felt that they needed to make progress towards their goals (and it was working as they were seeing results) or were afraid of regressing (e.g., gaining weight back) if they discontinued app use. The following quotes describe this finding:

So I’m...I’m doing it because I know if I stop doing it, I’m just worried I’m going to do the same thing again and going, “Oh yeah,” and then lose track of it. By...by not tracking it or measuring it, I really don’t have a clue. I can...I can lie to myself pretty good, going, “Oh yeah, no I...I didn’t eat that much yesterday,” but if you plug it all in and then you can graphically see it...It’s just...I kind of need it. [Participant #16, Male, 31-50y]

I mean part of it for me is I don’t want to gain weight back and so that’s a big draw; this still allows me to be able to see what I can do and what I can’t do. [Participant #4, Female, 31-50y]

...for me, personally – and this is not a really great reason – but it’s the fear of putting weight back on. That if I were to go at it on my own and not track anything, like, “Oh yeah I’m making some good choices here or whatever; I know what I’m doing.” So that for me, that’s the biggest motivator, is the fear of putting the weight back on and having to go through – like it was not easy to go from a 300-calorie diet to a 1,200. [Participant #4, Female, 31-50y]

Well I’ve seen good progress, so I’m like “why not keep using it?” I mean I obviously, I don’t think I’m going to use it forever, but I don’t know. I guess for now, I’ve still... Like I think I still haven’t quite met like my target weight or whatever, so I’ll just keep using it... [Participant #3, Female, 18-30y]

I know there is a goal in mind that...when I get weighed in at the end of the week, then I will see progress or not depending how well I’ve used the app. If I’ve been tracking accurately and using the app accurately then you know I guess, I’ll be...I’ll become that much closer to my goal at the end of the week and if I haven’t used my app, then, you know, I haven’t reached my goal. [Participant #8, Female, 31-50y]

Although positive progress tended to be motivational, seeing poor progress was difficult and in some cases decreased motivation to adhere to app use. This was described by several participants in quotes listed below:

I had a different job and I wasn't working out a lot. Like, I was kind of eating a lot of crappy food so I think using [*MyFitnessPal*] was actually more of like, a downer... Like, I wasn't in a place where I was ready to make any changes in my life for the better, nutritionally. [Participant #15, Female, 18-30y] (note: participant reported stopping app use when in this previous situation)

I remember one thing was that I get discouraged discouraged when my like progress would regress so if I see like regression too much I don't wanna like open the app anymore. [Participant #19, Female, 18-30y]

Whenever it's like... So, at least in my weight loss experience, I would plateau. I'd be like, "I'm staying within my limits and things aren't happening." That made it harder, because you weren't seeing the results, but you get through a week or two of that and then you drop again. And it would be fine again for a while. So I just found those areas of plateau-ing were hard to continue at times, because of you're not seeing results and you then begin to wonder, 'is this actually working, am I doing this right, is something not working with the app itself, do I need to change something in the settings', like those sorts of questions. [Participant #4, Female, 31-50y]

...there will be weeks that obviously I will struggle with what I'm eating and therefore won't use the app as much. But I don't think it's necessarily struggle with using the app, it's more just a struggle with me and eating. [Participant #8, Female, 31-50y]

8.3.1.2.4.2 Privacy

Several participants felt that tracking their diet and managing their body weight was a private matter. Hence, they did not use and were not interested in social support features offered by dietary tracking apps (e.g., friends on the app, social media integration, user communities) despite social media use in general. Interestingly, a few participants were very engaged with social support offered by exercise apps (e.g., Fitbit®, Strava®). Many participants also wanted to keep this private from their friends and/or family and they did not know if any of their friends were using apps; however, some felt that social aspects would be

useful for some users and possibly themselves (although they had not used it). However, some did report sharing data/progress with close friends or family. Some participants used other online forums not attached to the app (e.g., general nutrition/fitness forums, Facebook® groups, reddit®) and appeared to find these resources helpful. Yet, others reported being uncomfortable knowing about other people's progress, and being exposed to inappropriate advice that could be given on such forums. The following participant quotes illustrate these findings:

I don't want to share what I'm doing or not for either...I don't want to be congratulated on anything, nor do I want to be shamed so I choose not to share with anybody else. [Participant #15, Female, 18-30y]

...you know, where they were...and they're saying...they'll come up with the messages going, you know, if you...if you have this going with two friends, there's a 'x' percentage more chance that you will achieve your your goals and stuff like that but it's been sort of, kind of...kind of like, personal. I've kept it...I've kept it close and stuff like that. [Participant #16, Male, 31-50y]

I guess when I signed up I wouldn't really want people to know that I'm trying to lose weight or think those kind of stuff. Like I'm fine if they see my activity and my physical activities but what I'm eating less so. [Participant #17, Female, 18-30y]

I wouldn't tell anybody that I'm actually doing [*recording diet using MyFitnessPal*]. [Participant #17, Female, 18-30y]

I have I have one friend [*on MyFitnessPal*], he's a very close friend of mine. He's also, he's recently gotten into like fitness and that kind of thing...But I aside from that no I mean I haven't really checked out his profile or anything, it's more like we just kind of added each other as friends that was it, I don't really use a lot of the social stuff. I do kind of see this as a little bit personal and not really stuff that you'd be willing to share. Unless it's with you know people you're comfortable with, like with this guy I don't really care if he looks or whatever or comments cause we're both kind of, you know we'll support each other and that kind of thing, working towards goals. But I don't really see, I haven't ever really used any like social aspects. [Participant #18, Male, 18-30y]

It's it's an individual thing, I never I don't look at any of the updates I don't have any friends on it or anything. [Participant #21, Female, 18-30y]

Some, but not all, participants indicated that they did not feel comfortable entering their data around other people, in restaurants, or in social situations; therefore, they would sometimes delay data entry until a more appropriate time or possibly not record at all. However, others said that because everyone uses apps, no one would know and it did not matter where they were. These findings are described in the following quotes:

...it's not something that I will do in front of everyone, in general, because I find it's a bit weird so I try to do it either before I'm going to eat or after I have eaten and I am by myself. [Participant #13, Female, 18-30y]

Also, I feel like it's slightly anti-social to use like these apps especially if you're eating with like other people, which I mean a lot of us do. And you're taking time away you have to be like I have to input this, and then you're like how many units is this, how many servings is it? And you might make your like friend feel guilty if I don't know, they just want to enjoy their meals. [Participant #19, Female, 18-30y]

...I feel like I have to hide it because it's a bit... uhm like eating is something that you normally do socially right and like. Measuring that is kind of like makes people uncomfortable, I think. uhm. And I don't want to push, I don't like have my like food diary out while people are eating, while my roommate's eating, like while she's eating her Brie cheese, like fancy French bread, so she doesn't like I don't want to like offend people I guess. I I really shouldn't worry about that but it's something that's kind of like in the back of my mind. [Participant #24, Female 18-30y]

...if I'm with other people I have to worry about like 'oh, can they see my screen' or what are they going to think about it if they find the app or anything like that. When I'm alone is easiest [*to use the app*]. [Participant #1, Female, 18-30y]

I would use it when I was by myself so that people didn't think I was very obsessed with all that. [Participant #22, Female, 18-30y]

8.3.1.2.4.3 Knowledge

Some participants mentioned that they did not have much knowledge about nutrition or had knowledge about selected variables only (e.g., calories, protein) when using these apps. They commented on confusions regarding what they should be doing and what the app numbers were telling them. The vast majority of participants were using these tools

independent of health professional support and individuals frequently reported getting nutrition information from the Internet or from non-professional sources.

8.3.1.2.5 Obsession

Although adherence is generally regarded as a positive aspect of nutrition mobile app use, a drawback of use by some female participants was that use could be ‘addictive’, ‘overcome life’, and promote an unhealthy obsession with calories, food and weight. Worry about eating disorder development linked to app use was raised by a few of these participants.

The following participant quotes illustrate these findings:

It’s addicting. I think it’s really easy to become too dependent on it and to be too concerned if you’re over or under your goals for the day; like that kind of stuff. [Participant #1, Female, 18-30y]

But I think it’s...there’s a fine line between being motivated and wanting to eat better but then, at the same time, obsessing over calories. And I’m always aware and I try not to...I try to watch myself and not be on that side where I’m counting calories constantly. [Participant #13, Female, 18-30y]

What I can see...it hasn’t happened to me...it can get, like, addictive so it might like, promote eating disorders maybe...And like, attention to caloric intake might, like, feel guilty for overeating so...and that’s something I can see happening. [Participant #7, Female, 18-30y]

There is at one point, where I found it addicting, potentially towards the end of that 600 days. Like I actually would think like, ‘oh what if I want to go on vacation, how do I keep this going?’ Or... And I found I was trying to make decisions based on my ability to access the app – which was silly, and you know, one week not putting stuff in is not going to kill me. [Participant #4, Female, 31-50y]

Some strategies to overcome an unhealthy obsession with app use was through stopping app use for a while, ignoring recommended targets for a bit and finding that there was no difference in their outcomes, or forcing themselves to not worry about recording some meals to focus on just enjoying them. Quotes from Participants #5, #9 and #13 illustrate these findings:

I started – I remember I got super obsessive about what I’m eating, like it was interesting. Because like I remember I had like a little bit of like an existential crisis for a little bit. I’m like, am I developing an eating disorder? Like, this is so – it’s so regimed. It’s like all I care about, like my life revolves around food now, for a while. So that’s why I stopped using it for a while, but now I got back into it. [Participant #5, Female, 18-30y]

I mean, I think sometimes I think I’m a little bit too diligent about it. It’s like I feel too guilty if I... It’s like ‘no, [*first name of participant*], like this is a birthday party. You can eat cake and feel fine’ and that’s fine. So I think sometimes... I don’t think it’s gotten like to an unhealthy level, but just definitely like a little bit more than I would like to sometimes and so I just have to remind myself, like “it’s okay if you go over your goal for like two days in a row; you’re not going to die”, like those kind of things. [Participant #3, Female, 18-30y]

If I can be completely honest, I think for me, like, I’m a very obsessive person and I’ve had issues with, like, exercise and food before so I think there’s a fine line, for me at least, between being very obsessive about it and being, okay, I’m going to stop doing this for a few days and like, just, you know, allowing for flexibility so I think the apps really enforce inflexibility on us sometimes and just learning to be...like, I can enter my food but I can also be flexible and... [Participant #9, Female, 18-30y]

I think, sometimes, it can be dangerous from the point of view of the disordered eating pattern because you...you will ask yourself, like, “Am I doing something that with the...within normal? Like, is this...is this normal that I actually care to track what I’m eating?” So that is always something that I have thought and sometimes struggled with. It was like, “Was this...like, is this going beyond where...what it should be?” And that’s why I try not to actually do it every day, always. It’s...it’s part of my...almost like my balance or how I can see things being still normal even though I’m trying...yeah. [Participant #13, Female, 18-30y]

8.4 Discussion

There is no doubt that mobile apps have advanced dietary self-monitoring practices that traditionally encompassed pen and paper, and more recently other computer-based approaches (e.g., website). Not only have these apps transformed the process of dietary self-monitoring (e.g., improving portability, instant feedback in real-world situations), they have also made powerful diet self-monitoring tools more accessible and front and centre to the general public (e.g., these apps are frequently among the top downloads in commercial app stores). This

research is unique as it investigated the experiences and perceptions of members of the general public already using these tools. Not only is this reflective of what goes on in the natural settings, it allows uptake of and adherence to these apps to be better studied relative to other qualitative studies in this area which tend to focus more on research participant perspectives of specific app-related features.

In general, participants in this study felt positively about mobile apps to help them change their diet behaviours. In fact, many participants did mention that they were able to make positive changes to their behaviour while using these apps which in some cases translated into beneficial weight and/or body composition changes. Users also generally felt that these mobile apps were more convenient for diet self-monitoring compared to other self-monitoring approaches (and some mentioned they could not go back to other approaches (e.g., paper records) now that they have used apps). These results also agree with other qualitative studies in this area which found liking for features such as large food databases, barcode scanners, and the ability to record data and access feedback and information anytime (170, 174, 175). However, use of apps for diet self-monitoring was not free of challenges (e.g., difficult and time consuming food entry, technical difficulties) which have also been reported in other studies (170, 174, 175).

This study is unique as it provides insight into factors that can affect use of and satisfaction with diet self-monitoring apps when used outside of research trial settings which has relevance to research, health, and information technology professionals. These factors included those related to data entry (e.g., database size, portion size, entry of complex dishes), accountability, feedback and progress, technical and app-related (e.g., access to Wi-Fi/cellular data, broken hardware, app speed). They also include those related to the person (e.g., self-

motivation for behaviour change, self-motivation to record data), progress (i.e., positive progress was motivation to continue recording and vice versa), privacy and knowledge). In this study, different factors were more or less important depending on the user and factors sometimes interacted with one another. This suggests adherence to mobile apps for nutrition behaviour change is both a complex and individualized process.

In the Diffusion of Innovations (68) framework, there are five attributes of innovations (*relative advantage, complexity, compatibility, trialability, observability*) (defined in Chapter 2) which are thought to affect whether an individual will adopt an innovation. These attributes have also been suggested to help explain reasons an individual may discontinue use of an ehealth innovation (56) in the *confirmation* stage of the Innovation-Decision process. In the case of participants from the current study, these attributes appeared to play a role in both adoption and continuation/discontinuation of use. For example, for *complexity*, users appeared to be more interested in adopting apps that had a lower perceived complexity of the food recording process (e.g., contained large food databases). Food data entry was also a complex process for some users (e.g., portion size determination, choosing correct food from the database), more so than automated exercise data entry, which caused some to end use. Moreover, a few users also reported that technical problems made the app too complex to use which caused them to end use. *Compatibility* was also a major factor that affected both adoption and discontinuance of use. For example, the types of nutrition variables that could be tracked (e.g., Weight Watchers® points, calories) had to be compatible with user needs for them to adopt use. Many users did not feel that social support features in mobile apps were compatible with their privacy needs, and therefore this specific feature was frequently not adopted. Changes in user situation (e.g., home eating to residence cafeteria eating) and needs

(e.g., no longer want to lose weight) could affect whether the app was compatible with needs and in some cases could explain discontinuance. *Observability* did not appear to be as important as other attributes for adoption of apps, however, in the current study, participants who observed changes in themselves were more likely to continue adhering to using the app and vice versa. *Relative advantage* was also important. Users felt that apps, even though they were sometimes hard to use, were superior compared to paper records, and this had an effect on their decision to adopt. *Trialability* was also important for adoption (as users could easily download these tools to test them out from app stores), but it was not important for continuance/discontinuance.

Privacy was also commonly mentioned by participants. Many participants wanted to keep use of nutrition apps for weight management private; however, there were a few participants who were comfortable sharing that they were using these tools with close friends/family and one who was comfortable sharing content with anyone. As a consequence, some participants also did not feel comfortable using these apps when around others, despite the large number of individuals who use smartphones in society, and many did not use and were not interested in social support features (e.g., social media sharing, user communities, friends) offered by several diet tracking apps. Interestingly, some participants were very interested in social support features for exercise but not diet tracking. These findings agree with previous studies of mobile apps, wearables, and websites for nutrition, exercise, and health behaviour change which also found limited use of (160-162, 164, 165, 168) and concerns with (165, 168, 170, 173) social support features, despite benefits being seen in those who use them (65, 138). The degree of comfort that individuals have with using these types of supports varies, and despite potential benefits (e.g., encouragement and motivation, recognition

for success, accountability, friendly competition) (234), there are many individuals who may not be interested in using such tools. When designing future tools, the cost-benefit of such features must be considered.

One key finding was that some female participants reported concerns about obsession with use which could possibly lead to eating disorder development. Concerns with electronic dietary assessment tools and recording caloric intake have been documented previously by professionals (235, 236); however, to the author's knowledge, this is the first time that this type of finding has been reported by the actual users of these types of mobile apps. The Diffusion of Innovations (68) framework identifies that innovations may have *undesirable consequences*. Although use of mobile apps for dietary recording resulted in desirable consequences for many participants, this obsession is an *undesirable consequence* for some users. With this knowledge that dietary tracking apps can have some undesirable consequences and with many individuals using these tools without professional support, it is essential that safeguards be in place to facilitate appropriate use. Moreover, health professionals and professional organizations (e.g., DC) could play important roles in educating the public about these potential consequences and providing some strategies on how to use these tools safely. Health professionals (e.g., dietitians) also need to be mindful of this possible *undesirable consequence* when suggesting that patients use these apps for weight management purposes.

Another finding that is worthy of additional discussion is that the nutrition knowledge level of individuals using these mobile apps varied, and was frequently low. In addition, some participants were following diets that would not be recommended by health professionals. Although most participants were not using these apps in conjunction with professional support, some were interested in having more professional support alongside use of these tools. With

the large number of individuals using these types of tools, determining the best ways to provide low cost/free health professional support (e.g., online, by phone, in person) is worthy of further investigation. This is beginning to be investigated by others (237). Moreover, the eaTracker® My Coach tool where dietitians can view client food records and provide feedback is one such tool that may be worthy of future investigation to support app users.

Strengths of this study included recruitment of individuals who had various experiences and perspectives, conducting all interviews in person (which allows body language to be captured and for the researcher to view the participant interacting with the app), and using rigorous qualitative methods (e.g., sampling to data saturation) of which the reporting was guided by a rigorous qualitative methods checklist (COREQ checklist (219)). Limitations of this study included a skewed sample with many participants being female, and 18-30y of age. In addition, participants from this study may have been more motivated to speak about these tools compared to other users from the general population. This study also did not capture health professional perspectives working with clients who are using these tools; this is an area for future investigation.

8.5 Conclusion

Mobile apps have become an exciting and mainstream tool to help individuals improve their nutrition and physical activity behaviours. Although these tools can offer numerous benefits, dietary self-monitoring using these tools can still be a difficult process. Moreover, there are numerous factors which can affect use of these tools, and sometimes users may have limited nutrition knowledge. There is a possibility that users could become obsessed with

nutrition mobile app use. Health professionals have an important role in guiding appropriate use and development of these tools.

Table 7: Participant characteristics

	n (%)
Sex	
Female	19 (79.2%)
Male	5 (20.8%)
Age	
18-30y	15 (62.5%)
31-50y	6 (25.0%)
51-70y	3 (12.5%)

Table 8: Categories and subcategories representing experiences and perceptions with nutrition mobile app use for weight management

<p>Data entry</p> <ul style="list-style-type: none"> • Food data entry <ul style="list-style-type: none"> ○ Food database ○ Food data entry methods ○ Portion size ○ Entry of complex Foods • Other 	<p>Accountability, feedback and progress</p> <ul style="list-style-type: none"> • Goals setting • Accountability, monitoring, feedback 	<p>Technical and app-related factors</p>	<p>Personal factors</p> <ul style="list-style-type: none"> • Self-motivation • Privacy • Knowledge 	<p>Obsession</p>
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CHAPTER 9: USE OF MOBILE DEVICE APPLICATIONS IN CANADIAN DIETETIC PRACTICE¹

9.1 Introduction

Recently, use of mobile devices with computer-like capabilities (e.g., smartphones) and their applications (apps) has become common. In March 2012, 48% of Canadian cellphone users used smartphones, and 70% of these users had downloaded apps (238). The popularity of health professional and consumer health apps has also blossomed. In March 2012, 34% of Canadian smartphone users who had downloaded apps reported they used health, fitness, or wellness apps (238). Recent studies also reveal mobile device and app popularity among physicians (180-182, 187, 189-191).

In dietetic practice, apps may be useful for both dietitians (e.g., organization and reference tools) and their clients (e.g., nutrition information look-up, diet self-monitoring, and diabetes management tools). To date, peer-reviewed research on relevant apps has focused on previous generation diet/exercise monitoring apps (69, 108, 121, 239) and diabetes management apps (240, 241). Oklahoma dietitians' and dietetic students' personal digital assistant/app use has also been examined (176). Studies on relevant current commercial apps have emphasized content evaluation (127, 129, 242-244). Further, current apps have been evaluated in weight management (113, 114, 245, 246) and diabetes management (247) interventions. Given the recent trends in mobile device and app popularity, it is expected there will be growing interest in these tools for dietetic practice; however, few data are available on this topic.

¹ A version of this work has been published: Lieffers JR, Vance VA, Hanning RM. Use of mobile device applications in Canadian dietetic practice. *Can J Diet Pract Res.* 2014;75(1):41-7.

9.2 Purpose

The purpose of this study was to use a cross-sectional web-based survey of volunteer dietitians to explore various topics related to mobile devices and their apps in Canadian dietetic practice. The objectives of this research were as follows: to describe dietitian use of mobile devices and apps in dietetic practice; describe factors affecting dietitian use of apps in their dietetic practice; describe through dietitian self-report, whether their clients are asking about or using nutrition/food apps and, if so, such client characteristics; and to describe whether dietitians recommend nutrition/food apps to their clients and factors affecting their recommendation or non-recommendation.

9.3 Methods

The University of Waterloo Office of Research Ethics provided ethics approval [Appendix 15]. Survey questions were drafted and different question formats (e.g., multiple choice, open-ended, ranked) were used to explore topics related to mobile devices/apps in dietetic practice. These included dietitian use of these tools, appraisal of current apps, suggestions for using apps more effectively, reasons for not using apps, client interest in nutrition/food apps, recommendation of nutrition/food apps to clients, suggestions for future apps, and continuing education interest. Related studies (176, 191) helped guide question development. The survey was mounted on SurveyMonkey® (SurveyMonkey, Palo Alto, California).

The draft survey was pre-tested with Edmonton dietitians and dietetic interns (n=11) in summer 2011, reviewed by the University of Waterloo Survey Research Centre (SRC) in October 2011, and pre-tested again with Waterloo region dietitians (n=6) in November and

December 2011. Pre-testers were asked to provide feedback on the survey (e.g., length, content, question clarity). Question content was modified after the first pre-test and the SRC review; minor grammatical changes were made after the second pre-test. The final survey contained 49 possible questions and was estimated to take no more than 20 minutes to complete [**Appendix 16**]. The number of questions varied for each participant because of conditional skips.

DC, a supporter of this research, promoted the survey to members (n=approximately 6,000) in its monthly electronic newsletters from January 2012 to April 2012. The newsletter heading for January/February was “Do you use ‘Apps’ in your dietetic practice?” In March/April, the heading was changed to “Your input is needed on new ‘Apps’ for dietetic practice,” in order to increase response. Only dietitians (n=approximately 4,600) were eligible to participate. The survey was available in English only. Responses received from January 2012 to May 2012 were included for analysis.

Quantitative data were analyzed using SPSS Statistics (version 20, IBM Corp., Armonk, New York, 2011); descriptive statistics are presented. Open-ended responses, from questions shown in **Table 9**, were coded and underwent thematic analysis for information on factors that affect dietitians’ use of apps and whether they recommend apps to clients; this analysis was guided by standard principles of qualitative analysis (220). A second qualitative researcher performed an independent review of all codes and themes; discrepancies were discussed and consensus was achieved. During this review, a second line-by-line coding of individual responses to survey questions was conducted to establish inter-rater reliability for emerging themes and subthemes. Frequency counts (i.e., the number of similar comments within categories) were used to support the salience of recurring themes. Detailed summary

notes were reviewed to compare data interpretation and determine the extent to which similar conclusions were drawn.

9.4 Results

Of 165 DC members who completed consent forms, 139 answered at least one question about mobile devices and apps in practice, and 118 finished the survey; the response rate was approximately 3% of eligible DC members. Losses were the result of refusal to participate (n=3), ineligibility because the person was not a dietitian (n=17), and failure to respond (n=6). Respondent demographics and practice areas are shown in **Table 10**.

9.4.1 Dietitian use of mobile devices/apps in practice

Fifty-eight percent of respondents reported current smartphone use (69.9%, 16.4%, and 12.3% of whom were iPhone®, BlackBerry® (BlackBerry Limited, Waterloo, Ontario), and Android™ users, respectively); 16.7% reported current tablet use (80.0% of whom were iPad® users) and 13.3% reported current iPod touch® (Apple Inc., Cupertino, California) use in practice. Overall, 69.4% of respondents reported current use of mobile devices (smartphone, tablet, and/or iPod touch®) in practice; of those respondents who reported current use of mobile devices in practice, 30.9% reported being 35 years of age or older. In addition, among respondents who reported not using a mobile device in practice, 51.2% reported being 35 years of age or older. Most users reported device use for less than one year and a frequency of at least once or twice a week. About 50% of smartphone and tablet users reported using these every day or almost every day.

Overall, 57.3% of respondents reported current app use in practice. **Table 11** shows the frequency of use for different app types; organization apps (e.g., calendar/agenda) were used most frequently and nutrition/food/exercise/diabetes/dietitian apps were used less often. An important finding was that 83.6% of respondents who did not use apps in practice were interested in future use.

9.4.2 Clients and nutrition/food apps

In total, 54.2% of respondents indicated a client had asked about or used a nutrition/food app. Overall, 98.4%, 16.1%, and 1.6% of these respondents said app clients were adults, children/youth (or their parents), and seniors, respectively. Furthermore, 46.8% of these respondents said app clients were equally likely to be female or male; 27.4% said they were mainly female, 12.9% said they were mainly male, and 12.9% were uncertain about the sex distribution. Overall, 58.7% of these respondents reported seeing these clients one to two times a month or more often.

Respondents were asked to indicate their top three choices for these clients' nutrition concerns: overweight/obesity/weight loss was the most reported top choice (83.9%), followed by general healthy eating (72.6%) and diabetes (50.0%). Respondents also indicated which app types these clients asked about or used: calorie/nutrient/food group trackers were the most commonly reported (90.3%), followed by food nutrition information lookup apps (61.3%) and restaurant nutrition information look-up apps (50.0%).

Among respondents, 40.5% had recommended nutrition/food apps to clients in their practice. Some recommended specific apps. MyFitnessPal®, and Lose It!® were the most

frequently mentioned. However, others recommended apps in general or provided guidance on choosing apps.

9.4.3 Factors affecting app use and recommendations

Several factors appeared to affect dietitians' use of apps and whether they recommended them to clients. Because similar factors applied to both situations, they were grouped together. Three themes emerged from the data. In some cases, respondents also suggested potential solutions to identified barriers.

9.4.3.1 Theme - mobile device and app factors

Respondents mentioned many factors relevant to this theme. These factors included access to information/tools, content quality, ease of use, accessibility/compatibility, and cost.

Several respondents reported that apps are convenient, have improved their access to information/tools (e.g., calculators, reminder alarms), and have enhanced their organization because everything is in one place and always in their hand. This improved access has increased efficiency, helped them to keep up to date, and allowed them to provide better services. The following respondent quotes illustrate how this has affected practice. One respondent stated: "I am able to carry less with me when seeing clients in communities as I have increased accessibility to knowledge. I also am able to serve clients better because I can access nutrition-related and non-nutrition-related information via my iPod that I wouldn't necessarily be able to without it." Another said: "They [*apps*] make my life easier as they reduce the time it takes to do things. They keep me organized without a bunch of sticky notes

and a messy desk full of papers. I can have all my schedules and reminders in my hands at all times.”

Some respondents said apps were an accessible and convenient tool for clients to complete different tasks (e.g., self-monitoring) because they normally used mobile devices. One respondent said: “If people are using a smartphone already, it is an easy way to add a task or habit into their lives.”

When they were discussing content quality, some respondents said apps were accurate, comprehensive (e.g., large food databases), and a trusted information source. However, many also reported concerns. They suggested that current apps did not meet their needs or the needs of their clients (e.g., because no comprehensive dietitian apps existed, because of calculations that are too basic) and they had difficulty finding appropriate apps. Concerns about quality were common, and included a lack of credibility, accuracy, and validity, limited Canadian content, a lack of updates, and no reputable organization approval. Concern about privacy protection was also mentioned. Some respondents also felt that energy calculations were inaccurate, and apps focused too much on calories rather than healthy eating. One respondent explained this concern: “Most clients that I see are using these apps to support disordered eating behaviour and thus continues the preoccupation with food, body size, and shape. Also, the apps place the focus on nutrients and calories rather than looking at whole foods and lifestyle factors. I would strongly not recommend using any nutrition apps for these reasons.”

Respondents expressed a wish for credible, high-quality Canadian apps for dietitians and clients; further, they wanted these apps to be recommended by reputable organizations (e.g., DC). Participants made several suggestions for such apps; many wanted a Practice-based Evidence in Nutrition (PEN) (248) app, and an all-in-one dietitian tool/information app.

Many respondents reported that apps had good ease of use; however, others reported they were not easy to use (e.g., they were too complicated, had fixed units, had hard-to-search databases, and had poor instructions). One respondent said, “Rather than the app working the way I would like, I often have to adapt and manipulate the way I use the app to meet my needs.” Some respondents also felt that some devices were too small and/or hard to use with clients.

In terms of accessibility and compatibility, some respondents reported difficulties with apps that required Internet access and preferred those that did not require such access. Also mentioned were difficulties accessing apps because of limited availability for some devices/platforms. Some respondents liked and wanted apps for different device/platform types (including computers and websites). A few respondents also mentioned app compatibility with other programs, devices, and platforms; both good compatibility (e.g., information easily transferred between different tools) and poor compatibility of mobile device apps with other programs, platforms, and devices were reported.

Some respondents believed that apps were low cost and liked this factor, while others felt costs were too high. Cost appeared to affect dietitians’ use of apps and their recommendations to clients. Some respondents wanted more free apps.

9.4.3.2 Theme - personal factors

Various subthemes emerged. These included knowledge, interest, suitability, and willingness/ability to pay. Many respondents who did not use or recommend apps reported inadequate knowledge about them (e.g., types, content, quality, how they were used, benefits of use) and wanted more information (e.g., what was available, how others were using apps,

reviews, instructions, training). One respondent stated, “Just knowing what is available would help a lot.”

Most respondents, including those who did not use apps appeared interested in app use in practice. However, some respondents had less interest. Some who did not use apps reported no need to use them or preferred to use computers. In addition, some said apps were an extra item to check, and becoming dependent on them was a possibility. Interest also appeared to affect app recommendation to clients; some respondents recommended apps when clients were interested in their use.

In terms of suitability, some respondents said apps might be a good option for certain clients (e.g., young, “techies,” already use mobile devices). However, several felt apps were inappropriate for certain clients (e.g., long-term care patients, seniors, infants, those with low literacy, those of low socioeconomic status, and inpatients). One respondent said: “I work with a population that struggles with food security. Recommending apps is not where the clients are at.” Some respondents believed recommendations about apps depended on the client population. For example, they would recommend apps for young people and/or those comfortable with devices/apps, but would not recommend them to seniors and/or individuals uncomfortable with devices/apps. One dietitian did not want to assume clients had devices and therefore did not recommend apps. Suitability may also vary among dietitians; one respondent was “not tech savvy” and did not own a device compatible with apps.

Willingness/ability to pay for apps, service plans, and devices affected both dietitian use of apps and recommendation to clients. Some respondents felt costs were too high for themselves and/or their clients. One respondent stated: “I do not have a cellphone (only a land

phone) as I do not think that I can afford a cellphone. I have been waiting for costs/charges to come down.”

9.4.3.3 Theme - workplace factors

Some respondents were not allowed to use mobile devices at work (particularly in hospitals); one respondent stated that “use of [a] phone on units is strongly opposed in my hospital; there would be a lot of explaining to do.” Lack of mobile technology adoption and limited infrastructure (e.g., no Wi-Fi access, no devices/apps provided) in the workplace were also mentioned. One respondent explained this point by stating: “Health care has not adopted these technologies for work practices. The industry is still at the PC stage. The industry is not investing time, money, or expertise to incorporate newer technologies in the workplace.”

One respondent also reported that synchronizing mobile devices with workplace computers was not allowed. Another believed that bedside use of apps is inappropriate. Some suggested a mobile device-supportive workplace (e.g., permission to use devices at work, mobile technology adoption, reliable Wi-Fi access, device and app funding) might help them use apps more easily.

9.5 Discussion

This work provides the first glimpse into mobile devices and their apps in Canadian dietetic practice. The data are timely because of the recent increased popularity of this tool. We hope these findings will help inform future use of apps in practice, as well as research and development in this area.

Overall, 69.4% of respondents self-reported mobile device use in practice, with many reporting both frequent and recent use. However, the mobile device use level in our study is possibly higher than the level in the overall Canadian dietitian population because many respondents were 34 years of age or younger, and, in general, younger adults tend to use mobile devices more than older adults do (238). Nevertheless, the use level in our study is comparable to levels among physicians (180-182, 187, 189-191).

Overall, 57.3% of respondents self-reported app use in practice. Organization apps were the most frequently used in our study and most commonly used in a related 2008 study (176), and nutrition/food/exercise/diabetes/dietitian apps were used less frequently.

Only 40.5% of respondents recommended nutrition/food apps to clients, although more than 50% reported that clients had asked about or used apps. Various factors appear to affect app use by dietitians and whether they recommend them to clients. These factors should be considered when developing, choosing, implementing, and recommending apps.

Although most respondents appeared excited about apps, mixed feelings about this tool were reported; similar findings have emerged from other studies with physicians and medical trainees (187, 190). Undoubtedly, apps can have benefits for both health professionals and clients (33, 187, 190, 249); however, the reported concerns (e.g., poor quality, not easy to use) are not surprising. First, studies in which the content of current commercial apps with nutrition, exercise, and diabetes content has been evaluated suggest suboptimal quality (127, 129, 242-244). In addition, sometimes apps may be based on developer preferences rather than on what is best for users (250). To address these concerns, future apps should be designed with health professional and patient/client involvement, applying a user-centred approach, and undergo rigorous evaluation.

Lack of knowledge about apps also affected dietitian use and recommendation; this knowledge deficiency may be partially due to limited scholarly literature in this area. Respondents wanted reputable organizations (e.g., DC) to provide apps and information on this topic. Dietetics organizations are starting to provide these services (e.g., DC has released the apps EatWise® and eaTipster® and the Academy of Nutrition and Dietetics in the United States has released apps and has app reviews) (251). Organizations such as these may be looked upon to provide more of these services in the future.

Some respondents reported workplace barriers that prevented app use (e.g., not being allowed to use them, insufficient infrastructure). Apps may provide benefits to professionals (e.g., quick information access), but potential concerns exist, such as patient privacy and appropriateness of bedside use. Codes, guidelines, and policies are now surfacing on appropriate mobile device use in clinical settings (252), and research is emerging on their use in health care environments; this research includes patients' perceptions of health providers' app use (253, 254) and the use of apps during rounds (182). Patient information privacy is also a frequently mentioned issue in the mobile health literature (250, 254, 255). Dietitians should ensure appropriate security protection when they are using devices containing patient information. Future research to understand appropriate use in the workplace and improved devices/apps may stimulate greater workplace adoption and acceptance.

9.5.1 Study strengths and limitations

The major study strength is the diversity of perspectives that emerged because respondents represented various practice areas across Canada. Nevertheless, further research in specific practice areas and locations is needed to verify and extend the findings.

The main study limitations are response bias and a low response rate. Possibly respondents were overly enthusiastic about apps and not representative of all Canadian dietitians. In addition, younger ages may be overrepresented and French-speaking dietitians may be underrepresented because the survey was available only in English.

This study also did not address mobile device and app use by nutrition students/dietetic interns, which may be an important consideration as health care students' app use for educational purposes has received attention (252, 256) and may have benefits (e.g., increased confidence) (252). One respondent had used apps since the beginning of internship; this may become standard in the future and warrants investigation.

9.6 Relevance to practice

Dietitians appear enthusiastic about the potential for app use to enhance services, and considerable interest is also apparent among clients. However, currently available apps may not meet existing needs. This study provides a better understanding of factors that can affect the use and recommendation of apps; these factors likely interact with one another and they must be considered when apps are developed, recommended, implemented, and chosen.

Respondents wanted quality Canadian apps for both themselves and their clients, and wanted these apps to be recommended by reputable organizations. In addition, participants wanted more information about apps and the ability to use devices/apps at work. Overall, 85.3% of respondents were interested in continuing education on apps; PEN pathways, conference sessions, app reviews/overviews (similar to those that have been published for other health professionals) (257-259), and a technology network are possible venues for the provision of such information. Dietitians should consider becoming involved in app

development and evaluation to help ensure quality products are available to support dietetic practice.

Table 9: Open-ended questions on factors that could affect dietitians' use and recommendation of mobile device apps

	Question
<p>Questions asked to dietitians who use apps in practice</p>	<ol style="list-style-type: none"> 1) What do you like about the non nutrition/food related apps for mobile devices that you currently use in your dietetic practice? 2) What do you dislike about the non nutrition/food related apps for mobile devices that you currently use in your dietetic practice? 3) What has been your overall satisfaction with non nutrition/food apps for mobile devices used in your dietetic practice? Have they changed your practice? Please explain. 4) What do you like about the nutrition/food apps for mobile devices that you currently use in your dietetic practice? 5) What do you dislike about the nutrition/food apps for mobile devices that you currently use in your dietetic practice? 6) What has been your overall satisfaction with nutrition/food apps for mobile devices that you have used in your dietetic practice? Have they changed your practice? Please explain. 7) In your opinion, what would help you to more effectively use applications (whether or not nutrition/food related) for mobile devices in your dietetic practice?
<p>Questions asked to dietitians who do not use apps in practice</p>	<ol style="list-style-type: none"> 1) Please list and explain reasons for not using apps for mobile devices in your current dietetic practice. 2) Please explain why you would or would not be interested in using apps in the future.
<p>Question about recommendation of nutrition/food apps to clients (asked to all practicing dietitians)</p>	<ol style="list-style-type: none"> 1) Please explain the reasons for recommending or not recommending nutrition/food apps for mobile devices in your dietetic practice.

Table 10: Respondent demographics and practice areas

	number (%)
Sex	
Female	115 (98.3)
Male	2 (1.7)
Age Category	
<25 years	6 (5.1)
25 years to 34 years	61 (51.7)
35 years to 44 years	20 (16.9)
45 years to 54 years	20 (16.9)
55 years to 64 years	8 (6.8)
≥65 years	3 (2.5)
Province of Residence	
British Columbia	13 (11.0)
Alberta	21 (17.8)
Saskatchewan	6 (5.1)
Manitoba	7 (5.9)
Ontario	52 (44.1)
Quebec	2 (1.7)
Maritimes	14 (11.9)
Territories	3 (2.5)
Practice Areas^a	
Hospital- Inpatients	47 (34.1)
Hospital- Outpatients	46 (33.3)
Long Term Care	28 (20.3)
Community Health Centre	20 (14.5)
Private Practice	19 (13.8)
Primary Care	14 (10.1)
Research/Academic	8 (5.8)
Foodservice Management	7 (5.1)
Public Health/Population Health	7 (5.1)
Homecare	6 (4.3)
Food Industry	6 (4.3)
Not currently working in dietetic practice	4 (2.9)
Other	19 (13.8)

Note: Numbers vary because different numbers of respondents answered each question.

^aA total of 138 respondents answered this question. Percentages do not add up to 100 because respondents were permitted to select one or more practice areas.

Table 11: Frequency of use of different app types by dietitians who reported app use in practice

	Everyday (or almost everyday) number (%)	1-2 times/week number (%)	1-2 times/month number (%)	1-2 times/year or less often number (%)	Never used number (%)
Calendar/agenda	44 (62.0)	5 (7.0)	6 (8.5)	2 (2.8)	14 (19.7)
Clock/timer	39 (56.5)	6 (8.7)	4 (5.8)	3 (4.3)	17 (24.6)
Contact lists/address book	34 (49.3)	7 (10.1)	5 (7.2)	2 (2.9)	21 (30.4)
Social media	20 (29.9)	7 (10.4)	7 (10.4)	1 (1.5)	32 (47.8)
To do lists	20 (29.0)	12 (17.4)	17 (24.6)	1 (1.4)	19 (27.5)
Notes	16 (23.2)	16 (23.2)	11 (15.9)	5 (7.2)	21 (30.4)
Medical/drug reference and databases	16 (23.2)	15 (21.7)	12 (17.4)	7 (10.1)	19 (27.5)
PDF/document readers	9 (13.0)	7 (10.1)	13 (18.8)	7 (10.1)	33 (47.8)
Camera	4 (5.8)	18 (26.1)	14 (20.3)	8 (11.6)	25 (36.2)
GPS/maps	7 (10.0)	12 (17.1)	23 (32.9)	12 (17.1)	16 (22.9)
Client scheduling	11 (15.9)	6 (8.7)	0 (0)	3 (4.3)	49 (71.0)
Voice/video calling (e.g., Skype®)	1 (1.5)	9 (13.4)	8 (11.9)	9 (13.4)	40 (59.7)
Voice recording	2 (3.0)	6 (9.0)	3 (4.5)	10 (14.9)	46 (68.7)
Meeting apps	4 (6.2)	3 (4.6)	4 (6.2)	5 (7.7)	49 (75.4)
Lab value monitoring	6 (9.8)	1 (1.6)	4 (6.6)	1 (1.6)	49 (80.3)
Nutrition/food/exercise/dietitian apps					
Calculators (BMI, caloric needs, etc.)	14 (22.2)	7 (11.1)	8 (12.7)	9 (14.3)	25 (39.7)
Calorie/nutrient/food group trackers	8 (12.5)	13 (20.3)	12 (18.8)	6 (9.4)	25 (39.1)
Food nutrition info look-up	10 (16.1)	10 (16.1)	12 (19.4)	4 (6.5)	26 (41.9)
Recipe/cookbook	3 (4.8)	15 (24.2)	11 (17.7)	4 (6.5)	29 (46.8)
Fitness/exercise	6 (9.5)	10 (15.9)	6 (9.5)	6 (9.5)	35 (55.6)
Restaurant nutrition info look-up	4 (6.3)	11 (17.2)	18 (28.1)	5 (7.8)	26 (40.6)
Dietitian Apps (e.g., Nutrition Workbench, Dietitian Tool, Dietitian App Box)	5 (7.9)	6 (9.5)	5 (7.9)	6 (9.5)	41 (65.1)
Nutrition and/or food education/information	5 (8.2)	4 (6.6)	9 (14.8)	5 (8.2)	38 (62.3)
Grocery shopping list	5 (7.9)	3 (4.8)	6 (9.5)	7 (11.1)	42 (66.7)
Body weight/composition trackers	5 (8.1)	3 (4.8)	8 (12.9)	4 (6.5)	42 (67.7)
Menu planning	2 (3.2)	5 (8.1)	6 (9.7)	5 (8.1)	44 (71.0)

BMI = body mass index; GPS = global positioning system; PDF = portable document format

^aThe following categories of apps were used by <10% of respondents \geq 1-2 times a week and were never used by >70% of respondents: word processing, spreadsheets, staff scheduling, electronic charting, finance, inventory tracking, diabetes monitoring, nutrition support, dieting/quick weight loss plans, food allergen information look-up, and nutrition education games.

^bTotals in rows vary because different numbers of respondents answered each question.

CHAPTER 10: DISCUSSION

This thesis presented novel research on electronic tools to support nutrition and physical activity behaviour change from the perspectives of members of the public using such tools to health professionals assisting such individuals. This research examined different electronically-based approaches to support behaviour change and the findings provide a basis for guiding subsequent developments in this rapidly evolving field. The Diffusion of Innovations (68) framework provides a useful foundation to integrate findings from across different studies in this thesis. The attributes of innovations, communication channels, characteristics of the adopters, and consequences will be discussed.

10.1 Using the Diffusion of Innovations framework to integrate findings from the different studies in this thesis

10.1.1 Attributes of Innovations

The Diffusion of Innovations (68) framework specifies five attributes of innovations that influence whether an individual decides to adopt an innovation (*relative advantage*, *complexity*, *compatibility*, *trialability*, and *observability*), which are defined in Chapter 2. Eysenbach (56) suggested that these attributes may also explain whether someone will stop using an ehealth innovation in the *confirmation* stage of the Innovation-Decision process; the work presented in this thesis does support a role for these attributes in both cases.

10.1.1.1 Relative advantage

Throughout this thesis research, participants made references to the *relative advantage* of electronic technologies to support nutrition and physical activity behaviour change which

appeared to have influenced adoption as well as in some cases discontinuance. For example, in Chapter 8, participants mentioned that dietary tracking using mobile apps provided benefits over traditional dietary tracking approaches (e.g., paper records, websites) as it was more convenient (e.g., allowed them to enter food intake information whenever desired including when on the go) and allowed them to receive instant feedback which could be used to make subsequent changes throughout their day. Dietitians who completed the survey of mobile app use in dietetic practice described in Chapter 9 also mentioned that apps were convenient for clients and also enabled dietitians to access materials and information when seeing clients without having to carry around paper resources. The convenience of these tools provides an advantage over other methods.

The features offered by both the My Goals tool and nutrition mobile apps also provided a *relative advantage* which appeared to be influential in user adoption of these tools. For example, in Chapter 6, participants mentioned that the My Goals feature provided goal setting guidance and ideas for goals which had not been something previously accessible. Some participants in Chapter 7 also felt that the ERO motivational messages reminded them of their goals and provided an advantage over not receiving these messages. However, others felt such messaging did not provide any benefit and was a factor in promoting discontinuance. In Chapter 6, a few participants also felt that tracking goals without having to complete food records provided a *relative advantage* since recording full food records can be a challenging process as mentioned in Chapter 6 and 8. Moreover, as described in Chapter 8, mobile apps can provide several different desirable features including large food databases, reminder messages, barcode scanning, instant graphical and numerical feedback, and social support which appeared to have provided an advantage over traditional approaches which do not

contain these features; this was influential in user decisions to adopt these tools to support nutrition and physical activity behaviour change. Also, as described in Chapter 8, participants felt that apps with a larger choice of foods offered in the database offered a *relative advantage* over apps with smaller databases; in some cases this motivated participants to discontinue use of apps with smaller databases.

Throughout studies presented in this thesis research, participants made references to cost. For example, in Chapter 8, participants felt that mobile apps were lower cost versus other methods (e.g., gym memberships, Weight Watchers® programs), and some dietitians in Chapter 9 also mentioned that the low cost of these tools was beneficial. However, in Chapter 9, the cost of the actual mobile devices and apps was also perceived as a relative disadvantage over other strategies for themselves or their clients. Cost therefore was an important factor that affected choices regarding adoption of electronic tools to support nutrition and physical activity behaviour change.

Participants also made several references to time in the studies presented in this thesis. Some participants in Chapter 8 felt that mobile apps had features in them that allowed for data to be entered quickly (e.g., multi-add) and saved time over other nutrition self-monitoring approaches (e.g., paper records); however, entry of mixed dishes was found to be time consuming, and in fact was a reason why some participants decided to discontinue use of the mobile app and look into other options for healthy eating.

References to quality of electronic tools to support nutrition and physical activity behaviour change was also made throughout the studies described in this thesis. For example, dietitians from the study presented in Chapter 9 mentioned that they had concerns about the quality of some apps currently available, and some users in Chapter 8 also expressed some

concerns about accuracy and quality. Such incentives may be disincentives to adoption or continuing use of these tools, or may place other tools perceived as credible (e.g., Dietitians of Canada's eaTracker®) at *relative advantage*.

10.1.1.2 Complexity

Complexity was another attribute of innovation that appeared frequently including in the studies presented in Chapters 6, 8, and 9. In Chapter 8, participants in general felt that apps were easy to use and learn how to use, fairly intuitive, and had features to decrease the complexity of use (e.g., adding food via favourites, barcode scanner, large food databases). However, food data entry (including estimating portion size, using provided portion size units, finding the correct foods, adding mixed dishes) was a complex process for some users and was an important factor that explained discontinuance for some participants. Technical issues were also sometimes encountered which made the app more complex to use and in some cases also explained discontinuance.

Some participants in Chapter 6 found tracking goals with the My Goals Tracker to be a complex process as they could not find the tracker and because it was too hard to use; complexity was likely a key reason some users did not track their goals at all or consistently. In addition, adding write your own goals was also perceived by some to be a complex process.

Dietitian participants from the study described in Chapter 9 also felt that some apps were hard to use and complex (e.g., fixed units, hard-to-search databases, poor instructions). When designing future electronic tools to support nutrition and physical activity behaviour change, it is important to ensure that complexity is minimized to ensure optimal use and minimize discontinuance.

10.1.1.3 Compatibility

Participants across thesis chapters described *compatibility* of these tools with their needs, values, and experiences and provided several examples that affected both adoption and discontinuance of these tools. For example in Chapter 8, users mentioned that they looked for apps that provided them with variables that they were interested in monitoring (e.g., Weight Watchers® Points, calories) when deciding to adopt these tools. In Chapter 9, dietitians mentioned that sometimes they could not find apps that were compatible with their needs or the needs of their users (e.g., no comprehensive dietitian apps exist, calculations too basic) which would affect mobile app adoption. In Chapter 8, users also described that sometimes their situation changed (e.g., lost enough weight, eating in residence cafeteria vs. home, availability of Internet, holidays) which made the app was no longer compatible with their needs, which could prompt them to discontinue use either temporarily or permanently. Several users mentioned that they wanted to keep use of their app private as described in Chapter 8, and consequently, they did not adopt use of the social support features offered in apps.

In Chapter 6, users felt that the concept of My Goals was compatible with their beliefs that goals were a good method to promote behaviour change. However, the tool was ultimately not compatible with their needs (e.g., did not allow them to change the difficulty of ready-made goals, did not allow them to track the degree of goal progress). Users provided several suggestions to increase *compatibility* with their needs (e.g., front and centre presence, improving goal tracking) which can be instituted in the future.

Compatibility with user devices was another factor that emerged that could affect adoption of these tools. In Chapter 9, mobile apps were sometimes not compatible with user

devices; however, with iOS™ and Android™ being now the two major mobile device operating systems, this is likely now less of an issue than in 2012. Nevertheless, there are still some mobile apps that are only available for certain operating systems and devices. This finding was also found in the study presented in Chapter 8 although it appeared to be less of an issue.

Several dietitians (Chapter 9) mentioned that apps were not compatible with their workplace (e.g., not allowed to use devices at work, lack of infrastructure (e.g., Wi-Fi), not compatible with workplace computers). Until workplaces are more compatible with this technology, these tools cannot be easily be adopted into practice.

10.1.1.4 Observability

Observability did not appear to be a factor that strongly affected adoption of electronic tools by the participants in studies presented in this thesis. There were a few participants in the study in Chapter 8 who mentioned that they had heard about outcomes that others had experienced with nutrition apps (e.g., via social media, friends, family); but for the most part, observability did not appear to be an important of a factor affecting adoption. One reason may be that many individuals, especially in the study presented in Chapter 8, did not want others to know they were using these tools, and therefore, there would be few discussions about them. However, physical activity apps may not follow this pattern, and in general, participants did appear more willing to talk about these tools. In addition, participants in this chapter did mention that observing positive outcomes in themselves promoted adherence to app use, and vice versa.

10.1.1.5 Trialability

Free publicly available ehealth tools are well positioned to allow prospective users to easily trial those tools. Both the eaTracker® My Goals tool described in studies presented in Chapters 5, 6, and 7, and nutrition mobile apps as described in Chapters 8 and 9 were very trialable as they are low/no cost and publicly available. In the case of the My Goals tool, many individuals appeared to have tried out the tool (i.e., set goals), but that was the extent of their adoption. Participants in Chapter 8 also mentioned trialing different apps.

10.1.2 Characteristics of the adopter

The Diffusion of Innovations (68) framework discusses how characteristics of the adopter can affect adoption of innovations as well as discontinuance of innovations. More specifically for discontinuance, this framework suggests that individuals with relatively low education, socioeconomic status, less contact with change agents, or later adopters are more likely to discontinue use of an innovation (68). Greenhaugh et al (260) conducted a review of diffusion of innovations in health service organizations and suggested that both the motivation and ability of the adopter are important for innovation adoption. In the study presented in Chapter 8, self-motivation was also an important factor that affected adherence to mobile app use and discontinuance. Users mentioned that they needed to be self-motivated both to change their behaviour as well as to track their dietary intake in the app as it took time. If they lacked one or more of these types of motivation, success in changing their behaviours using the mobile app would be affected.

10.1.3 Communication channels

Participants in the study presented in Chapter 7 frequently reported that they were not aware that ERO dietitians could help them with their goals despite having an advertisement about this service on the eaTracker® and ERO website. Further, these participants sometimes reported being unsure about how dietitians could help them with their goals. Future marketing of ERO should focus on enhancing *how-to* and *awareness knowledge* of this service as described in the Diffusion of Innovations (68) framework. Front and centre advertising on the eaTracker® website, advertisement about this service to dietitians and other health care professionals, and mass media channels (e.g., press release about service) would likely help to improve adoption of this service in the future.

In Chapter 6, participants reported finding out about eaTracker® through a variety of methods including mass media, Internet, and interpersonal communication; however, specifically for the My Goals tool, users reported finding out about it secondarily through use of the eaTracker® website which is best known for diet and physical activity self-monitoring. Participants in Chapter 8 also reported finding out about nutrition tracking apps through various types of communication channels usually encompassing mass media, Internet, and interpersonal communication; however, again, finding out about different app features themselves appeared to be more through self-discovery. These findings suggest that strong communication about services offered by these apps is essential both when advertising the tool and within the tool itself (e.g., pop-up boxes).

10.1.4 Consequences

Throughout the studies in this thesis, consequences of using electronic tools to support nutrition and physical activity behaviour change were described. The Diffusion of Innovations (68) framework outlines several types of consequences including those which are desirable and undesirable. In Chapters 6 and 7, participants expressed several *desirable consequences* of using the My Goals tool and motivational messaging (e.g., helped them to use goals for nutrition and physical activity behaviour change, messaging provided them with new ideas to meet their goals); however, the *desirable consequences* of this innovation were likely less than was anticipated because of limitations of the My Goals feature itself. Participants in Chapter 8 also mentioned several *desirable consequences* of using nutrition mobile apps (e.g., weight loss, more awareness of behaviours).

However, despite several *desirable consequences* being reported, the study in Chapter 8 revealed a key *undesirable consequence* of using nutrition apps for weight management as some female users reported becoming obsessed with recording as well as food, and body weight. Health professionals need to be aware of the potential for this *undesirable consequence* when supporting users of these tools.

10.1.5 Integration conclusion

The findings of this thesis align with the Diffusion of Innovations framework (68) in general. Specifically, the attributes of innovations, communication channels, and consequences described in the Diffusion of Innovations framework (68) fit the results of this thesis relatively well.

The Diffusion of Innovations (68) framework places less emphasis on discontinuance compared to adoption of innovations as less research had been conducted in this area (56); in fact, in a comprehensive and highly cited review by Greenhaugh et al (2004, (260)) looking at diffusion of innovations in health service organizations, a note was made about how few studies there were exclusively on discontinuance of innovations. Rogers (2003, (68)) did allude to adopter characteristics affecting discontinuance, e.g., lower education or socioeconomic status, but did not specify motivation which was an important factor in the current research. Here, as described in Chapter 8, both motivation to change behaviours as well as motivation to record information into tools affected discontinuance. Hence, the current research has the potential to add to better understanding of the process of discontinuance and is a potential modification of the Rogers framework.

The Innovation-Decision process (from knowledge to confirmation) within the Diffusion of Innovations framework, was useful for thinking about the overall process of adoption, implementation or discontinuance of innovations for the studies presented in this thesis. It also informed the design of the interview guide (Chapter 8). Yet, users went quickly from knowledge to implementation of the ehealth innovations and it was difficult to isolate each individual step in this process. This is perhaps a unique trait of how individuals make decisions about electronic tools in general.

10.2 Strengths and limitations of this research

Overall, this research has several strengths. First, this research provides needed information on both user and professional perspectives with electronic tools to support nutrition and physical activity behaviour change. There are few available studies that have

examined user perspectives with these tools and even fewer in a in a Canadian context. Second, this work focuses on use and perspectives with these tools when used naturally outside of a research trial setting; most of the peer-reviewed literature to date focuses on use of these tools within a research trial setting which may not be representative of natural use. Third, this work used a variety of methods to gather information including one-on-one qualitative interviews, survey, and database analysis. Triangulation of sources provides a more robust evaluation (261, 262) and specifically in the work evaluating the My Goals feature (Chapters 5, 6, and 7), results from the dietitian interviews, user interviews, and user data all pointed towards the same findings. Fourth, there are very few qualitative data that have focused specifically on use of an online goal setting and tracking tool and therefore, this work makes a substantial contribution in this emerging area. Fifth, rigorous research methods were applied to studies throughout this thesis (e.g., reviews by second coder, sampling to data saturation, COREQ checklist (219)) which has not always been the case for some other research in this area. Sixth, this work provides practical information which can improve the studied tools, however it is also helpful to developers looking to modify or create new tools and for dietitians and other health professionals looking to support individuals using these types of tools.

Although this work has several strengths, there are some limitations that need to be acknowledged. First, the participants in the interview and survey studies presented in Chapters 6, 7, 8, and 9 were likely more interested in these types of tools and topic compared to others; this may have biased the findings. Nevertheless, for the My Goals feature, this thesis included a study examining the entire population of Ontario and Alberta My Goals users (Chapter 5). Second, for the My Goals interview studies (Chapters 6 and 7), the perspectives of individuals who did not use the My Goals tool and Ontario users who did not subscribe to the ERO

motivational messaging were not captured. Interviewing these individuals might have provided important insight into reasons for not adopting these tools. Third, the evaluation of the My Goals feature and ERO supports was completed after the large scale release of this feature and supports; formative evaluation would have allowed some of the issues that arose to be fixed prior to large scale launch. In spite of these limitations, findings from this evaluation are useful to both DC as well as others looking to develop or modify tools to support nutrition or physical activity behaviour change in general.

10.3 Future directions

Both qualitative interview data and naturalistic usage data can provide important insight into use of electronic tools for nutrition and physical activity behaviour change. To date, research on these types of tools has generally focused on studying effectiveness (e.g., in short term weight loss trials); however, more research using a range of approaches is needed to understand and optimize effectiveness of such tools. Similar research in individuals who use mobile apps for chronic disease management would be useful in the future. In addition, further research on perspectives of health care providers working with clients who are using these mobile apps would help optimize effectiveness of these tools as an adjunct to professional support. Exploration into new ways to offer health professional support to users of electronic tools is also warranted; research with the eaTracker® My Coach tool which allows users to connect with a dietitian coach to receive feedback on their food entries is a possible area of future exploration. Diffusion of innovations such as mobile apps into health care domains is also complex process. Frameworks such as Diffusion of Innovations as adapted and extended

in this and other research (260) may help to guide the development, adoption, and implementation of these tools.

10.4 Final conclusion

The lessons learned from the studies presented in this thesis can help direct: improvements to specific tools (e.g., eaTracker® My Goals feature), future tools to support diet and physical activity behaviour change, and integration of such electronic tools into dietetic or other health professional practice. These findings have relevance to health professionals, health care organizations, information technologists and researchers. Ultimately, application of enhanced electronic tools to support diet and physical activity behaviour change may help promote health and reduce the risk and impact of chronic disease for the Canadian public.

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Jessica Lieffers, School of Public Health and Health Systems, University of Waterloo, 200 University Avenue West, Waterloo, Ontario, Canada, N2L 3G1 phone: 780-490-8480, fax number: I do not have a fax number.

Thank you in advance!
Jessica Lieffers

Date: Thu, 14 Apr 2016 10:09:31 -0400 [04/14/16 10:09:31 EDT]
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The article is:

Use of mobile device applications in Canadian dietetic practice.
Lieffers JR, Vance VA, Hanning RM.
Can J Diet Pract Res. 2014 Spring;75(1):41-7.

Regards,

Jessica Lieffers

Jessica Lieffers MSc RD PhD Candidate
School of Public Health and Health Systems University of Waterloo
519-888-4567 ext. 37031
jlieffer@uwaterloo.ca

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Dawna Royall MSc RD
PEN® Evidence Analyst, Dietitians of Canada
Editor, Canadian Journal of Dietetic Practice and Research
T 226-383-1956 | E dawna.royall@dietitians.ca

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APPENDICES

Appendix 1: Ready-made goals: goal categories and goals falling under each category

Total Categories = 13 Total Goals = 87

Category: Choosing more vegetables and fruit

- 1) Choose fruit instead of juice at least 3 times this week.
- 2) Eat 1 cup of vegetables or 2 cups of salad with dinner 4 times this week.
- 3) Eat a dark green vegetable every day this week (e.g. spinach, broccoli, Romaine lettuce, bok choy, swiss chard).
- 4) Eat an orange vegetable every day this week (e.g. carrots, sweet potatoes, orange-coloured squash).
- 5) Eat at least 7 servings of vegetables and fruit every day this week. 1 serving is 1 piece of fruit, 1/2 a cup of fruit or vegetables or 1 cup of leafy vegetables.
- 6) Have fruit as a dessert 4 times this week.
- 7) Make half my plate vegetables at lunch or dinner every day this week.

Category: Choosing healthier grain products

- 1) Eat a new type of whole grain at least 1 time this week (e.g. barley soup, quinoa salad, brown rice, oatmeal).
- 2) Eat whole grain bread or cereal 3 times this week.
- 3) Make at least half of my grain choices whole grain every day this week.

Category: Choosing healthier milk and alternatives

- 1) Eat lower fat yogurt (less than 2% Milk Fat or M.F.) instead of full fat yogurt this week.
- 2) Eat lower fat cheese (less than 20% Milk Fat or M.F.) instead of full fat cheese this week.
- 3) Drink lower fat milk (1% or skim) or unsweetened fortified soy beverage this week.

Category: Choosing healthier meat and alternatives

- 1) Buy and use lean or extra lean ground beef instead of regular ground beef this week.
- 2) Eat 1/4 cup (a small handful) of nuts as a snack 2 times this week.
- 3) Eat one meal with legumes (e.g. beans, peas or lentils) this week.
- 4) Have fish (e.g. salmon, trout, sole, halibut) 2 times this week.
- 5) Make a recipe that uses a meat alternative like tofu, beans, peas or lentils this week.
- 6) Trim the fat and skin off meat and chicken before cooking it this week.

Category: Choosing healthier beverages

- 1) Use skim, 1% or 2% milk instead of cream in my coffee this week.
- 2) Use only 1 teaspoon of sugar in my coffee and tea.
- 3) Replace pop and juice with drinks like water or milk this week.
- 4) Replace hot and cold sweetened coffee beverages with plain coffee made with 1 teaspoon of sugar and low fat milk.
- 5) Drink skim, 1% or 2% milk or fortified soy beverage every day this week.
- 6) Drink one extra glass of water every day this week.

Category: Eating a healthy breakfast

- 1) Avoid baked goods (e.g. donuts, pastries, muffins) at breakfast this week.
- 2) Eat a high fibre cereal (4g per serving) for breakfast 3 times this week.
- 3) Eat a piece of fruit with breakfast 3 times this week.
- 4) Eat breakfast every day this week that includes 3 of the 4 food groups (e.g. whole grain cereal, a sliced banana and low fat milk).
- 5) Eat breakfast every day this week.

Category: Eating a healthy lunch

- 1) Eat a healthy homemade packed lunch 3 times this week.
- 2) Eat cut up vegetables with your lunch 3 times this week.
- 3) Eat lunch with 3 of the 4 food groups every day this week (e.g. whole grain bread, low sodium tuna and carrot sticks).
- 4) Eat two vegetarian lunches this week.
- 5) Replace deli meat with leftover cooked chicken or turkey for lunch this week.
- 6) Use whole grain bread for your sandwiches 2 times this week.

Category: Eating a healthy dinner

- 1) Eat dinner with 3 of the 4 food groups every day this week (e.g. brown rice, steamed vegetables and salmon).
- 2) Prepare and eat dinner at home at least 3 times this week.
- 3) Prepare two types of vegetables with dinner 3 times this week.
- 4) When eating out, order a side dish of salad or vegetables instead of fries this week.

Category: Getting more fibre

- 1) Eat brown rice or whole wheat pasta instead of white rice or white pasta this week.
- 2) Eat fruits and vegetables with the skin on them (e.g. apples, pears, potatoes) this week.
- 3) Eat one meal with legumes (e.g. beans, peas or lentils) this week.
- 4) Eat whole grain bread instead of white bread this week.

Category: Eating less fat, sodium or sugar

- 1) Avoid all fried foods this week.
- 2) Avoid french fries when eating out this week.
- 3) Compare the Nutrition Facts Table on food labels and choose products that have less fat and sodium when grocery shopping this week.
- 4) Don't add salt to foods when eating out or at home this week.
- 5) Eat meat, fish and vegetables without breading or rich sauces this week.
- 6) Pass on the baked goods when buying coffee 3 times this week.
- 7) Prepare my own rice and pasta instead of using a pre-packaged mix to lower the amount of sodium I eat 3 times this week.
- 8) Replace a sweet or salty snack with a healthy snack (e.g. fruit, yogurt) 3 times this week.
- 9) Use herbs and spices instead of salt when cooking at home 2 times this week.
- 10) Use less fat when cooking (e.g. bake, broil, steam and stir-fry) this week.
- 11) Use small amounts of unsaturated oils like canola, olive and soybean oil when cooking this week.

Category: Managing your weight

- 1) Avoid second helpings during meals and snacks every day this week.
- 2) Avoid snacking while reading, using the computer or watching TV every day this week.
- 3) Do not skip meals any day this week.
- 4) Eat only one portion of meat, chicken or fish the size of a deck of cards when I eat these foods this week.
- 5) Have a second helping of vegetables at mealtime if I am still hungry this week.
- 6) Limit eating out to 2 times this week.
- 7) Portion out my snacks and avoid eating from the container or bag this week.
- 8) Share a main entrée with someone when eating out this week.
- 9) Skip the appetizer and dessert when eating out this week.

Category: Planning and preparing food

- 1) Use leftovers from dinner to make my lunch 3 times this week.
- 2) Make one new healthy recipe for lunch this week.
- 3) Make one new healthy recipe for dinner this week.
- 4) Make a menu plan and shopping list and use it this week.
- 5) Make a healthy dessert recipe this week.

Category: Getting active

- 1) Be physically active for 150 minutes this week (e.g. brisk walking, jogging, bike riding, dancing, swimming)
- 2) Be physically active for 20 minutes 2 times this week (e.g. brisk walking, jogging, bike riding, dancing, swimming).
- 3) Be physically active for 30 minutes 3 times this week (e.g. brisk walking, jogging, bike riding, dancing, swimming).
- 4) Be physically active for 60 minutes 4 times this week (e.g. brisk walking, jogging, bike riding, dancing, swimming).
- 5) Do 15 minutes of activity 2 times this week that strengthen my muscles and bones (e.g. weights, Pilates, yoga).
- 6) Do 30 minutes of activity 2 times this week that strengthen my muscles and bones (e.g. weights, Pilates, yoga).
- 7) Do an outdoor family activity with the kids this weekend (e.g. go for a hike, play at the park, play tag in the backyard).
- 8) Go for a bike ride for 20 minutes 1 time this week.
- 9) Go for a walk with a friend for 15 minutes 2 times this week.
- 10) Go to the local YMCA, community centre or gym and do an activity (e.g. aerobics, Zumba, swimming) 1 time this week.
- 11) Replace 30 minutes of screen time (e.g. TV, social networking, gaming, watching videos) with 30 minutes of physical activity 2 times this week.
- 12) Take the stairs instead of the elevator or escalator every day this week.
- 13) Try a new physical activity this week.
- 14) Walk briskly for 10 minutes every day this week.
- 15) Walk briskly for 20 minutes every day this week.
- 16) Walk briskly for 30 minutes every day this week.
- 17) Walk briskly for 60 minutes every day this week.
- 18) Walk or bike ride instead of using the car to do an errand 1 time this week.

Appendix 2: My Goals feature sample screenshots

Main eaTracker® login page (<http://www.eaTracker.ca/>)

eaTracker

Use eaTracker to check your food and activity choices, analyze your recipes and plan your meals. [Sign up](#) to set goals and track your progress.

Plan Your Meals **Analyze Your Food** **Track Your Activities** **Meet Your Goals**

Featured Recipes

- Roasted vegetables pasta**
Cal: 313
Fat: 9.2g
- Peachy Buckwheat Muffins**
Cal: 313
Fat: 7.6g
- Banana-Berry Wake-Up Shake**
Cal: 231
Fat: 4.6g


Featured Exercises

- Yoga**
Yoga is especially good for stress reduction.
- Running**
Running counts as a vigorous intensity activity.
- Pilates**
Pilates targets all muscle groups.

Featured Tips

- Meal Planning**
A weekly meal plan can cut down on trips to the grocery store.
- Healthy Weight**
Balance your food intake with your daily activities...
- Healthy Eating**
A single meal or day of eating rich foods will not...

Main Goal Setting Page

 Brought to you by Dietitians of Canada

[? Help](#) [Français](#) [Connect](#) [Logout](#)

My Profile | **My Food** | **My Activities** | **My Recipes** | **My Coach**

Fri May 23

Calories	Fat	Protein	Carbohydrates	Activity Time	Activity Calories Burned	Weight
0	0g	0g	0g	0min	0	<input type="text"/> kgs lbs

My Goals

Welcome to eaTracker **Goal Tracking Tool!** Setting goals and tracking progress is an important part of starting and keeping up a healthy lifestyle.

Use MY GOALS to:

- set goals for yourself
- track and view your progress
- see the goals you have achieved

Add A Goal

Choose a ready-made goal from the drop-down list.

OR

Write your own SMART goal. SMART stands for: [i](#)


- Specific
- Measurable
- Action-oriented
- Realistic
- Time-framed

We recommend that you select 1 to 3 goals.

Check the [My Messages](#) tab for your weekly motivational reminders from EatRight Ontario.

Ready-Made Goals Write Your Own Goal

Get answers to your nutrition & healthy eating questions from Registered Dietitians for free.


 EatRight Ontario
1-877-810-810-2
www.eatrightontario.ca

Ready Made Goal Setting

Add A Goal

Choose a ready-made goal from the drop-down list.

OR


Write your own SMART goal. SMART stands for: 


- Specific
- Measurable**
- Action-oriented
- Realistic
- Time-framed

We recommend that you select 1 to 3 goals.

Check the [My Messages](#) tab for your weekly motivational reminders from EatRight Ontario.

Ready-Made Goals Write Your Own Goal

Please select a category 




or [Cancel](#)

Write Your Own Goal Setting

Add A Goal

Choose a ready-made goal from the drop-down list.

OR

Write your own SMART goal. SMART stands for: 



- Specific
- Measurable**
- Action-oriented
- Realistic
- Time-framed

We recommend that you select 1 to 3 goals.

Check the [My Messages](#) tab for your weekly motivational reminders from EatRight Ontario.


Ready-Made Goals **Write Your Own Goal**

Enter your custom goal here

Ongoing  Specific Date End 

or [Cancel](#)

My Goals Tracker

 Brought to you by Dietitians of Canada

[? Help](#) [Français](#) [Connect](#) [Logout](#)

My Profile	My Food	My Activities	My Recipes	My Coach			
Fri May 23	Calories 0	Fat 0g	Protein 0g	Carbohydrates 0g	Activity Time 0min	Activity Calories Burned 0	Weight <input type="text"/> <small>kgs lbs</small>

My Dashboard

My Goals

My Eating Targets

My Motivations

My Messages

My Details

My BMI

My Account

Customize Dashboard

Enter today's meals

Enter today's activities

My Goals Tracker


Below is the list of goals you are currently working on. Click on the buttons beside each goal to record how you are doing.

 Weekly my goal is to Eat a dark green vegetable every day this week (e.g. spinach, broccoli, Romaine lettuce, bok choy, swiss chard).

[Met My Goal](#)

[Still Trying](#)


[Remove Goal](#)

 Weekly my goal is to Eat one meal with legumes (e.g. dried beans, peas or lentils) this week.

[Met My Goal](#)

[Still Trying](#)

[Remove Goal](#)


 Weekly my goal is to Have fish (e.g. salmon, trout, sole, halibut) 2 times this week.

[Met My Goal](#)

[Still Trying](#)

[Remove Goal](#)

Get answers to your nutrition & healthy eating questions from Registered Dietitians for free.


 EatRight Ontario

1-877-610-610-2
www.eatrightontario.ca

Manage My Goals

Manage My Goals Hide


See the goals you are working on below. View your progress.



Replace hot and cold sweetened coffee beverages with plain coffee made with 1 teaspoon of sugar and low fat milk.
Frequency : Weekly Hide

Goal Completion History

Goal Date	Met My Goal	Still Trying
2014-May-20	•	




Eat one meal with legumes (e.g. dried beans, peas or lentils) this week.
Frequency : Weekly History

My Success

My Success Hide

Congratulations on your goal activity. See the goals you have reached.

Number of times you met your goal



Eat one meal with legumes (e.g. dried beans, peas or lentils) this week. 2

EatRight Ontario motivational messaging

Sample email message



EatRight Ontario and eaTracker are here to help motivate you to reach your healthy eating and physical activity goals!

Your goal: Eat a dark green vegetable every day this week (e.g. spinach, broccoli, Romaine lettuce, bok choy, swiss chard).

Tip: To help you eat a dark green vegetable every day this week, add fresh or frozen chopped greens to vegetable soups, stews or chili.

Login to your www.eattracker.ca account and track your progress!



Quick Links

- [EatRight Ontario](#)
- [My Menu Planner](#)
- [Email a Dietitian](#)

If you have additional questions about nutrition or healthy eating please do not reply to this email instead:

- Call EatRight Ontario toll-free at [1-877-510-510-2](tel:1-877-510-510-2)
- Email a Dietitian from www.eatrightontario.ca

You are receiving this email because you have registered for EatRight Ontario's motivational messages and tips to help you meet your goal. These messages are also found in the MY MESSAGES section of www.eattracker.ca when you login to your account.

Click [Here](#) to stop receiving motivational messages about this goal.

To log into eaTracker, please click [here](#)

eaTracker® message delivery – My Messages

The screenshot shows the 'My Messages' section of the eaTracker.ca website. The top navigation bar includes 'Help', 'Français', 'Connect', and 'Logout'. Below this is a dashboard with tabs for 'My Profile', 'My Food', 'My Activities', 'My Recipes', and 'My Coach'. The 'My Food' tab is active, showing a summary of daily intake: Calories (0), Fat (0g), Protein (0g), Carbohydrates (0g), Activity Time (0min), and Activity Calories Burned (0). The 'My Messages' section is expanded, showing a list of messages. The first message is titled 'EatRight Ontario motivational message for you.' and contains the following text: 'Your goal: Eat a dark green vegetable every day this week (e.g. spinach, broccoli, Romaine lettuce, bok choy, swiss chard). Tip: Try [Swiss Chard and Navy Bean Soup](#). It is delicious and is made with a nutritious dark green vegetable.' The message is dated '2014-MAY-25 9:00:05 AM'. The second message is also titled 'EatRight Ontario motivational message for you.' and contains the text: 'Your goal: Eat one meal with legumes (e.g. dried beans, peas or lentils) this week. It can sometimes be hard to meet your healthy eating goals. The good news is that you are not alone! Call EatRight Ontario at 1-877-510-510-2 to speak to a Registered Dietitian. Let us keep you motivated!' This message is dated '2014-MAY-25 9:00:04 AM'. A 'Delete All Messages' button is visible at the top right of the message list.

Permission granted by Dietitians of Canada (Janice Macdonald) to include eaTracker® screen shots in this thesis; permission granted by EatRight Ontario (Helen Haresign) to include ERO motivational message screen shots in this thesis. These permissions were granted by email on April 20, 2016.

Appendix 3: Evaluation of the My Goals feature of eaTracker® and ERO supports: application for ethics review

APPLICATION FOR ETHICS REVIEW OF RESEARCH INVOLVING HUMAN PARTICIPANTS

Please remember to **PRINT AND SIGN** the form and **forward with all attachments** to the Office of Research Ethics, Needles Hall, Room 1024.

A. GENERAL INFORMATION

1. Title of Project: Evaluation of the EatRight Ontario My Goals Feature of eaTracker

2. a) Principal and Co-Investigator(s)

NEW As of May 1, 2013, all UW faculty and staff listed as investigation must complete the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Tutorial, 2nd Ed. (TCPS2) prior to submitting an ethics application. The tutorial takes at least three hours; it has start and stop features.

Name	Department	Ext:	e-mail:
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2. b) Collaborator(s)

NEW As of May 1, 2013, all UW faculty and staff listed as investigation must complete the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Tutorial, 2nd Ed. (TCPS2) prior to submitting an ethics application. The tutorial takes at least three hours; it has start and stop features.

Name	Department	Ext:	e-mail:
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Helen Haresign	Dietitians of Canada		helen.haresign@dietitians.ca
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Mark Wilson	Dietitians of Canada		mark.wilson@dietitians.ca
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Leo Lam	Dietitians of Canada		leo.lam@lmsolutions.com
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3. Faculty Supervisor(s)

NEW As of May 1, 2013, all UW faculty and staff listed as investigation must complete the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Tutorial, 2nd Ed. (TCPS2) prior to submitting an ethics application. The tutorial takes at least three hours; it has start and stop features.

Name	Department	Ext:	e-mail:
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Rhona Hanning	Health Studies & Gerontology Propel Centre for Population Health Impact	35685	rhanning@uwaterloo.ca
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4. Student Investigator(s)

Name	Department	Ext:	e-mail:	Local Phone #:
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Jessica Loeffers	Health Studies & Gerontology	37031	jlieffer@uwaterloo.ca	780-490-8480
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5. Level of Project: PhD **Specify Course:**

Research Project/Course Status: New Project\Course

6. Funding Status (If Industry funded and a clinical trial involving a drug or natural product or is medical device testing, then Appendix B is to be completed):

Is this project currently funded? Yes

- If Yes, provide Name of Sponsor and include the title of the grant/contract: Other : Dietitians of Canada
- If No, is funding being sought OR if Yes, is additional funding being sought? No
- Period of Funding: March 1, 2013 to March 1, 2014

7. Does this research involve another institution or site? No

If Yes, what other institutions or sites are involved:

8. Has this proposal, or a version of it, been submitted to any other Research Ethics Board/Institutional Review Board? No

9. For Undergraduate and Graduate Research:

Has this proposal received approval of a Department Committee? Not Dept. Req.

10. a) Indicate the anticipated commencement date for this project: 6/1/2014

b) Indicate the anticipated completion date for this project: 3/1/2014

11. Conflict of interest: Appendix B is attached to the application if there are any potential, perceived, or actual financial or non-financial conflicts of interest by members of the research team in undertaking the proposed research.

B. SUMMARY OF PROPOSED RESEARCH

1. Purpose and Rationale for Proposed Research

a. Describe the purpose (objectives) and rationale of the proposed project and include any hypothesis(es)/research questions to be investigated. For a non-clinical study summarize the proposed research using the headings: Purpose, Aim or Hypothesis, and Justification for the Study. For a clinical trial/medical device testing summarize the research proposal using the following headings: Purpose, Hypothesis, Justification, and Objectives.

Where available, provide a copy of a research proposal. For a clinical trial/medical device testing a research proposal is required:

Dietitians of Canada (DC) eaTracker (<http://www.eatracker.ca/>) is a web-based system that allows members of the public in Canada (and abroad) to track their diet and/or physical activity behaviours and compare them recommendations (including those released by Health Canada).

Goal setting is a common and key behaviour change technique used to help individuals modify their diet and/or physical activity behaviours. Up until recently, eaTracker did not have the capability to allow users to set diet and/or physical activity goals; however, in January 2013, DC and EatRight Ontario (ERO) launched a new addition to the eaTracker program whereby users can choose one of 87 ready-made SMART goals from 13 different categories and/or have the option to write their own goals. This feature also allows all users to keep a record of whether their goals have been met. Furthermore, Ontario users will have the option to receive weekly motivational messages and the opportunity to speak with an ERO RD to help them meet their goals (these are the enhanced version users). Users in other parts of Canada (e.g., Alberta) only have the option to form goals and indicate whether their goals have been met (unenhanced version users).

The information obtained from this evaluation is essential to understand if this enhanced component is effective and why or why not and to understand more about how to make online diet and/or physical activity behaviour change (specifically goal setting tools including this tool) better in general. Moreover, there is very little qualitative information about the experiences and perceptions of individuals who use web-based diet and/or physical activity behaviour change programs (let alone goal setting tools) and the experiences of professionals who work with these clients. The findings from this study would be extremely useful to practitioners who want to help their clients to use these tools more effectively and for government, organizations, and industry to develop more effective tools. Furthermore, this information will help ERO and DC provide better services to the general public. This information will also be used to develop a survey for a large number of My Goals users to further understand the effectiveness and experiences of people of this tool. We anticipate administering this survey in Fall 2013. This survey project will be submitted in a separate and future UW ORE application following development of the survey. Individuals who provide input do not have any proprietary rights to any products developed by ERO, DC or the University of Waterloo.

Objectives:

Using quantitative data provided by Dietitians of Canada and EatRight Ontario

1) To describe, the relative number and demographics of Ontario eaTracker users who do and do not use the My Goals feature (broken down by ERO enhanced version users and

non enhanced version users), and Alberta eaTracker users who use and do not use My Goals (non enhanced version); and if possible, to identify the number of visits per client (mean (SD), median, range), the length of time per visit (mean (SD), median, range), patterns in the frequency or duration of visits over the 9 (or 12) month period and;

2) To determine whether individuals registered for the enhanced ERO My Goals feature in Ontario self-report that they are more successful in achieving their goals compared to other eaTracker users using the non enhanced My Goals feature in Ontario and Alberta and, if possible, to understand patterns of use of this program (e.g., numbers and types of goals, how long it takes individuals to achieve goals, how individuals use the program after their goals are achieved etc.)

Using qualitative one-on-one interviews of ERO My Goals users and non enhanced My Goal users from Alberta,

3) To use thematic analysis to describe client perspectives on the content, services and functionality of the respective tools, with an emphasis on the role (and potential role) of goal setting, motivational messages and the ability to speak with a Registered Dietitian (e.g., what works well for them, what does not work well, what suggestions they have for modifying the tools to better support their dietary goals).

Using qualitative one-on-one interviews with ERO dietitians and selected DC staff

4) To understand experiences and perceptions of the ERO My Goal feature

a. To understand ERO dietitian experiences and perceptions of working with clients who are using the ERO My Goal feature

b. To understand ERO dietitian experiences of providing feedback for the customized goals

c. To understand whether ERO RDs and DC staff have any suggestions for other features/functions/improvements for the ERO My Goals feature to help users to achieve their goals

b. In lay language, provide a one paragraph (approximately 100 words) summary of the project including purpose, the anticipated potential benefits, and basic procedures used.

eaTracker is a Canadian website that allows people to track their diet and/or physical activity behaviors and compare them to recommendations. Recently, an enhancement was launched whereby users can pick diet and/or physical activity goals and indicate whether they have been met. Furthermore, Ontario users can receive guidance from a dietitian and motivational messages. This work will evaluate this new feature by conducting one-on-one interviews with users and dietitians/Dietitians of Canada staff to understand what works and does not work and why. We will also ask for suggestions for improvements. We will also examine whether people who use this enhanced version are more likely to meet their goals compared to people who do not, and we will also look at how people use this system. Information will then be used to build an online survey to obtain more information on the effectiveness and experiences and of people using this program. This information will help to provide better services for the public who want to use these types of tools and will help to develop better electronic diet and/or physical activity behavior change tools in general.

C. DETAILS OF STUDY

1. Methodology/Procedures

a. Indicate all of the procedures that will be used. Append to form 101 a copy of all materials to be used in this study.

Interview(s) (in person)
Interview(s) (by telephone)
Audio-recording
Analysis of secondary data set
Unobtrusive observations

b. Provide a detailed, sequential description of the procedures to be used in this study. For studies involving multiple procedures or sessions, provide a flow chart. Where applicable, this section also should give the research design (e.g., cross-over design, repeated measures design).

Objectives 1 and 2: Coded quantitative data obtained from the eaTracker databases provided by DC and ERO on Alberta and Ontario users will be used to address objectives 1 and 2.

Data requested from DC and ERO:

Demographic Information: birthdate (month and year), gender, pregnancy/breastfeeding status (yes/no), height, weight, physical activity level, province (AB or ON), participant code for all active Ontario and Alberta eaTracker users. This information will be categorized by My Goals unenhanced users, My Goals enhanced users, and eaTracker users who do not use My Goals. (This last group is needed to understand how the demographics of My Goals users compare to the rest of the eaTracker users.)

My Goals Information: retrospective information broken down by the user about the number and types of goals chosen, whether goals have been met or not (and for how long have they been met), information about abandoned goals, and how often and for how long this feature is used (to investigate patterns of use). Data will be requested as far back as when the My Goals feature began.

Objective 3: Both purposeful and maximal variation sampling will be used to ensure that participants who have had both experience (at least one month of use) and diverse experiences with the My Goals feature are chosen. Approximately 30 participants will be chosen for this portion of the study; ~20 participants will be current My Goals enhanced users and ~10 participants will be My Goals unenhanced users from Alberta who do not have access to the ERO My Goals feature enhancements.

All participants will be interviewed one-on-one, and in-person or by telephone or Skype/FaceTime/Google Hangouts etc. using semi-structured interviews by a trained researcher at a time that is appropriate, and without disturbance for both individuals. Phone interviews were chosen because participants are located in diverse geographical areas; however, if individuals are located within close proximity to researchers, efforts will be made to conduct in-person interviews (either at the University of Waterloo main campus or in coffee shops). The semi-structured interviews will be guided by an interview protocol with open-ended questions designed to address objective 3. Both clarifying and elaborating probes will be used to gather additional data. See attached interview protocol

for questions. This protocol will also be reviewed by the project advisory team (consisting of ERO dietitians, members from the DC Information Technology team, other relevant DC staff, and one member of the target group, if someone appropriate can be found) and will be pilot tested with two individuals from the target population. All interviews will be audio recorded and transcribed word for word using a transcriptionist who is required to sign a confidentiality agreement (see attachment). Moreover, all research assistants involved with this study will also be required to sign a confidentiality agreement (see attachment).

During interviews, if it comes up in the conversation, it may be appropriate and useful to observe participants interacting with the eaTracker My Goals feature. Although this will likely not be part of most interviews, we want to have approval to conduct these unobtrusive observations if it comes up.

Objective 4: To address objective 4, one-on-one semi-structured qualitative interviews will also be conducted with ERO dietitians and DC staff (n= \sim 4-10) using similar methods as described above; the interview protocol likely cannot be pilot tested for this group because there are a very few individuals that could be recruited in the first place. If possible, these interviews will be conducted in person, or if located far away from researchers, will be conducted by telephone/Skype/FaceTime/Google Hangouts etc. As described above, the interview protocol will also be reviewed by the project advisory team. Purposeful and snowball sampling will be used to recruit participants for this portion of the study. We may also observe participants interacting with software and databases that are relevant for this project (e.g., customized PEN software for ERO dietitians).

c. Will this study involve the administration/use of any drug, medical device, biologic, or natural health product? No

2. Participants Involved in the Study

a. Indicate who will be recruited as potential participants in this study.

Non-UW Participants:

Adults

b. Describe the potential participants in this study including group affiliation, gender, age range and any other special characteristics. Describe distinct or common characteristics of the potential participants or a group (e.g., a group with a particular health condition) that are relevant to recruitment and/or procedures. Provide justification for exclusion based on culture, language, gender, race, ethnicity, age or disability. For example, if a gender or sub-group (i.e., pregnant and/or breastfeeding women) is to be excluded, provide a justification for the exclusion.

Objectives 1-3: Participants are eaTracker users who are 18 years of age or older. These individuals are members of the general public in Ontario or Alberta who can be female or male. These individuals may be using eaTracker and My Goals for different reasons.

Objective 4: Participants are staff of ERO and/or Dietitians of Canada. They are all 18 years of age or older. They can be male or female. They may be dietitians, managers/directors, information technology staff or in other roles, but they all work for those organizations.

c. How many participants are expected to be involved in this study? For a clinical trial, medical device testing, or study with procedures that pose greater than minimal risk, sample size determination information is to be provided.

For objectives 1 and 2, we expect to obtain data on >500 individuals. For objective 3, we expect to interview about 30 My Goals users. For objective 4, we expect to interview approximately a total of approximately 4-10 people who are ERO RDs, DC IT team members and other relevant DC/ERO staff.

3. Recruitment Process and Study Location

a. From what source(s) will the potential participants be recruited?

Businesses, industries

Pop up boxes on the eaTracker website, ERO mailing lists, Dietitians of Canada mailing lists, notices on Dietitians of Canada and ERO websites, DC and ERO Social Media Websites (e.g., Facebook, Twitter), word of mouth

b. Describe how and by whom the potential participants will be recruited. Provide a copy of any materials to be used for recruitment (e.g. posters(s), flyers, cards, advertisement(s), letter(s), telephone, email, and other verbal scripts).

Objective 3: Participants will be recruited primarily via the eaTracker website. Alberta and Ontario individuals who have used the My Goals feature for one month or more will be invited via a pop up box to participate in either a one-on-one interview either in-person or by telephone. Participants will be invited to leave their contact information and a time that is convenient to reach them in a pop-up box on the eaTracker website that will be securely stored by Dietitians of Canada. This information will be passed onto our research group by DC/ERO. Our UW research group will be responsible for contacting the participants. We may also recruit through the other means listed, but the pop up box will be the primary and first line for recruitment and likely our only source of recruitment. Please see attachment for a copy of the recruitment materials. Objective 4: Key informants from ERO, and Dietitians of Canada will be approached by researchers in-person, by email, or phone to participate in this study. Purposeful and possibly snowball sampling may also be used for this portion of the study.

c. Where will the study take place? On campus: Burt Matthews Hall, Propel Centre for Population Health Impact, Lyle Hallman Institute for Health Promotion Off campus: DC office in Toronto, ERO office in Toronto, coffee shops

4. Remuneration for Participants

Will participants receive remuneration (financial, in-kind, or otherwise) for participation? Yes

If Yes, provide details:

My Goals users who participate in semi-structured interviews will receive a DC cookbook (value: ~\$20-\$30) that will be donated by DC. ERO and DC staff will not receive any remuneration for study participation.

5. Feedback to Participants

Describe the plans for provision of study feedback and attach a copy of the feedback letter to be used. Wherever possible, written feedback should be provided to study participants including a statement of appreciation, details about the purpose and predictions of the study, restatement of the provisions for confidentiality and security of data, an indication of when a study report will be available and how to obtain a copy, contact information for the researchers, and the ethics review and clearance statement. Feedback will be provided to interview participants immediately after they complete the study. These participants will be given a feedback letter immediately after they complete the interview either in person or email or mail). See attached.

The feedback letter will thank participants for their involvement, include details about the

purpose of the study, provide the ethics review and clearance statement, and include researcher contact information should participants require further information. Please see the attachments for the participant feedback letter. One feedback letter will be used for both types of interviews (i.e., My Goals users, and DC/ERO staff).

D. POTENTIAL BENEFITS FROM THE STUDY

1. Identify and describe any known or anticipated direct benefits to the participants from their involvement in the project.

There is no immediate direct benefit to participants.

However, the information learned from My Goals users will help to understand who uses this tool, how this tool is used, what works, what does not work and why to help enhance capabilities of the My Goals feature and other supports alongside this feature to better meet user needs. It is possible that results from this study could be implemented in time for My Goals users who were studied to use and hopefully benefit from the enhancements. Furthermore, it is also possible that these findings may lead to the generation of new diet and/or physical activity behavior change tools (by DC, ERO, UW and others) that may directly benefit those participants in the future.

We also hope that the information provided by ERO dietitians and DC staff will further enhance the quality of the My Goals tool and supports alongside this tool to allow them to better serve their clients and do their job better.

2. Identify and describe any known or anticipated benefits to the scientific community/society from the conduct of this study.

As mentioned previously, the information gathered from this research is directly relevant to the DC and ERO to help enhance use of this feature. This information may also be directly relevant to DC and ERO to develop new types of electronic diet and/or physical activity behaviour change tools

This information is also useful to the scientific community in general. To date there is very little qualitative information on the experiences and perceptions of individuals who use web-based diet and/or physical activity behaviour change tool (including goal setting tools). This will provide information to add to the overall body of peer reviewed literature to better develop and use tools for this purpose in the future.

E. POTENTIAL RISKS TO PARTICIPANTS FROM THE STUDY

1. For each procedure used in this study, describe any known or anticipated risks/stressors to the participants. Consider physiological, psychological, emotional, social, economic risks/stressors. A study-specific current health status form must be included when physiological assessments are used and the associated risk(s) to participants is minimal or greater.

No known or anticipated risks

Interviews: none of the questions are of the nature that they would pose any psychological, physiological, emotional, social or economic stress or risk.

For the quantitative data obtained from DC and ERO, the data obtained will not contain any personal identifiers that could identify participants.

2. Describe the procedures or safeguards in place to protect the physical and psychological health of the participants in light of the risks/stressors identified in E1.

No anticipated risk is expected to be associated with this project. Participants will be assured that their interview answers are confidential, that their participation is voluntary, they can stop completing of the interview at anytime and that no one except the researchers will see or hear their answers. These assurances are included in information letters. Only anonymous quotes will be used; these quotes will not be able to identify participants in any way.

For the quantitative data, no personally identifiable information will be provided to researchers; therefore, participants cannot be identified in any way.

F. INFORMED CONSENT PROCESS

1. What process will be used to inform the potential participants about the study details and to obtain their consent for participation?

Information letter with written consent form

2. If written consent cannot be obtained from the potential participants, provide a justification for this.

3. Does this study involve persons who cannot give their own consent (e.g. minors)? No

G. ANONYMITY OF PARTICIPANTS AND CONFIDENTIALITY OF DATA

1. Provide a detailed explanation of the procedures to be used to ensure anonymity of participants and confidentiality of data both during the research and in the release of the findings.

The quantitative data obtained from DC and ERO to address objectives 1 and 2 will not contain any personal identifying information that could identify participants; this dataset will only include information on participant month and year of birth, province of residence, gender, pregnancy/breastfeeding status, height, weight, activity level, and information on use of the My Goals feature. This dataset will not contain any direct identifiers listed in section G. Participants will be known only by a code or a number. We will ask that participants be identified by a number because when we conduct the second part of this study, we will want to be able to identify respondents who completed our survey to understand how the demographics of the overall population of My Goals users compare with those who completed the survey. That is the only reason we would ask for an ID number. The interview transcripts will not contain any names, locations, or any other identifying information. The transcriptionist will be required to sign a confidentiality agreement (see attachment) and will be asked to destroy all audio files after completion of the transcription process. Participants will be informed during the consent process that all information they provide is considered completely confidential. Participant names or any other identifying information will not appear in any thesis paper, presentation, or report

resulting from this study. All findings will be presented as group data; individual participants will not be identified. Anonymous quotes from the interviews may be used with participant permission on the consent form. Only researchers associated with this project will have access to the data. All paper documents will be stored in locked offices in Burt Matthews Hall or the Propel Centre for Population Health Impact. Electronic files will be stored on password protected computers. Any research assistants hired for this study will also be required to sign a confidentiality agreement (see attachment).

2. Describe the procedures for securing written records, video/audio tapes, questionnaires and recordings. Identify (i) whether the data collected will be linked with any other dataset and identify the linking dataset and (ii) whether the data will be sent outside of the institution where it is collected or if data will be received from other sites. For the latter, are the data de-identified, anonymized, or anonymous?

The data to address objectives 1 and 2 will be received from DC and ERO. This data will be anonymized and will not contain any personal identifying information that could identify participants; this dataset will only include information on participant month and year of birth, province of residence, gender, pregnancy/breastfeeding status, height, weight, activity level, and information on use of the My Goals feature. This dataset will not contain any direct identifiers listed in section G. Participants will be known only by a code or a number. We will ask that participants be identified by a number because when we conduct the second part of this study (survey study that will be conducted in Fall 2013), we will want to be able to identify respondents who completed our survey to understand how the demographics of the overall population of My Goals users compare with those who completed the survey. That is the only reason we would ask for some type of ID number. This data will be sent to us from DC/ERO by the DC IT team through a password protected secure website. For objective 3, when participants leave their name and contact information with DC and ERO, this information will be stored on a secure server and transmitted to researchers through a password protected secure website and will be in a password protected file. Following the study, DC and ERO will delete the information from interested participants from their server. All data for this study will be stored on password protected computers and/or in locked offices in Burt Matthews Hall or the Propel Centre for Population Health Impact. For the interview data used to address objectives 3 and 4, there will be one master password protected file stored on a password protected computer containing the names and contact information and participant codes to identify participants on the interview transcripts. This is the only file that will contain both the names of participants and their codes. This data will not be sent outside of the research institution.

3. Indicate how long the data will be securely stored and the method to be used for final disposition of the data.

Paper Records

Confidential shredding after 7 year(s).

Audio/Video Recordings

Erasing of audio/video recordings after 7 year(s).

Electronic Data

Erasing of electronic data after 7 year(s).

Location: Filing cabinets in locked offices in Burt Matthews Hall and/or the Population Centre for Population Health Impact

4. Are there conditions under which anonymity of participants or confidentiality of data cannot be guaranteed? No

H. PARTIAL DISCLOSURE AND DECEPTION

1. Will this study involve the use of partial disclosure or deception? Partial disclosure involves withholding or omitting information about the specific purpose or objectives of the research study or other aspects of the research. Deception occurs when an investigator gives false information or intentionally misleads participants about one or more aspects of the research study. No

Researchers must ensure that all supporting materials/documentation for their applications are submitted with the signed, hard copies of the ORE form 101/101A. Note, materials shown below in bold are normally required as part of the ORE application package. The inclusion of other materials depends on the specific type of projects.

Protocol Involves a Drug, Medical Device, Biologic, or Natural Health Product

If the study procedures include administering or using a drug, medical device, biologic, or natural health product that has been or has not been approved for marketing in Canada then the researcher is to complete Appendix A. Appendix A is to be attached to each of the one copy of the application that are submitted to the ORE. Information concerning studies involving a drug, biologic, natural health product, or medical devices can be found on the ORE website.

Please **check** below all appendices that are attached as part of your application package:

- Recruitment Materials: A copy of any poster(s), flyer(s), advertisement(s), letter(s), telephone or other verbal script(s) used to recruit/gain access to participants.
- Information Letter and Consent Form(s)*. Used in studies involving interaction with participants (e.g. interviews, testing, etc.)
- Data Collection Materials: A copy of all survey(s), questionnaire(s), interview questions, interview themes/sample questions for open-ended interviews, focus group questions, or any standardized tests.
- Feedback letter *
- Research Proposal: A copy should be appended for faculty, undergraduate or graduate research if available.*

* Refer to sample letters.

NOTE: The submission of incomplete application packages will increase the duration of the ethics review process.

To avoid common errors/omissions, and to minimize the potential for required revisions, applicants should ensure that their application and attachments are consistent with the *Checklist For Ethics Review of Human Research Application*

Please note the submission of incomplete packages may result in delays in receiving full ethics clearance.

We suggest reviewing your application with the Checklist For Ethics Review of Human Research

Applications
to minimize any required revisions and avoid common errors/omissions.

INVESTIGATORS' AGREEMENT

I have read the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans, 2nd Edition (TCPS2) and agree to comply with the principles and articles outlined in the TCPS2. In the case of student research, as Faculty Supervisor, my signature indicates that I have read and approved this application and the thesis proposal, deem the project to be valid and worthwhile, and agree to provide the necessary supervision of the student.

NEW As of May 1, 2013, all UW faculty and staff listed as investigators must complete the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Tutorial, 2nd Ed. (TCPS2) prior to submitting an ethics application. Each investigator is to indicate they have completed the TCPS2 tutorial. If there are more than two investigators, please attach a page with the names of each additional investigator along with their TCPS2 tutorial completion information.

Print and Signature of Principal Investigator/Supervisor

Date

Completed TCPS2 tutorial:
 YES NO In progress

Print and Signature of Principal Investigator/Supervisor

Date

Completed TCPS2 tutorial:
 YES NO In progress

Each student investigator is to indicate if they have completed the Tri-Council Policy Statement, 2nd Edition Tutorial (<http://pre.ethics.gc.ca/eng/education/tutorial-didacticiel/>). If there are more than two student investigators, please attach a page with the names of each additional student investigator along with their TCPS2 tutorial completion information.

Signature of Student Investigator

Date

Completed TCPS2 tutorial:
 YES NO In progress

Signature of Student Investigator

Date

Completed TCPS2 tutorial:
___YES ___NO ___ In progress

FOR OFFICE OF RESEARCH ETHICS USE ONLY:

Maureen Nummelin, PhD
Chief Ethics Officer
OR
Julie Joza, MPH
Senior Manager, Research Ethics
OR
Sacha Geer, PhD
Manager, Research Ethics

Date

ORE 101
Revised August 2003

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Appendix 4: New analysis on relationships between My Goals user demographics and types of goals set with the My Goals feature

Sex	<p>Females were significantly (p<0.05) more likely to set goals related to...</p> <ul style="list-style-type: none"> • Activity • Planning/preparing food • Vegetables and fruit • When/where foods eaten • Night time eating • Psychological aspects of eating • <i>Weight loss, weight management/maintenance</i> 	<p>Male more significantly (p<0.05) more likely to set goals related to...</p> <ul style="list-style-type: none"> • Grain products • Breakfast • <i>Weight gain, body composition</i>
Age (with increasing age)	<p>Significantly (p<0.05) less likely to set goals related to...</p> <ul style="list-style-type: none"> • Activity • Eating out • Breakfast • <i>Body composition</i> 	<p>Significantly (p<0.05) more likely to set goals related to...</p> <ul style="list-style-type: none"> • Grain products • Meat and alternatives • When/where foods eaten and night-time eating • Portion control • Calorie/food intake • Alcohol • Eat less of certain nutrients • Self-monitoring • <i>Weight loss, being healthier, disease management, weight management/maintenance</i>
BMI (with increasing BMI)	<p>Significantly (p<0.05) less likely to set goals related to...</p> <ul style="list-style-type: none"> • Vegetables/fruit • Milk products • Meat and alternatives • Eating more nutrients • <i>Weight gain, body composition</i> 	<p>Significantly (p<0.05) more likely to set goals related to...</p> <ul style="list-style-type: none"> • Activity • Eating out • Breakfast • When/where food eaten • Portion control • Self-monitoring • <i>Weight loss</i>
Activity	<p>Significantly (p<0.05) related to goals for... activity, vegetables and fruit, meat and alternatives, breakfast, when/where food is eaten, eating more nutrients, <i>fitness, weight management/maintenance</i></p>	
Pregnant	<p>Significantly (p<0.05) less likely to set goals related to...</p> <ul style="list-style-type: none"> • Activity • <i>Weight loss</i> 	<p>Significantly (p<0.05) more likely to set goals related to...</p> <ul style="list-style-type: none"> • Milk and alternatives

Ready-made and write your own goals were grouped together into fewer topic areas. Goals in *italics* are write your own goas that were outcome goals; other goals were behaviour-based.

Analysis encompassed multivariate binary logistic regression with goal type as the dependent variable (set goal type, did not set goal type). Sex, age, BMI, pregnancy, breastfeeding, and self-reported activity were independent variables. Analysis was conducted with SPSS version 23. Analysis included n=7,979 users as it excluded n=88 users who had either an implausible BMI or an unspecified activity level.

Appendix 5: Evaluation of the My Goals feature of eaTracker® and ERO supports: information letters and consent forms

My Goals User Information Letter



200 University Avenue West, Waterloo, ON, Canada N2L 3G1
519 888 4557 | fax 519 746 2510 | chs.uwaterloo.ca/sphhs

Date

Dear [name of participant]:

RE: Evaluation of the EatRight Ontario My Goals Feature of eaTracker

This letter is an invitation to participate in a study I am conducting as part of my PhD in the School of Public Health and Health Systems at the University of Waterloo under the supervision of Professor Rhona Hanning. I would like to provide you with more information about this project and what your involvement would entail if you decide to take part.

Dietitians of Canada's eaTracker (<http://www.eatracker.ca/>) is a web-based program that allows members of the public in Canada (and abroad) to track their eating and physical activity behaviours and compare them to guidelines (including those released by Health Canada). Because goal setting is a common and key technique used to help individuals modify their eating and/or physical activity behaviours, eaTracker also has a feature called "My Goals" whereby users can choose goals from a list of ready-made goals and/or have the option to write their own goals. This feature also allows users to keep a self-reported record of whether their goals have been met or not. In January 2013, EatRight Ontario launched new additions to the My Goals feature for Ontario users. Ontario users now have the option to receive weekly motivational messages and the opportunity to consult with a EatRight Ontario Registered Dietitian to help them choose their goals and to discuss progress in meeting goals when using the My Goals feature.

This research study will involve evaluating the My Goals feature and the recent EatRight Ontario additions. We are interested in describing client perspectives on the content, services and functionality of the My Goals feature, with an emphasis on the role (and potential role) of motivational messages and the ability to consult with a Registered Dietitian. Specifically, we are interested in understanding what works well for you, what does not work well for you, how you use this feature, and any suggestions you may have to make it better to support achievement of your healthy eating and/or physical activity goals.

Because you have recently used the eaTracker My Goals feature, we want to learn from you.

Participation in this study is voluntary. This project will involve a one-on-one interview of approximately one hour in length to take place by phone (or Skype/FaceTime/Google Hangouts etc), or in-person at mutually agreed upon location. You may decline to answer any of the interview questions if you so wish. Further, you may decide to withdraw from this study at any time without any negative consequences, by advising the researcher. With your permission, the interview will be audio recorded to facilitate collection of information. We may also ask you to show us how you interact with eaTracker and the My Goals feature, with your permission. All information you provide is considered completely confidential. Your name will not appear in any thesis, report or presentation resulting from

this study, however, with your permission anonymous quotations may be used. Data collected during this study will be retained for 7 years in a locked office in my supervisor's lab. Only researchers associated with this project will have access. There are no known or anticipated risks to you as a participant in this study.

Remuneration: In appreciation for your time in participating in this study, you will receive a copy of a Dietitians of Canada cookbook.

If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please contact me at 1-519-888-4567 ext. 37031 or by email at jliefers@uwaterloo.ca. You can also contact my supervisor, Professor Rhona Hanning at 1-519-888-4567 ext. 35685 or by email at rhanning@uwaterloo.ca.

I would like to assure you that this study has been reviewed and received ethics clearance through the University of Waterloo Office of Research Ethics. However, the final decision about participation is yours. If you have any comments or concerns resulting from your participation in this study, please contact Dr. Maureen Nummelin in the Office of Research Ethics at 1-519-888-4567, ext. 36005 or maureen.mummelin@uwaterloo.ca.

The information obtained from this project will help to understand the effectiveness of and how people use the My Goals feature and the new EatRight Ontario additions to this feature, and how to make them better. These findings will also be helpful for practitioners who want to better help their clients to achieve their goals using web-based tools. Furthermore, these results will also be of interest to government, organizations (including EatRight Ontario and Dietitians of Canada), and industry to develop more effective electronic healthy eating and/or physical activity behaviour change tools (especially goal setting tools) and supports to be used alongside these tools. These findings will also be used to develop a survey for My Goals users to further evaluate this feature.

Thank you in advance for your assistance in this project.

Yours Sincerely,

Jessica Liefers MSc RD
PhD Student
School of Public Health and Health Systems
University of Waterloo

EatRight Ontario Dietitian Information Letter



260 University Avenue West, Waterloo, ON, Canada N2L 3G1
519 888 4557 | fax 519 746 2510 | chs.uwaterloo.ca/sphhs

DATE

Dear [name of potential participant]:

RE: Evaluation of the EatRight Ontario My Goals Feature of eaTracker

This letter is an invitation to participate in a study I am conducting as part of my PhD in the School of Public Health and Health Systems at the University of Waterloo under the supervision of Professor Rhona Hanning. I would like to provide you with more information about this project and what your involvement would entail if you decide to take part.

(For email recruitment only: If you could let me know if you are interested or are not interested in participating in this study by replying to this email, I would be most grateful.)

Dietitians of Canada's eaTracker (<http://www.eatracker.ca/>) is a web-based program that allows members of the public in Canada (and abroad) to track their eating and physical activity behaviours and compare them to guidelines (including those released by Health Canada). Because goal setting is a common and key technique used to help people modify their eating and/or physical activity behaviours, eaTracker also has a feature called "My Goals" whereby users can choose goals from a list of ready-made goals and/or have the option to write their own goals. This feature also allows users to keep a self-reported record of whether their goals have been met or not. In January 2013, EatRight Ontario launched new additions to the My Goals feature for Ontario users. Ontario users now have the option to receive weekly motivational messages and the opportunity to consult with an EatRight Ontario Registered Dietitian to help them choose their goals and to discuss progress in meeting goals when using the My Goals feature.

This research study will involve evaluating the My Goals feature, including the recent EatRight Ontario additions. As part of this evaluation, we are interested in understanding the experiences and perspectives of Dietitians of Canada/EatRight Ontario staff on this service and whether they have suggestions for other features/functions/improvements to help individuals to better achieve their healthy eating and/or physical activity goals. We are also interested in understanding the experiences of EatRight Ontario dietitians working with clients who are seeking assistance with goal setting and advice while they are trying to achieve their goals, and especially those clients who are using the My Goals feature/EatRight Ontario motivational messaging. We are also interested in understanding the thoughts and experiences that EatRight Ontario dietitians have on the process of providing motivational messaging to individuals who have written their own goals.

Participation in this study is voluntary. This project will involve a one-on-one interview of approximately one hour in length to take place by phone (or Skype/FaceTime/Google Hangouts, etc), or in-person at mutually agreed upon location. You may decline to answer any of the interview questions if you so wish. Further, you may decide to withdraw from this study at any time without any negative consequences, by advising the researcher. With

your permission, the interview will be audio recorded to facilitate collection of information. We may also ask you to show us how you interact with relevant software (e.g., the customized PEN program for ERO RDs) with your permission. All information you provide is considered completely confidential. Your name will not appear in any thesis, report or presentation resulting from this study; however, with your permission anonymous quotations may be used. Data collected during this study will be retained for 7 years in a locked office in my supervisor's lab. Only researchers associated with this project will have access. There are no known or anticipated risks to you as a participant in this study.

If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please contact me at 1-519-888-4567 ext. 37031 or by email at jliefers@uwaterloo.ca. You can also contact my supervisor, Professor Rhona Hanning at 1-519-888-4567 ext. 35685 or email rhanning@uwaterloo.ca.

I would like to assure you that this study has been reviewed and received ethics clearance through the University of Waterloo Office of Research Ethics. However, the final decision about participation is yours. If you have any comments or concerns resulting from your participation in this study, please contact Dr. Maureen Nummelin in the Office of Research Ethics at 1-519-888-4567, ext. 36005 or maureen.nummelin@uwaterloo.ca

Overall, the information obtained from this project will help to understand the effectiveness of and how people use the My Goals feature including new EatRight Ontario additions, and how to make them better. These findings will be helpful for practitioners who want to better help their clients to achieve their healthy eating and/or physical activity goals. Furthermore, these results will also be of interest to government, organizations (including EatRight Ontario and Dietitians of Canada), and industry to develop more effective electronic healthy eating and/or physical activity behaviour change tools (especially goal setting tools) and supports to be used alongside these tools. These findings may also be used to develop a survey for My Goals users to further evaluate this feature.

(For email recruitment only: Again, if you could indicate by email whether you are or are not interested in participating in this study, I would be most grateful.)

Thank you in advance for your assistance in this project.

Yours Sincerely,

Jessica Liefers MSc RD
PhD Student
School of Public Health and Health Systems
University of Waterloo
jliefers@uwaterloo.ca

My Goals User In-Person Consent Form



260 University Avenue West, Waterloo, ON, Canada N2L 3G1
519 888 4557 | fax 519 746 2510 | chs.uwaterloo.ca/sphhs

CONSENT FORM

By signing this consent form, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities

I have read the information presented in the information letter about a study being conducted by Jessica Lieffers under the supervision of Professor Rhona Hanning from the School of Public Health and Health Systems at the University of Waterloo. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

I am aware that I have the option of allowing my interview to be audio recorded to ensure an accurate recording of my responses. I am aware that I have the option of allowing researchers to observe me using eaTracker, but I am not required to do so.

In appreciation of my time given to the interview, I am aware that I will receive one Dietitians of Canada cookbook.

I am aware that excerpts from the interview may be included in reports, thesis, presentations and/or publications resulting from this research, with the understanding that the quotations will be anonymous.

I was informed that I may withdraw my consent at any time without penalty by advising the researcher.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I was informed that if I have any comments or concerns resulting from my participation in this study, I may contact Maureen Nummelin, the Director for the Office of Research Ethics at 519-888-4567 ext. 36005 or at maureen.nummelin@uwaterloo.ca.

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

YES NO

I agree to have my interview audio recorded.

YES NO

I agree to let researchers observe me interacting with eaTracker.

YES NO Not Applicable

I agree to the use of anonymous quotations in any report, thesis, presentation and publication that comes from this research.

YES NO

Participant Name: _____ (Please print)

Participant Signature: _____

Witness Name: _____ (Please print)

Witness Signature: _____

Date: _____

EatRight Ontario In-Person Dietitian Consent Form



260 University Avenue West, Waterloo, ON, Canada N2L 3G1
519 888 4557 | fax 519 746 2510 | chs.uwaterloo.ca/sphhs

CONSENT FORM

By signing this consent form, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities

I have read the information presented in the information letter about a study being conducted by Jessica Lieffers under the supervision of Professor Rhona Hanning from the School of Public Health and Health Systems at the University of Waterloo. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

I am aware that I have the option of allowing my interview to be audio recorded to ensure an accurate recording of my responses. I am aware that I have the option of allowing researchers to observe me using software and databases relevant to this study (e.g., PEN customized software for ERO RDs), but I am not required to do so.

I am aware that excerpts from the interview may be included in reports, thesis, presentations and/or publications resulting from this research, with the understanding that the quotations will be anonymous.

I was informed that I may withdraw my consent at any time without penalty by advising the researcher.

This project has been reviewed by, and received ethics clearance through, the Office of Research Ethics at the University of Waterloo. I was informed that if I have any comments or concerns resulting from my participation in this study, I may contact Maureen Nummelin, the Director for the Office of Research Ethics at 519-888-4567 ext. 36005 or at maureen.nummelin@uwaterloo.ca.

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

YES NO

I agree to have my interview audio recorded.

YES NO

I agree to let researchers observe me interacting relevant software/databases (e.g., customized PEN program for ERO RDs).

YES NO Not Applicable

I agree to the use of anonymous quotations in any report, thesis, presentation and publication that comes from this research.

YES NO

Participant Name: _____ (Please print)

Participant Signature: _____

Witness Name: _____ (Please print)

Witness Signature: _____

Date: _____

My Goals User Telephone and Online Consent Form



200 University Avenue West, Waterloo, ON, Canada N2L 3G1
519 888 4557 | fax 519 746 2510 | chs.uwaterloo.ca/sphhs

TELEPHONE/ONLINE (e.g., Skype/FaceTime/Google Hangouts)

CONSENT FORM

Participant ID: _____

By consenting to this study, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities

Have you had the opportunity to read the information presented in the information letter about a study being conducted by Jessica Lieffers under the supervision of Professor Rhona Hanning from the School of Public Health and Health Systems at the University of Waterloo?

YES NO

Have you have had the opportunity to ask any questions related to this study, to receive satisfactory answers to your questions, and any additional details you wanted.

YES NO

Are you aware that in appreciation of your time given for the interview, you will receive one Dietitians of Canada cookbook.

YES NO

Were you informed that you may withdraw consent at any time without penalty by advising the researcher.

YES NO

Are you aware this project has been reviewed by, and received ethics clearance through the Office of Research Ethics at the University of Waterloo?

YES NO

Have you been informed that if you have any comments or concerns resulting from your participation in this study, that you may contact Maureen Nummelin, the Director for the Office of Research Ethics at the University of Waterloo whose contact information is available on the information letter.

YES NO

With full knowledge of all foregoing, do you agree, with your own free will, to participate in the interview.

YES NO

Do you agree to have your interview audio recorded?

YES NO

Do you agree to the use of anonymous quotations in any report, thesis, presentation and publication that comes from this research.

YES NO

Name of Researcher Obtaining Consent: _____ (Please print)

Signature of Researcher Obtaining Consent: _____

Date: _____

EatRight Ontario Dietitian Telephone/Online Consent Form



260 University Avenue West, Waterloo, ON, Canada N2L 3G1
519 888 4557 | fax 519 746 2510 | chs.uwaterloo.ca/sphhs

TELEPHONE/ONLINE (e.g., Skype/FaceTime/Google Hangouts)

CONSENT FORM

Participant ID: _____

By consenting to this study, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities

Have you had the opportunity to read the information presented in the information letter about a study being conducted by Jessica Lieffers under the supervision of Professor Rhona Hanning from the School of Public Health and Health Systems at the University of Waterloo?

YES NO

Have you have had the opportunity to ask any questions related to this study, to receive satisfactory answers to your questions, and any additional details you wanted.

YES NO

Were you informed that you may withdraw consent at any time without penalty by advising the researcher.

YES NO

Are you aware this project has been reviewed by, and received ethics clearance through the Office of Research Ethics at the University of Waterloo?

YES NO

Have you been informed that if you have any comments or concerns resulting from your participation in this study, that you may contact Maureen Nummelin, the Director for the Office of Research Ethics at the University of Waterloo whose contact information is available on the information letter.

YES NO



With full knowledge of all foregoing, do you agree, with your own free will, to participate in the interview.

YES NO

Do you agree to have your interview audio recorded?

YES NO

Do you agree to the use of anonymous quotations in any report, thesis, presentation and publication that comes from this research.

YES NO

Name of Researcher Obtaining Consent: _____ (Please print)

Signature of Researcher Obtaining Consent: _____

Date: _____

Appendix 6: Evaluation of the My Goals feature of eaTracker® and ERO supports: pop-up box contents for eaTracker® recruitment

Wanted: Participants for an evaluation of the eaTracker My Goals feature

Tell us what works or doesn't work for you

Shape future developments with the My Goals feature

Help improve this service

The School of Public Health and Health Systems at the University of Waterloo is looking for volunteers to evaluate the eaTracker My Goals feature, including the recent additions available to Ontario users (e.g., motivational messaging and access to EatRightOntario Registered Dietitians to help you set your goals and discuss progress). We want to learn what does and does not work well for you, your experiences with and perceptions of the My Goals feature, which includes these recent additions, and your suggestions for improvements.

As a participant in this study, you would be asked to complete a one-on-one phone or in-person interview at a mutually agreed upon time/location that should take approximately one hour of your time.

In appreciation for your time, you will receive a free Dietitians of Canada cookbook.

Your responses are confidential.

For more information or to volunteer for this study, please contact Jessica Lieffers MSc RD from the School of Public Health and Health Systems at the University of Waterloo by email at jliefers@uwaterloo.ca or phone at **1-519-888-4567** ext. 37031 or by indicating your interest below.

This study has been reviewed by, and has received ethics clearance from the University of Waterloo Office of Research Ethics.

I am interested in participating in this study:

Yes (taken to next box to leave contact information)

No thanks (message will not appear again)

Later (will appear again next time they log on)

Thank you very much for your interest. Please list your name and contact information below. By listing your contact information below, you agree to be contacted by a member of the research team at the University of Waterloo to learn more about the study.

Name: _____
Email address: _____
Phone number: _____

I prefer to be contacted by:

Phone email

If you prefer to be contacted by phone, what is the best time for researchers to contact you?

morning afternoon evening

Appendix 7: Evaluation of the My Goals feature of eaTracker® and ERO supports: interview protocols

Interview Protocol for ERO My Goals Users (Ontario)

Anonymous Interviewee ID:

Interviewer:

Date of Interview:

Time of Interview:

Interview method (circle): In person Phone Online (Skype/FaceTime etc.)

Location (for in person interviews only):

Thank you very much for agreeing to participate in this study. The purpose of this project is to evaluate the eaTracker My Goals feature. The information obtained from this work will help to understand user experiences with and perceptions of this feature (including the new additions available from EatRight Ontario for Ontario users), and how to make it better. This study will also provide information to guide future modifications of the My Goals feature and development of similar types of tools.

I am going to be asking you questions about your experiences with and thoughts about the eaTracker My Goals feature and your thoughts on goal setting, motivational messaging and having access to EatRight Ontario Registered Dietitian support while setting goals and when working towards achieving your goals. This is a conversation more than anything and it should take up to 1 hour. (If joining by phone only: It would be useful to be near a computer and be logged into your eaTracker account to facilitate discussion.) Is it ok if I audiotape the interview? This will allow me to accurately capture what was said. Again, I want to stress that everything that you say here is confidential and will only be heard by members of the research team. You won't be identified personally. As well, if you are not comfortable answering any questions, please let me know and we can skip them. Likewise, if you do not want to continue the interview at any point, please let me know and we can stop. Do you have any questions before we begin?

Can you describe your thoughts on goal setting to help you make healthy eating and/or physical activity behaviour change?

Can you please tell me about your healthy eating and/or physical activity goals?

Can you describe your thoughts on web-based (or electronic) goal setting and tracking tools to help you to improve your healthy eating and/or physical activity behaviours?

Could you talk about the reasons behind your decision to use the eatTracker My Goals feature?

Possible follow-up questions: Could you tell me how you found out about the My Goals feature? How long have you been using the My Goals feature?

Can you please tell me about the goal(s) you are currently working towards (and/or have previously worked towards) using the My Goals feature?

Possible follow-up question: Could you tell me how you decided on your goals? Please explain.

With eaTracker open, can you please walk me through your typical use of the My Goals feature? I am interested in knowing your thoughts on different parts of the feature.

Ask about: usability/functionality of different program aspects, tracking goals outside of eaTracker?, frequency of use, suggestions for improvement.

Can you describe your experience using the My Goals feature to help you a) set goals and b) while working towards achieving your goals?

Possible follow-up questions: What has worked well for you? What has not worked well for you? Do you have any suggestions for improvements?

We are now going to shift our focus to discussing messaging as a tool to help you reach your goals.

Could you describe your thoughts on receiving weekly short electronic messages with tips (including recipes, website links) by email and website to help you meet your goals?

Possible discussion point: text messages/push messages to a smartphone

Have you received these types of messages from EatRight Ontario related to your goal?

If yes: What messages have you received?

How do you receive the messages? Are you satisfied with how they are provided?

Could you please discuss your thoughts on these messages?

Probe for: content, quality, relevance, length, whether they believe messages were helpful in reminding them about their goal & achieving their goals, types of messages that are most useful, usefulness of recipes and web pages, frequency.

Possible follow-up questions: What types of messages are and/or would be most helpful? What types of messages are not and/or would not be helpful?

Have you incorporated message content into your day-to-day life? Please explain.

On a scale of 1-10, how would you rate the quality of the EatRight Ontario messages? Please explain your ranking.

Do you have any suggestions to help improve messaging sent by EatRight Ontario?

EatRight Ontario also offers a free service whereby individuals can phone (toll-free call) or email a Registered Dietitian to ask nutrition related questions and receive nutrition advice. EatRight Ontario also has an extensive website with numerous nutrition resources available.

Did you know that EatRight Ontario Registered Dietitian support is available to help you a) choose your goals, and b) to discuss your progress when working towards your goals when using the My Goals feature? Have you used this service? If yes, how did you find out about this service?

If yes, how did you access this service? (toll-free call to RD, Email-a-RD, web site).

Could you please describe your experience with this service?

Possible follow-up questions: What worked well for you? What did not work well for you? Do you have any suggestions for improvement?

On a scale of 1 to 10, please rank the quality of the EatRight Ontario Registered Dietitian service that you received in conjunction with the My Goals feature. Please explain your ranking.

If no, could you describe reasons for not using this service?

Can you please describe your progress in meeting your goals?

Potential follow-up questions: Do you think it would be different if you did not have access to one or more of the EatRight Ontario components? What about no access to the My Goals tool? Please explain.

On a scale of 1-10, how would you rate the overall quality of the My Goals tool (with messaging) + EatRight Ontario Registered Dietitian support? Please explain your ranking.

Do you have any suggestions to help improve this service?

Would you recommend the My Goals feature (and EatRight Ontario Registered Dietitian support in conjunction with this feature) to others? Please explain.

Do you expect to use these services in the future? Please explain.

Possible follow-up question: Do you expect to use goal setting in the future?

Do you use any other tools/services to help you to set goals and/or to help you work towards achieving your goals?

If yes, what are these tools/services and can you tell me about your experiences.

If you could build a perfect tool/service to help people set goals and/or to help them achieve their healthy eating and/or physical activity goals, what would it look like?

Based on your experience with this service, is there anything that you want to say to:

- a) Eatright Ontario dietitians helping people to set goals and achieve their goals?
- b) Developers looking to improve the online My Goals feature or develop other similar tools?

Could you please classify your age into one of the following categories? 19-30y, 31-50y, 51-70y, 71+y.

Interview Closure

Is there anything else you would like to add?

I am very appreciative of the valuable information that you provided me today. It will go a long way in helping us to improve the My Goals feature and services offered alongside this tool. It will also help professionals, organizations, industry, and government to develop better tools and services to help people positively change their eating and physical activity behaviours.

Thank you again for completing the interview

Interview Protocol for Standard My Goals Users (Alberta)

Anonymous Interviewee ID:

Interviewer:

Date of Interview:

Time of Interview:

Interview method (circle): In person Phone Online (Skype/FaceTime etc.)

Location (for in person interviews only):

Thank you very much for agreeing to participate in this study. The purpose of this project is to evaluate the eaTracker My Goals feature. The information obtained from this work will help to understand user experiences with and perceptions of this feature (including some new additions available to Ontario users only), and how to make it better. This study will also provide information to guide future modifications of the My Goals feature and development of similar types of tools.

I am going to be asking you questions about your experiences with and thoughts about the eaTracker My Goals feature and your thoughts on goal setting, motivational messaging and having access to Registered Dietitian support while setting goals and when working towards achieving your goals. This is a conversation more than anything and it should take up to 1 hour. (If joining by phone only: It would be useful to be near a computer and be logged into your eaTracker account to facilitate discussion.) Is it ok if I audiotape the interview? This will allow me to accurately capture what was said. Again, I want to stress that everything that you say here is confidential and will only be heard by members of the research team. You won't be identified personally. As well, if you are not comfortable answering any questions, please let me know and we can skip them. Likewise, if you do not want to continue the interview at any point, please let me know and we can stop. Do you have any questions before we begin?

Can you describe your thoughts on goal setting to help you make healthy eating and/or physical activity behaviour change?

Can you please tell me about your healthy eating and/or physical activity goals?

Can you describe your thoughts on web-based (or electronic) goal setting and tracking tools to help you to improve your healthy eating and/or physical activity behaviours?

We are now going to shift the focus of our discussion to the eaTracker My Goals feature.

Could you talk about the reasons behind your decision to use the eaTracker My Goals feature?

Possible follow-up question: Could you tell me how you found out about the My Goals feature? How long have you been using the My Goals feature?

Can you please tell me about the goal(s) you are currently working towards (and/or have previously worked towards) using the My Goals feature?

Possible follow-up question: Could you tell me how you decided on your goals? Please explain.

With eaTracker open, can you please walk me through your typical use of the My Goals feature? I am interested in knowing your thoughts on different parts of the feature.

Ask about: usability/functionality of different program aspects, tracking goals outside of eaTracker?, frequency of use, suggestions for improvement.

Can you describe your experience using the My Goals feature to help you a) set goals and b) while working towards achieving your goals?

Possible follow-up questions: What has worked well for you? What has not worked well for you? Do you have any suggestions for improvements?

We are now going to shift our focus to discussing messaging as a tool to help you reach your goals.

Could you describe your thoughts on receiving weekly short electronic messages with tips (including recipes, website links) by email and a website like eaTracker to help you meet your goals?

Possible discussion point: text messages/push messages to smartphone

Could you please discuss what types of messages would be most helpful to you? Could you please discuss what types of messages would not be helpful to you?

EatRightOntario is a free service provided by Registered Dietitians to Ontario residents. Ontario users of the My Goals feature can receive additional features free of charge. The first addition is weekly motivational messages delivered via the eaTracker website. Users can also receive these messages by email. Here are some examples of messages that they currently receive [show them specific EatRight Ontario messages for goals relevant to them]. What do you think about this?

Possible follow-up question: Do you think this would be helpful to you? Please explain.

What are your thoughts on having access to free Registered Dietitian support (by phone, email, or website) to help you a) choose your goals and b) discuss your progress in meeting your goals when using the My Goals feature?

EatRight Ontario also offers a free service whereby individuals can phone (toll-free call) or email a Registered Dietitian to ask nutrition related questions and receive nutrition advice. EatRight Ontario also has an extensive website with numerous nutrition resources available to free of charge.

EatRightOntario Registered Dietitian support is also available to Ontario residents to help them choose their goals, and to discuss progress when working towards their goals when using the My Goals feature. What do you think about this?

Possible follow-up question: Do you think this would be helpful to you? Please explain. (Gather information about thoughts on assistance for goal setting vs. assistance while working towards their goals.)

Can you please describe your progress in meeting your goals?

Follow-up questions: Do you think it would be different if you had access to one or both of the EatRightOntario components? What about no access to the My Goals tool? Please explain.

On a scale of 1-10, how would you rate the overall quality of the My Goals feature? Please explain your ranking.

Do you have any suggestions to help improve the My Goals feature?

Would you recommend the My Goals feature to others? Please explain.

Do you expect to use the My Goals feature in the future? Please explain.

Possible follow-up question: Do you expect to use goal setting in the future?

Do you use any other tools/services to help you to set goals and/or to help you work towards achieving your goals?

If yes, what are these tools/services and can you tell me about your experiences.

If you could build a perfect tool/service to help people set goals and/or to help them achieve their healthy eating and/or physical activity goals, what would it look like?

Based on your experience with the My Goals tool, is there anything that you want to say to:

- a) Dietitians or other health professionals helping people to set goals and achieve their goals?
- b) Developers looking to improve the My Goals feature or to develop similar tools?

Could you please classify your age into one of the following categories? 19y-30y, 31y-50y, 51y-70y, 71+y.

Interview Closure

Is there anything else you would like to add?

I am very appreciative of the valuable information that you provided me today. It will go a long way in helping us to improve the My Goals feature and services offered alongside this tool. It will also help professionals, organizations, industry, and government to develop better tools and services to help people positively change their eating and physical activity behaviours.

Thank you again for completing the interview

Interview Protocol for EatRight Ontario Dietitians

Time of Interview:

Date:

Place:

Interviewer:

Anonymous Interviewee ID:

Thank you very much for agreeing to participate in this study. The purpose of this work is to evaluate the new eaTracker My Goals feature (including EatRight Ontario motivational messaging) launched by Dietitians of Canada and EatRight Ontario in Jan 2013. The information obtained from this work will help to better understand the effectiveness of this service and how to make it better. This study will also provide information to guide future modifications of the My Goals feature, EatRight Ontario motivational messaging, and other services offered alongside this feature and will help to guide the development of similar types of programs.

I am going to be asking you a series of questions about your thoughts on this new service and your experiences helping individuals to use this service. This is a conversation more than anything and it should take up to 1 hour. Is it ok if I audiotape the interview? Again, I want to stress that everything that you say here is confidential and will only be heard by members of the research team. As well, if you are not comfortable answering any questions, please let me know and we can skip them. Likewise, if you do not want to continue the interview at any point, please let me know and we can stop. Do you have any questions before we begin?

Could you please describe your job with Dietitians of Canada/EatRight Ontario?

Possible topics to ask about: Types of clients (callers) who they help in their position

Can you describe your thoughts on goal setting as a tool to help people make nutrition and/or physical activity behaviour change?

Do you recommend healthy eating and/or physical activity behaviour change goal setting to your clients (or callers)? Please explain your answer.

Possible follow-up questions:

How often do you recommend healthy eating and/or physical activity behavior goal setting in your practice as an EatRight Ontario Registered Dietitian?

In what situations/with what type of client (or caller) questions do you use goal setting?

Can you describe the process of helping your clients (or callers) to set healthy eating and/or physical activity behaviour change goals?

What types of strategies do you use with your clients (or callers) to help them achieve their goals?

What type of follow-up do you have with these clients?

We are going to be talking about the EatRight Ontario enhanced My Goals feature. This is a package of three different components (the eaTracker My Goals feature (which has some enhancements for Ontario users), motivational messaging sent by EatRight Ontario, and the ability for individuals to interact with an EatRight Ontario Registered Dietitian to receive assistance with goal setting and while working towards achieving their goals) that individuals can use to help them to meet their healthy eating and/or physical activity goals. We will first discuss each component individually and then together as a package.

We will begin with the eaTracker My Goals feature.

What are your thoughts on electronic (or web based) nutrition and physical activity goal setting and tracking tools to help people make nutrition and/or physical activity behaviour change?

eaTracker has a goal setting and tracking tool called My Goals. Are you familiar with this feature? (Show if not familiar)

What are your thoughts on the eaTracker My Goals feature?

Possible topics to ask about: usability/navigation/functionality, setting goals (ready-made goals/write your own goals, SMART goal instructions), My Goals Tracker, Manage My Goals, My Success, what works well, what does not work well, suggestions for improvement

The second component of this new EatRight Ontario enhanced My Goals feature is motivational messaging. EatRight Ontario is now sending out weekly short electronic messages with tips, recipes, and website links by email and website (My Messages tab on eaTracker) to help people meet their healthy eating and physical activity goals.

Were you aware that EatRight Ontario was sending out these messages? (if not, show them the messages)

What are your thoughts on these messages?

Possible topics to ask about: content, quality, relevance, length, frequency, whether they believe messages are helpful in reminding individuals about their goal & achieving their goals, frequency, look and feel of the email.

Possible follow-up questions: What types of messages are helpful? What types of messages are not helpful? Do you have any thoughts on how to improve these messages?

As of this point, messages for ready-made goals are sent automatically via eaTracker to clients; however, messages sent for write your own goals are manually sent by EatRight Ontario Registered Dietitians. Messages that are for the ready-made goals are tailored to the goal, whereas messages that are sent for the write your own goals are less tailored for the goal. What do you think about this?

Do you have experience sending motivational messages for My Goals users who are trying to achieve goals that they have written themselves (i.e., write your own goals) in eaTracker?

If **YES:** Could you describe your experiences writing and sending motivational messaging for My Goal users who are trying to achieve goals that they have written themselves? What is working well with this process? What is not working well (or what are the challenges) with this process? Do you have any suggestions to improve this process?

The third part of this package is that individuals can now use the EatRight Ontario toll-free call and email a RD services while setting goals and while working towards achieving their goals when using the eaTracker My Goals feature and the motivational messaging.

What are your thoughts on this?

Have you ever recommended the eaTracker My Goals feature (with motivational messaging) to clients (or callers) who you are helping set goals by phone or over email? Please describe reasons for your answer.

Possible topics to ask about: frequency, types of clients who you recommend or do not recommend using the My Goals feature/messaging, how the My Goals feature/messaging is introduced to clients, client reaction to the My Goals tool/messaging

Have you ever had a client ask you for assistance while working towards their goals when using the eaTracker My Goals feature/EatRight Ontario motivational messages?

Possible topics to ask about: frequency, information about these clients (similar or different compared to other clients), types of goals set, experience clients have with this system, types of guidance provided, experiences of providing guidance to these clients.

From your perspective, what is working well with the process of having EatRight Ontario Registered Dietitians working with clients who would potentially use the My Goals feature/motivational messaging and who are already using the My Goals feature/motivational

messaging? (Note: could be split into 2 separate questions) What is not working well? Do you have any suggestions on how to improve this service?

We are now going to discuss the whole package (eaTracker My Goals feature, EatRight Ontario motivational messaging, and EatRight Ontario Registered Dietitian support) as a tool to help people make healthy eating and/or physical activity behavior change.

What are your thoughts on this overall package?

Possible follow-up questions/topics: What is working well? What is not working well? Do you have any suggestions on how to improve this service package?

Do date, we have interviewed several users who have set goals with the My Goals tool and have signed up for the EatRight Ontario motivational messages and examined eaTracker database data on My Goals tool use. We wanted to get your thoughts on a couple of key findings that have come out of these interviews and data analysis.

Most of the individuals we have interviewed are not using the My Goals tracker to track their goals and this is also evident from the data that is available from the eaTracker database. What do you think about this? Is this surprising? Do you have any suggestions on how improvements could be made?

None of the participants who we have interviewed reported using EatRight Ontario Registered Dietitian services in conjunction with the My Goals tool/motivational messaging. What do you think about this? Does this surprise you? Do you have any suggestions on how improvements could be made?

If you could build your perfect web-based tool/service to help people meet their diet and/or physical activity goals, what would it look like?

Based on your experience with this combined service, is there anything that you would like to say to:

- c) developers looking to build tools to help people meet their healthy eating and/or physical activity goals?
- d) researchers/program planners helping to design programs to help people to better meet their healthy eating and physical activity goals

Do you have anything that you would like to add?

I am very appreciative of the valuable information that you provided me today. It will go a long way in helping us to understand the effectiveness of this service. It will also be useful for organizations, industry, and government to develop effective programs to help people meet their healthy eating and/or physical activity goals.

Thank you again for completing the interview

Appendix 8: Evaluation of the My Goals feature of eaTracker® and ERO supports: feedback letter



200 University Avenue West, Waterloo, ON, Canada N2L 3G1
519-888-4557 | fax 519-746-2510 | chs.uwaterloo.ca/SPHS

Title: Evaluation of the EatRight Ontario My Goals Feature of eaTracker

Thank you for participating in this research study. As a reminder, the purpose of this study is to evaluate the eaTracker My Goals feature, including the new additions recently launched by EatRight Ontario for Ontario users. This study will also provide information to guide future modifications of the My Goals feature and development of similar types of tools. These findings will also help professionals, organizations, industry, and government to develop better tools and services to help people positively change their eating and physical activity behaviours. Furthermore, study results will also be used to develop a survey to further evaluate the My Goals feature. Those who provide input do not have any proprietary rights to any products developed by EatRight Ontario, Dietitians of Canada, and the University of Waterloo.

Following all data collection and analysis, this information will be shared with Dietitians of Canada and EatRight Ontario, and the broader research and health professional community through conference presentations, seminars, and journal articles.

The researchers conducting this study are:

Jessica Liefers MSc RD
PhD Student

Rhona Hanning PhD RD FDC
Associate Professor

School of Public Health and Health Systems
University of Waterloo
200 University Avenue NW
Waterloo, Ontario, N2L 3G1

Phone: 1-519-888-4567, ext. 35685

Email: jliefers@uwaterloo.ca or rhanning@uwaterloo.ca

Please do not hesitate to contact the researchers if you have any questions about this study or if you are interested in obtaining a copy of the results. The results are expected to be available by March 1, 2014.

This project has been reviewed by, and received ethics clearance through the University of Waterloo Office of Research Ethics. In the event you have any comments or concerns resulting from your participation in this study, please contact Dr. Maureen Nummelin, Director of the Office of Research Ethics at 1-519-888-4567, ext. 36005 or by email at maureen.nummelin@uwaterloo.ca

Appendix 9: Experiences and perceptions of adults accessing publicly available nutrition behaviour change mobile apps for weight management: application for ethics review

APPLICATION FOR ETHICS REVIEW OF RESEARCH INVOLVING HUMAN PARTICIPANTS

Please remember to **PRINT AND SIGN** the form and **forward with all attachments** to the Office of Research Ethics, Needles Hall, Room 1024.

A. GENERAL INFORMATION

1. Title of Project: Experiences and perceptions of adults accessing commercial diet or diet and physical activity behavior change mobile device apps for weight management

2. a) Principal and Co-Investigator(s)

NEW As of May 1, 2013, all UW faculty and staff listed as investigation must complete the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Tutorial, 2nd Ed. (TCPS2) prior to submitting an ethics application. The tutorial takes at least three hours; it has start and stop features.

Name	Department	Ext:	e-mail:
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2. b) Collaborator(s)

NEW As of May 1, 2013, all UW faculty and staff listed as investigation must complete the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Tutorial, 2nd Ed. (TCPS2) prior to submitting an ethics application. The tutorial takes at least three hours; it has start and stop features.

Name	Department	Ext:	e-mail:
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3. Faculty Supervisor(s)

NEW As of May 1, 2013, all UW faculty and staff listed as investigation must complete the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Tutorial, 2nd Ed. (TCPS2) prior to submitting an ethics application. The tutorial takes at least three hours; it has start and stop features.

Name	Department	Ext:	e-mail:
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Rhona Hanning	Health Studies & Gerontology Propel Centre for Population Health Impact	35685	rhanning@uwaterloo.ca
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Jose Arocha Health Studies & Gerontology 32729 jfarocha@uwaterloo.ca

4. Student Investigator(s)

Name	Department	Ext:	e-mail:	Local Phone #:
Jessica Lieffers	Health Studies & Gerontology	37031	jlieffers@uwaterloo.ca	780-490-8480

5. Level of Project: PhD **Specify Course:**

Research Project/Course Status: New Project\Course

6. Funding Status (If Industry funded and a clinical trial involving a drug or natural product or is medical device testing, then Appendix B is to be completed):

Is this project currently funded? Yes

- If Yes, provide Name of Sponsor and include the title of the grant/contract: Other : Canadian Foundation for Dietetic Research, Title: Experiences and perceptions of adults accessing commercial diet or diet/physical activity behavior change mobile device apps for weight management
- If No, is funding being sought OR if Yes, is additional funding being sought? Not Answered
- Period of Funding: 2013-2014

7. Does this research involve another institution or site? No

If Yes, what other institutions or sites are involved:

8. Has this proposal, or a version of it, been submitted to any other Research Ethics Board/Institutional Review Board? No

9. For Undergraduate and Graduate Research:

Has this proposal received approval of a Department Committee? Not Dept. Req.

10. a) Indicate the anticipated commencement date for this project: 11/1/2013

b) Indicate the anticipated completion date for this project: 11/1/2014

11. Conflict of interest: Appendix B is attached to the application if there are any potential, perceived, or actual financial or non-financial conflicts of interest by members of the research team in undertaking the proposed research.

B. SUMMARY OF PROPOSED RESEARCH

1. Purpose and Rationale for Proposed Research

a. Describe the purpose (objectives) and rationale of the proposed project and include any hypothesis(es)/research questions to be investigated. For a non-clinical study summarize the proposed research using the headings: Purpose, Aim or Hypothesis, and Justification for the Study. For a clinical trial/medical device testing summarize the research proposal using the following headings: Purpose, Hypothesis, Justification, and Objectives.

Where available, provide a copy of a research proposal. For a clinical trial/medical device testing a research proposal is required:

Mobile devices (e.g., smartphones) and their applications (“apps”) have recently become mainstream. As of March 2012, 48% of Canadian mobile phone users used smartphones, 70% of whom had downloaded an app (Quorus Consulting Group, Canadian Wireless Telecommunications Association). Of interest for dietitians are the numerous commercial nutrition/food apps (e.g., diet self-monitoring) that have become easily accessible from app shops (e.g., Apple App Store). We recently found using a survey advertised to all Dietitians of Canada members that apps are also now infiltrating dietetic practice; overall, >50% of practicing dietitian respondents reported having had a client ask them about or use a nutrition/food app (Lieffers et al, in Press, Can J Diet Pract Res).

Although many types of nutrition/food apps are available, those for diet and diet/physical activity behavior change (e.g., diet self-monitoring) have received substantial attention, and especially for use as a weight loss tool. In addition, the dietitian respondents to our survey reported that clients who commonly asked about or used nutrition/food apps were mainly interested in overweight/obesity/weight loss. Diet and diet/physical activity behavior change apps can provide interactive tailored info, feedback and support when and where behaviors occur and can be accessed round-the-clock on an ongoing basis. To date, peer-reviewed articles have focused on the effectiveness of previous generation apps, specifically those for diet or diet/physical activity self-monitoring compared to traditional approaches (e.g., paper records) usually in a weight management setting. This research finds that app use resulted in more or equivalent anthropometric (e.g., weight loss) and/or diet behavior changes compared to traditional approaches. However, these studies also found that adherence could vary by user and decreased over time. This is also true of monitoring and adherence to diet change in general, and may have been a function of the limitations of previous electronic interfaces. Nevertheless, there are very few data about user experiences with and perceptions of using such apps, why usage drops over time, why some people have more success than others, and the utility of specific features. Currently there is a large push to develop apps rather than understanding these topics. Without this info, apps will likely not be used to their full potential.

Although available research supports the efficacy of diet and diet/physical activity behavior change apps for weight management, recent increases in app popularity and availability, and the high prevalence of excess body weight in the Canadian adult population makes it timely to more fully understand user experiences of and perceptions with this tool for weight management. This information will help us to better understand when and how to best use this tool, and will support future development of credible, user-friendly, and effective apps for use in dietetic practice.

Goal: To explore client experiences with and perceptions of current apps to support diet or diet/physical activity behavior change for weight management in order to identify what

works (or does not work), with whom and under what conditions.

Main objective: To conduct a thematic analysis of user experiences and perceptions with current apps to support diet or diet/physical activity behavior change for weight management

Sub-objectives:

- To identify how individuals choose these types of apps
- To describe how apps are used by individuals in their normal environment
- To determine factors associated with adherence and lack of adherence to use of different app components (e.g., diet self-monitoring, social support)
- To describe factors that influence satisfaction and dissatisfaction with app use
- To characterize experiences and perceptions by sex in order to explore potential differences

b. In lay language, provide a one paragraph (approximately 100 words) summary of the project including purpose, the anticipated potential benefits, and basic procedures used.

Mobile device apps are gaining interest as a diet (and physical activity) behavior change tool for weight management. Previous research finds these apps, and specifically those for behavior self-monitoring, may be associated with better weight loss/diet behavior change outcomes compared to conventional methods. However, this work suggests that app adherence may be problematic, and may have low satisfaction rates. Importantly, little research has been done to understand experiences and perceptions of individuals using apps for this purpose. This research will explore experiences/perceptions of individuals using current commercial diet or diet/physical activity behavior change apps for weight management in order to identify what works (or does not work), with whom and under what conditions. One-on-one semi-structured interviews will be carried out in adults who have used apps for this purpose. Ultimately, these findings will provide individuals/populations with better apps and guidance on how to best use them to increase success in weight management.

C. DETAILS OF STUDY

1. Methodology/Procedures

a. Indicate all of the procedures that will be used. Append to form 101 a copy of all materials to be used in this study.

Interview(s) (in person)
Interview(s) (by telephone)
Focus group(s)
Audio-recording
Unobtrusive observations

b. Provide a detailed, sequential description of the procedures to be used in this study. For studies involving multiple procedures or sessions, provide a flow chart. Where applicable, this section also should give the research design (e.g., cross-over design, repeated measures design).

Semi-Structured Interviews

All participants will be interviewed one-on-one and face-to-face using semi-structured interviews by a dietitian graduate student trained in qualitative data collection at a place and time that is appropriate, comfortable, and without disturbance for both individuals. Interviews will be done in-person as they allow participant body language to be observed which may help to better understand the phenomenon of interest. The semi-structured interviews will be guided by an interview protocol with open-ended questions designed to address the research objectives (see attachments for the protocol). Clarifying and elaborating probes will be used to gather additional data. Probes will also help to clarify information and findings that may be unanticipated.

All interviews will be audio taped using two digital voice recorders and notes will be taken during the interview on the interview protocol form in case of technology failure. Field notes will be taken immediately following each interview; both descriptive field notes and reflective field notes will be taken. A transcriptionist, who will be required to sign a confidentiality agreement (see attachments), will transcribe all interviews verbatim following each interview. Any names or other identifying locations mentioned in the interview will be anonymized in the transcripts.

Document/Application Analysis

As many apps have the ability record and store data, if applicable, participants will be asked if researchers can view the information that is stored in the application memory. With participant permission, photographs or screen shots may be taken. In addition, advertisement information, online videos about the app (e.g., YouTube videos) and instructions for the app will also be collected from sources such as app company websites and app shops (e.g., Apple App Store, No). The PI also will download (and purchase, if necessary) apps used by participants so that they can be closely examined to better understand the interview content.

Memos

Memos will be written throughout the entire study to document the research process and to provide a venue to capture researcher reflections and ideas/thoughts.

Focus Groups

Focus groups will be used for member checking. Ten random study participants will be invited back to the University of Waterloo following their interviews to participate in a focus group after preliminary data analysis is complete. Participants will be shown themes and asked to comment whether they believe the findings are correct and whether there is any

missing information. The focus groups will be conducted using established procedures and will be audio recorded and transcribed.

c. Will this study involve the administration/use of any drug, medical device, biologic, or natural health product? No

2. Participants Involved in the Study

a. Indicate who will be recruited as potential participants in this study.

UW Participants:

Undergraduate students
Graduate students
Faculty and/or Staff

Non-UW Participants:

Adults
Seniors

b. Describe the potential participants in this study including group affiliation, gender, age range and any other special characteristics. Describe distinct or common characteristics of the potential participants or a group (e.g., a group with a particular health condition) that are relevant to recruitment and/or procedures. Provide justification for exclusion based on culture, language, gender, race, ethnicity, age or disability. For example, if a gender or sub-group (i.e., pregnant and/or breastfeeding women) is to be excluded, provide a justification for the exclusion.

Community-based advertising will be used to recruit a minimum of 30 participants (15 males, 15 females) to the study who are using or have recently used diet or diet/physical activity behavior change mobile device apps for management of overweight/obesity. Individuals must be >18 years of age, have a BMI \geq 25 based on self-reported height and weight at the time of initiation of app use, be free from self-reported chronic diseases (e.g., diabetes, cancer, cardiovascular disease, renal disease), and have not undergone bariatric surgery. However, individuals can be included if they have self-reported chronic disease risk factors (e.g., high blood cholesterol). Individuals must also be willing to participate in an interview lasting ~1hr, can speak, read, and write in English and are able to provide written informed consent. The sample will be chosen from Waterloo, Kitchener, Cambridge, and Guelph (and surrounding areas), ON residents and Edmonton and surrounding area, AB residents.

We will select individuals who have used various types of apps for diet or diet/physical activity behavior change (e.g., diet/exercise self-monitoring, menu planning, etc.). Eligible diet or diet/physical activity behavior change apps must have been downloaded from an app shop (e.g., Google Play, Apple App Store) and could include those for smartphones (e.g., iPhone, BlackBerry, Android, Windows Phone devices), tablets (e.g., Apple iPad, BlackBerry Playbook, Android, Windows) and/or the iPod touch. However, individuals using fad diet apps or apps to follow diets <1200kcal will be excluded because these plans may be extremely difficult to follow and/or have safety concerns. Moreover, individuals who have only used exercise or physical activity apps for weight management will also be excluded.

To be eligible to participate in the study, individuals must have used the diet or diet/physical activity behavior change app repeatedly (i.e., most days) for at least one week to make sure that they had given it a good try before stopping and within the last three months to

ensure that they have a recent memory of the experience. Of note, one week would be the absolute minimum amount of time for use; we want to select individuals who have used them for variable and usually longer amounts of time. We only expect to have a couple of participants who have used them for around one week.

Both purposeful and maximal variation sampling will be used to choose participants who have had both experience and diverse experiences with diet or diet/physical activity behavior change apps. For each gender, we aim to select a range of user experiences with apps. Hence, at recruitment, individuals will be asked to self-rate their perceived success in meeting diet/physical activity behavior change and/or weight management goals with apps. Five individuals with rankings in each of poor, moderate and strong will be chosen for each gender.

c. How many participants are expected to be involved in this study? For a clinical trial, medical device testing, or study with procedures that pose greater than minimal risk, sample size determination information is to be provided.

We expect to have 15 male participants and 15 female participants.

3. Recruitment Process and Study Location

a. From what source(s) will the potential participants be recruited?

Other UW sources: Grad Studies mailing list, various staff/student mailing lists at UW, posters in public locations around UW (e.g., Student Life Centre)

KW residential community

Businesses, industries

Health care settings, nursing homes etc.

Online classifieds (e.g., kijiji, craigslist), local newspapers (e.g., The Record, Guelph Mercury), Social Media (e.g., Facebook, Twitter), posters in community locations (e.g., community centers, doctors offices), Waterloo Region Dietitians mailing list, UW Daily Bulletin

b. Describe how and by whom the potential participants will be recruited. Provide a copy of any materials to be used for recruitment (e.g. posters(s), flyers, cards, advertisement(s), letter(s), telephone, email, and other verbal scripts).

The recruitment process will be led by the student researcher conducting this study.

Recruitment will occur through several channels, which will include poster, print and online advertisements. Waterloo Region dietitians will be informed about the study via their listserv and encouraged to place posters in their worksite and to inform and refer any appropriate clients to the study; posters will also be placed in community locations (e.g., community centers, doctors offices). An article will be posted in the University of Waterloo daily bulletin, and ads will be placed on classified websites (e.g., Kijiji, Craigslist), social media websites (e.g., Facebook, Twitter), and workplace listservs. Word of mouth advertising will also likely be used as participants inform their friends about the study. Newspaper advertisements (e.g., Waterloo Region Record) may also be used depending on the response from other recruitment methods. A sample recruitment poster is attached. We will also advertise on the University of Waterloo campus (e.g., grad studies e-mail list); however, we will ensure that we have many participants who are not affiliated with UW to ensure that we have a representative sample. On all recruitment materials, the email and phone number of the student researcher will be provided. Individuals will be invited to either email or phone the researcher if they are interested in the study. The researcher will provide the information letter by email or verbally read it over the phone. Participants who are still interested after

this point will be asked a series of screening questions (attached). After they are deemed to be eligible, they will be asked about what times and places would work for an interview and an interview will be booked.

c. Where will the study take place? On campus: Various locations in BMH, Lyle Hallman Centre for Health Promotion Off campus: Local coffee shops/restaurants, libraries, other public places (please note: no interviews will ever take place in participants homes for safety reasons)

4. Remuneration for Participants

Will participants receive remuneration (financial, in-kind, or otherwise) for participation? Yes

If Yes, provide details:

Participants will be provided with a copy of a Dietitians of Canada cookbook (value: ~\$30) for participating in the qualitative one-on-one interview. Participants who return for the focus group portion of the interview will be provided with a University of Waterloo water bottle.

5. Feedback to Participants

Describe the plans for provision of study feedback and attach a copy of the feedback letter to be used. Wherever possible, written feedback should be provided to study participants including a statement of appreciation, details about the purpose and predictions of the study, restatement of the provisions for confidentiality and security of data, an indication of when a study report will be available and how to obtain a copy, contact information for the researchers, and the ethics review and clearance statement. Feedback will be provided to interview participants immediately after they complete the study. These participants will be given a feedback letter immediately after they complete the interview. See attached.

The feedback letter will thank participants for their involvement, include details about the purpose of the study, provide the ethics review and clearance statement, and include researcher contact information should participants require further information. Please see the attachments for the participant feedback letter.

D. POTENTIAL BENEFITS FROM THE STUDY

1. Identify and describe any known or anticipated direct benefits to the participants from their involvement in the project.

There is no immediate direct benefit to participants.

However, the information learned from app users will help to understand how this tool is used, what works, what does not work and why to help enhance future apps for this purpose and supports used alongside this tool to better meet user needs. It is possible that results from this study could be implemented in future apps that these participants may use (e.g., Dietitians of Canada is developing an app for eaTracker and this is one organization where our results will be disseminated).

2. Identify and describe any known or anticipated benefits to the scientific community/society from the conduct of this study.

To date, the peer reviewed literature on diet and diet/physical activity behavior change apps, including those for weight management, is in its infancy and has largely focused on quantitative outcomes (e.g., anthropometric changes) and has had mixed findings. To date, there is little information on how individuals use this tool in their real environment, why some individuals have better adherence than others, and on what works and what does not and why. The information obtained from participants will help to fill this important gap. Currently, there is a large push to develop apps rather than understanding these important research questions.

We will also ensure that 50% of our participants are males because they are potentially more susceptible to obesity and relatively understudied in the overall weight management literature. This approach will help to ensure the relevance of the findings for both genders and will provide more information about weight management interventions in this population.

We also anticipate findings from this study would provide practical information that will help dietitians to provide better services to individuals and populations interested in using apps. In addition, these findings can also be directly channeled into future development of new apps for use in Canadian dietetic practice by organizations (e.g., Dietitians of Canada), government, and industry.

E. POTENTIAL RISKS TO PARTICIPANTS FROM THE STUDY

1. For each procedure used in this study, describe any known or anticipated risks/stressors to the participants. Consider physiological, psychological, emotional, social, economic risks/stressors. A study-specific current health status form must be included when physiological assessments are used and the associated risk(s) to participants is minimal or greater.

No known or anticipated risks

None of the questions are of the nature that they would pose any psychological, physiological, emotional, social or economic stress or risk.

2. Describe the procedures or safeguards in place to protect the physical and psychological health of the participants in light of the risks/stressors identified in E1.

No anticipated risk is expected to be associated with this project. Participants will be assured that their interview answers are confidential, that their participation is voluntary, they can stop completing of the interview at anytime and that no one except the researchers will see or hear their answers. These assurances are included in information letters. Only anonymous quotes will be used; these quotes will not be able to identify participants in any way.

F. INFORMED CONSENT PROCESS

1. What process will be used to inform the potential participants about the study details and to obtain their consent for participation?

Information letter with written consent form

2. If written consent cannot be obtained from the potential participants, provide a justification for this.

3. Does this study involve persons who cannot give their own consent (e.g. minors)? No

G. ANONYMITY OF PARTICIPANTS AND CONFIDENTIALITY OF DATA

1. Provide a detailed explanation of the procedures to be used to ensure anonymity of participants and confidentiality of data both during the research and in the release of the findings.

The interview transcripts will not contain any names, locations, or any other identifying information. The transcriptionist will be required to sign a confidentiality agreement (see attachment) and will be asked to destroy all audio files after completion of the transcription process. Participants will be informed during the consent process that all information they provide is considered completely confidential. Participant names or any other identifying information will not appear in any thesis paper, presentation, or report resulting from this study. All findings will be presented as group data; individual participants will not be identified. Anonymous quotes from the interviews may be used with participant permission on the consent form. Only researchers associated with this project will have access to the data. All paper documents will be stored in locked offices in Burt Matthews Hall or the Propel Centre for Population Health Impact. Electronic files will be stored on password protected computers. Any research assistants involved with this study will also be required to sign a confidentiality agreement (see attachment).

2. Describe the procedures for securing written records, video/audio tapes, questionnaires and recordings. Identify (i) whether the data collected will be linked with any other dataset and identify the linking dataset and (ii) whether the data will be sent outside of the institution where it is collected or if data will be received from other sites. For the latter, are the data de-identified, anonymized, or anonymous?

All data for this study will be stored on password protected computers and/or in locked offices in Burt Matthews Hall or the Propel Centre for Population Health Impact. There will be one master password protected file stored on a password protected computer containing the names and contact information and participant codes to identify participants on the interview transcripts. This is the only file that will contain both the names of participants and their codes. This data will not be sent outside of the research institution.

3. Indicate how long the data will be securely stored and the method to be used for final disposition of the data.

Paper Records

Confidential shredding after 7 year(s).

Audio/Video Recordings

Erasing of audio/video recordings after 7 year(s).

Electronic Data

Erasing of electronic data after 7 year(s).

Location: Filing cabinets in locked offices in Burt Matthews Hall and/or the Population Centre for Population Health Impact

4. Are there conditions under which anonymity of participants or confidentiality of data cannot be guaranteed? No

H. PARTIAL DISCLOSURE AND DECEPTION

1. Will this study involve the use of partial disclosure or deception? Partial disclosure involves withholding or omitting information about the specific purpose or objectives of the research study or other aspects of the research. Deception occurs when an investigator gives false information or intentionally misleads participants about one or more aspects of the research study. No

Researchers must ensure that all supporting materials/documentation for their applications are submitted with the signed, hard copies of the ORE form 101/101A. Note, materials shown below in bold are normally required as part of the ORE application package. The inclusion of other materials depends on the specific type of projects.

Protocol Involves a Drug, Medical Device, Biologic, or Natural Health Product

If the study procedures include administering or using a drug, medical device, biologic, or natural health product that has been or has not been approved for marketing in Canada then the researcher is to complete Appendix A. Appendix A is to be attached to each of the one copy of the application that are submitted to the ORE. Information concerning studies involving a drug, biologic, natural health product, or medical devices can be found on the ORE website.

Please **check** below all appendices that are attached as part of your application package:

- Recruitment Materials: A copy of any poster(s), flyer(s), advertisement(s), letter(s), telephone or other verbal script(s) used to recruit/gain access to participants.
- Information Letter and Consent Form(s)*. Used in studies involving interaction with participants (e.g. interviews, testing, etc.)
- Information/Cover Letter(s)*. Used in studies involving surveys or questionnaires.
- Data Collection Materials: A copy of all survey(s), questionnaire(s), interview questions, interview themes/sample questions for open-ended interviews, focus group questions, or any standardized tests.
- Feedback letter *
- Research Proposal: A copy should be appended for faculty, undergraduate or graduate research if available.*

* Refer to sample letters.

NOTE: The submission of incomplete application packages will increase the duration of the ethics review process.

To avoid common errors/omissions, and to minimize the potential for required revisions, applicants should ensure that their application and attachments are consistent with the *Checklist For Ethics Review of Human Research Application*

Please note the submission of incomplete packages may result in delays in receiving full ethics clearance. We suggest reviewing your application with the Checklist For Ethics Review of Human Research

Applications
to minimize any required revisions and avoid common errors/omissions.

INVESTIGATORS' AGREEMENT

I have read the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans, 2nd Edition (TCPS2) and agree to comply with the principles and articles outlined in the TCPS2. In the case of student research, as Faculty Supervisor, my signature indicates that I have read and approved this application and the thesis proposal, deem the project to be valid and worthwhile, and agree to provide the necessary supervision of the student.

NEW As of May 1, 2013, all UW faculty and staff listed as investigators must complete the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Tutorial, 2nd Ed. (TCPS2) prior to submitting an ethics application. Each investigator is to indicate they have completed the TCPS2 tutorial. If there are more than two investigators, please attach a page with the names of each additional investigator along with their TCPS2 tutorial completion information.

Print and Signature of Principal Investigator/Supervisor

Date

Completed TCPS2 tutorial:
 YES NO In progress

Print and Signature of Principal Investigator/Supervisor

Date

Completed TCPS2 tutorial:
 YES NO In progress

Each student investigator is to indicate if they have completed the Tri-Council Policy Statement, 2nd Edition Tutorial (<http://pre.ethics.gc.ca/eng/education/tutorial-didacticiel/>). If there are more than two student investigators, please attach a page with the names of each additional student investigator along with their TCPS2 tutorial completion information.

Signature of Student Investigator

Date

Completed TCPS2 tutorial:
 YES NO In progress

Signature of Student Investigator

Date

Completed TCPS2 tutorial:
___YES ___NO ___ In progress

FOR OFFICE OF RESEARCH ETHICS USE ONLY:

Maureen Nummelin, PhD
Chief Ethics Officer
OR
Julie Joza, MPH
Senior Manager, Research Ethics
OR
Sacha Geer, PhD
Manager, Research Ethics

Date

ORE 101
Revised August 2003

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Appendix 10: Experiences and perceptions of adults accessing publicly available nutrition behaviour change mobile apps for weight management: recruitment document



Do you use nutrition or nutrition/physical activity mobile device apps to help manage your body weight?

Are you a healthy adult?

Are you willing to participate in a one-on-one, one hour interview about your experiences with these apps?

If you answered “yes,” to all of these questions, researchers from the School of Public Health and Health Systems at the University of Waterloo want to hear from you. We are conducting a study to help understand the experiences of healthy people who use nutrition or nutrition/physical activity apps for weight management. We also want to understand what does and does not work well for app users, how people use these tools, and to obtain suggestions to help make using apps easier.

As a participant in this study, you would be asked to complete a one-on-one in-person interview at a mutually agreed upon time/location that should take approximately one hour of your time.

In appreciation for your time, you will receive a Dietitians of Canada Cookbook. Your parking costs will also be reimbursed.

For more information or to volunteer for this study, please contact Jessica Liefers MSc RD from the School of Public Health and Health Systems at the University of Waterloo by email at jlieferr@uwaterloo.ca or phone at **519-888-4567 Ext. 37031**.

This study has been reviewed by, and has received ethics clearance through a University of Waterloo Research Ethics Committee

This study is funded by the Canadian Foundation for Dietetic Research (CFDR)



Appendix 11: Experiences and perceptions of adults accessing publicly available nutrition behaviour change mobile apps for weight management: information letter and consent form

Date

Dear XX,

RE: Experiences and perceptions of adults accessing commercial diet or diet/physical activity behavior change mobile device apps for weight management

This letter is an invitation to participate in a study I am conducting as part of my PhD in the School of Public Health and Health Systems at the University of Waterloo under the supervision of Professors Rhona Hanning and Jose Arocha. I would like to provide you with more information about this project and what your involvement would entail if you decide to take part.

Over the last five years, applications or “apps” for mobile devices (e.g., smartphone, tablet, iPod touch) related to health, nutrition, physical activity, and weight management have increased in popularity. Research using older generation mobile device apps finds that they can be effective, but that app use can drop off over time, and that satisfaction varies. The purpose of this study is to better understand the experiences and perceptions of individuals using current mobile device nutrition or nutrition/physical activity behaviour change apps for weight management.

Specifically, this study will examine factors that influence satisfaction and dissatisfaction with app use. We are also interested in identifying how people choose apps, how people use apps in their normal environment, and factors associated with adherence to different app components (e.g., diet self-monitoring, peer support). We are also interested in understanding whether there are differences in experiences and perceptions of app use between men and women.

We are looking for participants who meet the following inclusion criteria:

- 1) 18 years of age or older
- 2) healthy and free from chronic diseases (e.g., diabetes, cardiovascular disease, cancer, renal disease)
- 3) have not undergone bariatric (or weight loss) surgery
- 4) have used a nutrition or nutrition/physical activity behavior change app to help manage body weight for at least 1 week within the past 3 months

Participation in this study is voluntary. This study will involve a one-on-one interview of approximately one hour in length to take place in a mutually agreed upon location. You may decline to answer any of the interview questions if you so wish. Further, you may decide to withdraw from this study at any time without any negative consequences, by advising the researcher. With your permission, the interview will be audio recorded to facilitate collection of information. I may also ask you to show me the app that you have used and, with your permission, I may take some photographs of entries on the screen. These images will not be published. When all of the interviews and data analysis are complete, you may be invited to volunteer for a focus group at the University of Waterloo. Focus group participants will be shown findings from the study and asked to comment whether they believe the findings are comparable to their own experience with apps and whether there is any missing information. All information you provide is considered completely confidential. Your name will not appear in any thesis, report, manuscript, or presentation resulting from this study, however, with your permission anonymous quotations may be used. Data collected during this study will be retained for 7 years in a locked office in my

supervisor's lab. Only researchers associated with this project will have access. There are no known or anticipated risks to you as a participant in this study.

Remuneration: In appreciation for your time in participating in the interview, you will be provided with a Dietitians of Canada cookbook. You will also be reimbursed for your parking costs.

If you have any questions regarding this study, or would like additional information to assist you in reaching a decision about participation, please contact me at 519-888-4567 Ext. 37031 or jlieffer@uwaterloo.ca. You can also contact Professor Rhona Hanning at 519-888-4567 Ext. 35685 or rhanning@uwaterloo.ca or Professor Jose Arocha at 519-888-4567 Ext. 32729 or jfarocha@uwaterloo.ca.

I would like to assure you that this study has been reviewed by, and received ethics clearance through a University of Waterloo 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 contact Dr. Maureen Nummelin in the Office of Research Ethics at 519-888-4567 Ext. 36005 or maureen.nummelin@uwaterloo.ca.

I hope that the results of my study will help health professionals to provide better guidance to individuals and populations who want to use apps for nutrition or nutrition/physical activity behavior change. I am also hopeful that the findings will provide information that organizations, industry and government can use to develop better quality nutrition or nutrition/physical activity behavior change apps. However, ultimately, I am hopeful that the results will help individuals to have better outcomes when using nutrition or nutrition/physical activity behavior change apps to help manage body weight.

I very much look forward to speaking with you and thank you in advance for your assistance in this project.

Yours Sincerely,

Jessica Loeffers MSc RD
PhD Student
School of Public Health and Health Systems
University of Waterloo
200 University Avenue West
Waterloo, ON, N2L 3G1
519-888-4567 Ext. 37031
jlieffer@uwaterloo.ca

CONSENT FORM

By signing this consent form, you are not waiving your legal rights or releasing the investigator(s) or involved institution(s) from their legal and professional responsibilities

I have read the information presented in the information letter about a study being conducted by Jessica Lieffers under the supervision of Professors Rhona Hanning and Jose Arocha from the School of Public Health and Health Systems at the University of Waterloo. I have had the opportunity to ask any questions related to this study, to receive satisfactory answers to my questions, and any additional details I wanted.

I am aware that I have the option of allowing my interview to be audio recorded to ensure an accurate recording of my responses. I am aware that I have the option of allowing researchers to examine and possibly take screen shots of the data collected on my application but I am not required to do so.

In appreciation of my time given to the interview, I am aware that I will receive one Dietitians of Canada cookbook. I am also aware that my travel and parking costs will also be reimbursed.

I am aware that excerpts from the interview may be included in the thesis, presentations and/or publications resulting from this research, with the understanding that the quotations will be anonymous.

I was informed that I may withdraw my consent at any time without penalty by advising the researcher.

This project has been reviewed by, and received ethics clearance through a University of Waterloo Research Ethics Committee. I was informed that if I have any comments or concerns resulting from my participation in this study, I may contact Dr. Maureen Nummelin, the Director for the Office of Research Ethics at 519-888-4567 ext. 36005 or maureen.nummelin@uwaterloo.ca.

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

YES NO

I agree to have my interview audio recorded.

YES NO

I agree to let researchers see my application “app” and possibly take photographs of the screens.

YES NO

I agree to the use of anonymous quotations in any thesis, presentation and publication that comes from this research.

YES NO

I agree to being contacted in the future about participation in the focus group session to help verify study results.

YES NO

Participant Name: _____ (Please print)

Participant Signature: _____

Witness Name: _____ (Please print)

Witness Signature: _____

Date: _____

Appendix 12: Experiences and perceptions of adults accessing publicly available nutrition behaviour change mobile apps for weight management: screening questions

Once participants indicate that they are interested in the study, they will be asked the following screening questions either by email or phone to determine their eligibility:

- 1) Are you 18 years of age or older?
- 2) Are you free from chronic diseases such as diabetes, cancer, cardiovascular disease, and/or renal disease?
- 3) Have you ever had bariatric (or weight loss) surgery?
- 4) Which nutrition and/or nutrition/physical behavior change app(s) do you use (or have used)? On which device(s) have you used these app(s)?
- 5) Are you (or were you) eating less calories than usual and/or exercising more than normal to help you lose weight at the same time as using the app?
- 6) Can you tell me a little bit about the dietary plan you are (or were) following at the same time as using the app?
- 7) When was the last time that you used the app?
- 8) How long have you been using the app? (or How long did you use the app?)
- 9) How often did you use the app?
- 9) Please self-rate your perceived success with app use as poor, moderate or strong.

Appendix 13: Experiences and perceptions of adults accessing publicly available nutrition behaviour change mobile apps for weight management: interview protocol

Interview Protocol

Anonymous Interviewee ID:

Interviewer:

Date of Interview:

Time of Interview:

Circle Interview Type: In-Person Phone Skype/FaceTime/Google Hangouts

Location (for in-person interviews):

Thank you very much for agreeing to participate in this study. The purpose of this project is to help better understand the experiences and perceptions of adults who use publicly available nutrition (and physical activity) behavior change apps to help manage body weight. We are hopeful this information will help to develop better weight management apps and will allow professionals to better support individuals who want to use apps in the future.

I am going to be asking you questions about your experiences with and perceptions of using mobile apps for nutrition (and physical activity) behavior change and apps in general. This is a conversation more than anything, there are no right and wrong answers, and it should take up to 1 hour. Is it ok if I audiotape the interview? Again, I want to stress that everything that you say here is confidential and will only be heard by members of the research team. As well, if you are not comfortable answering any questions, please let me know and we can skip them. Likewise, if you do not want to continue the interview at any point, please let me know and we can stop. Do you have any questions before we begin?

What type of mobile device(s) (e.g., smartphone, tablet, iPod touch®) do you currently use?

Potential follow-up topics: Brand, model, operating system.

Have you used any other types of mobile devices in the past? If yes, what type of mobile device(s) did you use?

Approximately how long have you been using a mobile device? (both current and previous devices)

In general, what mobile apps do you currently use? Can you tell me how often you use mobile apps?

Potential follow-up topics: Has this changed over time?

Approximately how long have you been using mobile apps in general?

Can you tell me about your general day-to-day use of your mobile device and apps?

Potential follow-up topics: Has this changed over time?

We are going to switch topics to thinking more specifically about nutrition (and physical activity) behaviour change apps for weight management.

Can you please tell me about your nutrition, physical activity, and weight management goals?

Potential follow-up topics: sense of readiness to change

(In all questions after this point, apps refer to nutrition (and physical activity) behavior change apps used for weight management)

Can you describe your thoughts on mobile apps as a tool to help you manage your body weight?

What apps have you used? (i.e., used consistently for at least a week) How long have you been using/did you use these apps?

I want to understand more about the process that you went through when you first found out about these types of apps to deciding to try them. The next few questions will ask you more about this topic.

When did you first find out about these types of apps? How did you first find out about them?

Could you tell me a bit about your reaction when you first found out about these apps?

Could you tell me about the process of how you decided which app(s) to use?

Potential follow-up topics: How did you go about gathering information? What type of things did you look for? What factors were important in helping you to make a decision of which apps to use?

Could you describe the reasons behind your decision to use apps to help manage your body weight?

Potential follow-up topics: Ask about experiences with other weight management methods. What were you hoping to get out of using apps? Are there any apps that you explored but decided not to use?

Could you please walk me through on your device the app(s) that you use or have used?

Potential follow-up topics: Any features not used and reasons for non-use?

What are your thoughts on the apps that you have used? What has worked well for you? What has not worked well?

Can you talk about what it was like to add an app into your normal life?

Could you please walk me through your day when using these types of apps?

Potential follow-up topics: Frequency of use, locations of use, are apps used when users are around others? or alone?, are all data entered at once or throughout the day (for self-monitoring apps), when and where different features and components are used, day-to-day variability, change in usage over time, etc.

Can you talk about what it was like to use these apps over and over again (or over time)?

Potential follow-up topics: What do you think would help you or others to successfully use apps over time? Were there times or situations when it was easier to use the app than others? Is there anything (e.g., feature) that would help to keep you motivated?

Can you talk about any apps that you used for less than one week and abandoned?

(If Applicable) Can you please describe your experience using apps in conjunction with health professional assistance?

Potential follow-up topics: Type of professional visits where apps are used alongside care, were apps (either specific ones or apps in general) recommended by professionals or did the participant initiate use on their own?, are the data from the app memory used during appointments and/or follow-up care?, are health professionals supportive of app use?, are professionals knowledgeable about apps?

In the original screening questions, you were asked the following question: Please self-rate your perceived success in meeting your nutrition or nutrition/physical activity behavior change and/or weight management goals with the app as poor, moderate or strong. Could you please explain why you gave the app that rating?

Have there been any benefits with app use? If so, please describe. Have there been any drawbacks of app use? If so, please describe.

Are you still using these apps? Can you tell me about the reasons that you are still using these apps? Reasons that you are no longer using these apps?

Do you plan to use apps in the future? Please explain your answer.

Can you please describe your progress in meeting your goals?

Potential follow-up topics: Do you think it would be different if you did not have access to apps? Please explain.

If you could build a perfect app to help people improve their nutrition (and physical activity) behaviours to help manage their body weight, what would it look like?

Based on your experience with nutrition (and physical activity) behaviour change apps for weight management, is there anything that you would like to say to:

- a) individuals thinking about using apps for weight management? individuals currently using apps for weight management?
- b) dietitians (or other health professionals) looking to help people better use apps for weight management?
- c) developers looking to build better apps to assist people with weight management?

Of the following features, which would have appeal for you?

Look-up information (on calories or nutrients, restaurant menus etc.), general nutrition information/tips, goal setting, general motivational messages, motivational messages tailored to your specific information, opportunities to submit information to a dietitian and get feedback, chat rooms or forums with others trying to lose weight, chat room or forums with professionals, reminders (e.g., to complete food diaries), progress graphs, connections to social media, social media pages for the app, progress ‘competition’ against a buddy or group, emails from the app, water logging, notes section, etc.... or is there anything else that you would like? not like?

Lastly we want to describe the age of our participants. Please classify your age into one of the following categories: 18-30y, 31-50y, 51-70y, 71+y

Interview Closure

Is there anything else you would like to add?

I am very appreciative of the valuable information that you provided me today. It will go a long way in helping us to learn how to help people better use apps to manage body weight and how to develop better apps for this purpose in the future.

Thank you again for completing the interview. (Provide participant with Dietitians of Canada cookbook).

Field notes:

Sex: _____

Rough weight classification: _____

Did the participant appear to be tech savvy (explain):

Checklist

Many of these points would have likely been covered during the interview. If there are any points that were not covered, participant thoughts on these topics and whether they affected app acceptance/use can be gathered at the end of the interview only.

- Was/were app(s) trialed/tested prior to use? Explain.
- Was/were the app(s) easy or difficult to learn how to use? Explain.
- Amount of time it took to become comfortable with the app(s)
- Thoughts on mental effort required to use the app
- Thoughts on how easy it was to remember how to use app
- Overall thoughts on app ease of use (e.g., understandable?, clear to use?, navigation?, easy to get it to do what they wanted it to do?)
- Can you describe whether other people (e.g., important people, health care professionals, family members, friends etc.) wanted you to use apps.
- Thoughts on app performance (e.g., how well did it perform tasks?)
- Thoughts on how applicable the app was to their situation
- Thoughts on app accuracy (including food and physical activity databases, accuracy of calculations of energy required and expenditure)
- Overall thoughts on usefulness to help facilitate the behaviour change process (e.g., allows things to be done more quickly?)
- Whether outcomes that others have had with apps can be seen? Did they talk to others about their experiences with apps prior to using them?
- Did they feel they had necessary skills and background to use the app?
- Thoughts on whether necessary resources were available to properly use the app (e.g., Internet connection, social/professional support, technical support etc.)
- Thoughts on app compatibility e.g., with their life, other apps, websites, etc.

Appendix 14: Experiences and perceptions of adults accessing publicly available nutrition behaviour change mobile apps for weight management: feedback letter

UNIVERSITY OF WATERLOO | **SCHOOL OF PUBLIC HEALTH AND HEALTH SYSTEMS**

200 University Avenue West, Waterloo, ON, Canada N2L 3G1
519-888-4567 | fax 519-746-2510 | ahs.uwaterloo.ca/sphts

Title: Experiences and perceptions of adults accessing commercial diet or diet/physical activity behaviour change mobile device apps for weight management

Thank you for participating in this research study. As a reminder, the purpose of this study is to better understand the experiences and perceptions of individuals using current mobile device diet or diet/physical activity behaviour change apps for weight management. Specifically, this work will examine factors that influence satisfaction and dissatisfaction with app use. This work will also identify how people choose apps, how people use apps in their normal environment, and factors associated with adherence to different app components (e.g., diet self-monitoring, peer support). We are also interested in understanding whether there are differences in experiences and perceptions of app use between men and women. Those who provide input do not have any proprietary rights to any products developed by the University of Waterloo and other organizations.

Following all data collection and analysis, this information will be shared with the broader research and health professional community through conference presentations, seminars, and journal articles.

The researchers conducting this study are:

Jessica Lieffers MSc RD PhD Student	Rhona Hanning PhD RD FDC Professor	Jose Arocha PhD Associate Professor
--	---------------------------------------	--

School of Public Health and Health Systems

University of Waterloo

200 University Avenue NW

Waterloo, Ontario, N2L 3G1

Phone: 519-888-4567 Ext. 37031

Email: jlieferr@uwaterloo.ca or rhanning@uwaterloo.ca or jfarocho@uwaterloo.ca

Please do not hesitate to contact the researchers if you have any questions about this study or if you are interested in obtaining a copy of the results. The results are expected to be available by August 31, 2015.

This project has been reviewed by, and received ethics clearance through a University of Waterloo Research Ethics Committee. In the event you have any comments or concerns resulting from your participation in this study, please contact Dr. Maureen Nummelin, Director of the Office of Research Ethics at 519-888-4567 Ext. 36005 or by email at maureen.nummelin@uwaterloo.ca

Appendix 15: Use of mobile device applications in Canadian dietetic practice: application for ethics review

APPLICATION FOR ETHICS REVIEW OF RESEARCH INVOLVING HUMAN PARTICIPANTS

Please remember to **PRINT AND SIGN** the form and **forward with all attachments** to the Office of Research Ethics, Needles Hall, Room 1024.

A. GENERAL INFORMATION

1. Title of Project: Mobile Device Applications and Dietetic Practice: A Pilot Study (Formerly: Nutrition and Food Electronic Mobile Device Applications and Dietetic Practice: A Pilot Study)

2. a) Principal and Co-Investigator(s)

NEW As of May 1, 2013, all UW faculty and staff listed as investigation must complete the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Tutorial, 2nd Ed. (TCPS2) prior to submitting an ethics application. The tutorial takes at least three hours; it has start and stop features.

N/A

3. Project Supervisor(s)

Name	Department	Ext:	e-mail:
Rhona Hanning	Health Studies & Gerontology	35685	rhanning@uwaterloo.ca

4. Student Investigator(s)

Name	Department	Ext:	e-mail:	Local Phone #:
Jessica Lieffers	Health Studies & Gerontology		jlieffers@uwaterloo.ca	780-490-8480

5. Level of Project: Graduate Course **Specify Course:** HSG 741

Non-Theses Course Projects:

Research Project/Course Status:

6. Funding Status (If Industry funded and a clinical trial involving a drug or natural product or is medical device testing, then **Appendix B is to be completed):** N/A

7. Does this research involve another institution or site? NA

If Yes, what other institutions or sites are involved:

NA

8. Has this proposal, or a version of it, been submitted to any other Research Ethics Board/Institutional Review Board? N/A

9. For Undergraduate and Graduate Research:

Has this proposal received approval of a Department Committee? N/A

10. a) Indicate the anticipated commencement date for this project: 6/13/2011

b) Indicate the anticipated completion date for this project: 8/31/2011

11. Conflict of interest: Appendix B is attached to the application if there are any potential, perceived, or actual financial or non-financial conflicts of interest by members of the research team in undertaking the proposed research.

B. SUMMARY OF PROPOSED RESEARCH

1. Purpose and Rationale for Proposed Research

a. Describe the purpose (objectives) and rationale of the proposed project and include any hypothesis(es)/research questions to be investigated. For a non-clinical study summarize the proposed research using the headings: Purpose, Aim or Hypothesis, and Justification for the Study. For a clinical trial/medical device testing summarize the research proposal using the following headings: Purpose, Hypothesis, Justification, and Objectives.

Where available, provide a copy of a research proposal. For a clinical trial/medical device testing a research proposal is required:

Electronic mobile devices (e.g., Smartphones) and their applications (or "apps") are rapidly becoming more affordable, powerful, and popular. Specifically, Smartphone apps, which have been advertised to be able to perform "just about anything" (Apple Inc.) have become especially popular; they can be searched and downloaded directly onto Smartphones for free or a small charge. By January 2011, after only 30 months of operation, the Apple App Store (Apple Inc, Cupertino, CA) reported >300,000 apps and 10 billion app downloads. Of interest to dietitians and nutrition professionals are nutrition apps. Nutrition apps are numerous and new ones surface on a frequent basis; they vary widely, from facilitating diet self-monitoring to games to teach healthier fast food choices. For dietetic practice, electronic mobile device nutrition and food apps are a potential new tool to help clients make successful nutritional changes as they are carried at all times. This is exciting, especially at a time when nutrition is recognized as an important influence on many chronic diseases and their risk factors. However, despite the current popularity of smartphone applications, it remains unclear what experiences nutrition professionals have had with currently available nutrition and food apps for mobile devices. It is also unknown the place for nutrition and food apps in dietetic practice (e.g., which clients would benefit the most, what types of apps would be most useful). This information is essential to successfully incorporate this new emerging tool into dietetic practice.

Dietitians of Canada EATracker is a web based system that allows members of the public to track their food and exercise habits and compare them to recommendations put forth by Health Canada. The organization, Dietitians of Canada, is currently in the process of developing an EATracker smartphone app and some additional nutrition apps (e.g., a product look-up tool). This is an important development because there is little regulation placed on app quality, and there are few nutrition apps with Canadian nutrition content that dietitians could confidently recommend to their clients who may be interested in and/or are likely to be successful using type of tool. It is hopeful that these new Dietitians of Canada nutrition apps would be a solution to some of these problems. However, in order to develop applications that dietitians feel are useful for their clients, it is essential that their input be solicited during the development process. To our knowledge, a large group of dietitians has never been asked this type of information before. The input of the dietitians will be used to inform the Dietitians of Canada EATracker development team of potential avenues for product development to better serve Dietitians and the General public. Dietitians who provide input do not have any proprietary rights to any products developed by the DC EATracker team.

Objectives:

- 1) To describe the experiences of dietitians and dietetic interns with nutrition/food applications for mobile devices.
- 2) To describe the experiences of clients who see dietitians on nutrition/food applications for mobile devices, from the perspectives of dietitians.
- 3) To determine what dietitians and dietetic interns feel would be useful in new Dietitians of Canada smartphone apps.
- 4) To share the results from objective 3 with the Dietitians of Canada smartphone app development team.

b. In lay language, provide a one paragraph (approximately 100 words) summary of the project including purpose, the anticipated potential benefits, and basic procedures used.

C. DETAILS OF STUDY

1. Methodology/Procedures

a. Indicate all of the procedures that will be used. Append to form 101 a copy of all materials to be used in this study.

Survey(s) or questionnaire(s) (in person) None are standardized.

Computer-administered task(s) or survey(s) None are standardized.

b. Provide a detailed, sequential description of the procedures to be used in this study. For studies involving multiple procedures or sessions, provide a flow chart. Where applicable, this section also should give the research design (e.g., cross-over design, repeated measures design).

Participants will be asked to complete either a paper questionnaire or an online questionnaire administered through Survey Monkey. Participants will be recruited at the Dietitians of

Canada conference or through Dietitians of Canada mailing lists, network member lists, postings on network bulletin boards, newsletters, classifieds etc. The questionnaire that participants will be asked to complete was developed by the researchers conducting this study. A standardized questionnaire is not being used because this is a new field of study and there are no published, validated questionnaires available on this topic. However, a recently published questionnaire on a similar topic in orthopedic surgeons (Franco, 2011, Clin Orthop Relat Res; Available online May 6 2011) was used to help guide its development. The paper and online questionnaires will be identical. Please see appendix C for a copy of the questionnaire.

With the paper questionnaire, dietitians and dietetic interns will be first approached by researchers at the Dietitians of Canada National conference using a script (see appendix A). Those who agree to participate in the study will be given a paper copy of the questionnaire with a covering letter (see appendix B) attached to the top of the questionnaire or if they prefer, a poster (see Appendix A) with a link to first the questionnaire information sheet which will then to the questionnaire posted on the Survey Monkey website if they would like to complete the questionnaire at a later time. Participants recruited through Dietitians of Canada email lists, member networks, newsletters etc. will receive the recruitment poster (see Appendix A) with a link to the Survey Monkey website by email or will see it on a bulletin board or newsletter. When participants follow the link on the poster, they will be taken to the information letter (see Appendix B) and can then proceed to the questionnaire if they wish. Implied consent will be used for this study. It is expected that the questionnaire will take 10 minutes to complete by paper or Survey Monkey. Participants will be asked to return the paper questionnaire to researchers. Responses from the online questionnaire will be retrieved from the Survey Monkey website.

At the end of the questionnaire, participants will be asked whether they are interested in participating in future research on this topic. If they are interested, they will be asked to provide their name and contact information to researchers. For the paper questionnaire, a separate piece paper containing only this question and a space for their name and contact information will be stapled to the back of the questionnaire and covering letter. This page will be immediately detached from the rest of their answers when they give the survey back to researchers to ensure response anonymity. With the Survey Monkey online questionnaire, participants will be instructed if interested in participating in future research on this topic to click on a hyperlink at the end of the survey that will take them to a separate survey for registration. This allows their answers to be unlinked with their name and contact information. Participants at the end of the paper-based questionnaire will be provided with a feedback letter. At the end of the Survey Monkey questionnaire, participants will be provided with the feedback letter information on a new screen after completing the questionnaire. Please see appendix D for a copy of the feedback letter.

c. Will this study involve the administration/use of any drug, medical device, biologic, or natural health product? N/A

2. Participants Involved in the Study

a. Indicate who will be recruited as potential participants in this study.

Non-UW Participants:

Adults

Dietitians, dietetic interns

b. Describe the potential participants in this study including group affiliation, gender, age range and any other special characteristics. Describe distinct or common characteristics of the potential participants or a group (e.g., a group with a particular health condition) that are relevant to recruitment and/or procedures. Provide justification for exclusion based on culture, language, gender, race, ethnicity, age or

disability. For example, if a gender or sub-group (i.e., pregnant and/or breastfeeding women) is to be excluded, provide a justification for the exclusion.

Potential participants in this study will be dietitians and dietetic interns. Many will be members of Dietitians of Canada. They are males and females, all over 18 years of age.

c. How many participants are expected to be involved in this study? For a clinical trial, medical device testing, or study with procedures that pose greater than minimal risk, sample size determination information is to be provided.

We expect to receive 100 completed questionnaires during this study. We have not conducted any sample size calculations as this is a pilot study. We hope to receive as many back as possible.

3. Recruitment Process and Study Location

a. From what source(s) will the potential participants be recruited?

Dietitians of Canada mailing lists, Dietitians of Canada network group newsletters and bulletin boards, Dietitians of Canada newsletters and classifieds

b. Describe how and by whom the potential participants will be recruited. Provide a copy of any materials to be used for recruitment (e.g. posters(s), flyers, cards, advertisement(s), letter(s), telephone, email, and other verbal scripts).

Participants will be recruited in different ways. Participants will be approached at the Dietitians of Canada National Conference using a recruitment script (see appendix A). Participants will be approached through Dietitians of Canada email lists with a email advertisement (see appendix A). Participants may also be recruited through Dietitians of Canada member networks through email lists, or postings on member network bulletin boards (the email advertisement will also be used there as well).

c. Where will the study take place? Off campus: Dietitians of Canada National Meeting

4. Remuneration for Participants

Will participants receive remuneration (financial, in-kind, or otherwise) for participation? No

5. Feedback to Participants

Describe the plans for provision of study feedback and attach a copy of the feedback letter to be used. Wherever possible, written feedback should be provided to study participants including a statement of appreciation, details about the purpose and predictions of the study, restatement of the provisions for confidentiality and security of data, an indication of when a study report will be available and how to obtain a copy, contact information for the researchers, and the ethics review and clearance statement. Feedback will be provided to participants immediately after they complete the study (paper questionnaire: participants will be given a paper feedback letter immediately after they complete the questionnaire; Survey Monkey: participants will see the feedback letter on the final screen of the questionnaire). The feedback letter will thank participants for their involvement, include details about the purpose of the study, provide the ethics review and clearance statement, and include researcher contact information should participants require further information. See Appendix D for participant feedback letter. The same feedback letter will be used for the paper and Survey Monkey questionnaires.

D. POTENTIAL BENEFITS FROM THE STUDY

1. Identify and describe any known or anticipated direct benefits to the participants from their involvement in the project.

Participants will have the opportunity to provide direct input that will be used to inform the Dietitians of Canada EATracker development team to better serve Dietitians and the General public. The new apps created by this team may provide benefits to their dietetic practice and clients in the future. They are also providing important information that will help to inform future research projects on how to optimize use nutrition/food applications in dietetic practice.

2. Identify and describe any known or anticipated benefits to the scientific community/society from the conduct of this study.

Mobile devices, especially smartphones (e.g., Blackberry, iPhone) have become mainstream in our daily lives. Smartphones, with multiple capabilities including the ability to run applications, or apps, have become especially popular. The popularity and full-day access of smartphones and their apps offers an exciting opportunity to develop state-of-the-art approaches to help individuals make good dietary choices. This is especially needed at a time when poor nutrition (e.g., excess caloric intakes leading to obesity) is responsible for a high incidence of preventable chronic diseases (e.g., heart disease and diabetes) in Canadians. Research in this area is novel, timely and crucial for the public, dietitians, government, and industry as it is important to ensure that this technology is used as effectively as possible. To date, no studies have been published that have solicited the professional opinion of dietitians on this topic. This information will help to identify the strengths and issues with these tools and how to best incorporate this technology into dietetic practice to help Canadians improve their dietary intake.

The information gathered from this research is also directly relevant to the Dietitians of Canada smartphone application development team. Aggregate information collected from this survey will be immediately passed onto the development team who will take it into account when developing the new applications. This will allow them to create applications that is more tailored to and useful to dietitians and their clients. To date, this type of information has never been collected and is essential to develop an effective and useful nutrition smartphone apps.

E. POTENTIAL RISKS TO PARTICIPANTS FROM THE STUDY

1. For each procedure used in this study, describe any known or anticipated risks/stressors to the participants. Consider physiological, psychological, emotional, social, economic risks/stressors. A study-specific current health status form must be included when physiological assessments are used and the associated risk(s) to participants is minimal or greater.

No known or anticipated risks

This is a questionnaire study whereby dietitians and dietetic interns are asked questions about their opinions on electronic mobile device nutrition/food applications and their experiences with them in their dietetic practice. None of the questions are of the nature that they would pose any psychological, physiological, emotional, social or economic stress or risk.

2. Describe the procedures or safeguards in place to protect the physical and psychological health of the participants in light of the risks/stressors identified in E1.

No anticipated risk is expected to be associated with this project. Participants will be assured that their questionnaire answers are anonymous, that their participation is voluntary, they can stop completing of the questionnaire at anytime and that no one except the researchers will see their answers. These assurances are included in information letters.

F. INFORMED CONSENT PROCESS

1. What process will be used to inform the potential participants about the study details and to obtain their consent for participation?

Information/cover letter

2. If written consent cannot be obtained from the potential participants, provide a justification for this. Completing the paper or online questionnaire will mean that the participant has provided implied consent.

3. Does this study involve persons who cannot give their own consent (e.g. minors)? No

G. ANONYMITY OF PARTICIPANTS AND CONFIDENTIALITY OF DATA

1. Provide a detailed explanation of the procedures to be used to ensure anonymity of participants and confidentiality of data both during the research and in the release of the findings.

Participants will be informed that all information they provide is considered completely confidential. Their name will not appear in any course paper, presentation, or report resulting from this study. All questionnaires completed by participants will be anonymous; participant names will not be associated with the data set in any way and no information that could identify the participant will be collected from either the paper questionnaire or the online Survey Monkey questionnaire (including machine identifiers). Participant names left for future contact will be collected on a separate sheet of paper (for the paper questionnaire) that will be immediately detached from the questionnaire answers to ensure anonymity or by a separate Survey Monkey survey that will be unlinked with their original Survey Monkey survey answers for the online survey. All electronic files and paper surveys will be stored in locked offices at the Population Health Research Group. All findings will be presented as group data; individual participants will not be identified. Only researchers associated with this project will have access to the data.

2. Describe the procedures for securing written records, video/audio tapes, questionnaires and recordings. Identify (i) whether the data collected will be linked with any other dataset and identify the linking dataset and (ii) whether the data will be sent outside of the institution where it is collected or if data will be received from other sites. For the latter, are the data de-identified, anonymized, or anonymous?

Any paper based surveys collected during this study will be retained in a locked filing cabinet in the Population Health Research Group. Electronic information will be stored in password protected computer files. Only researchers associated with this project will have access to files. All surveys associated with this study will be deleted from the Survey Monkey servers following completion of the study at the end of August, 2011. The collected data will not be linked with any other dataset and the data will not be sent outside the institution.

3. Indicate how long the data will be securely stored and the method to be used for final disposition of the

data.

Paper Records

Confidential shredding after 5 year(s).

Electronic Data

Erasing of electronic data after 5 year(s).

Location: These filing cabinets and computers are located in locked offices at the Propel Centre for Population Health Impact, University of Waterloo

4. Are there conditions under which anonymity of participants or confidentiality of data cannot be guaranteed? No

H. PARTIAL DISCLOSURE AND DECEPTION

1. Will this study involve the use of partial disclosure or deception? Partial disclosure involves withholding or omitting information about the specific purpose or objectives of the research study or other aspects of the research. Deception occurs when an investigator gives false information or intentionally misleads participants about one or more aspects of the research study. N/A

Researchers must ensure that all supporting materials/documentation for their applications are submitted with the signed, hard copies of the ORE form 101/101A. Note, materials shown below in bold are normally required as part of the ORE application package. The inclusion of other materials depends on the specific type of projects.

Protocol Involves a Drug, Medical Device, Biologic, or Natural Health Product

If the study procedures include administering or using a drug, medical device, biologic, or natural health product that has been or has not been approved for marketing in Canada then the researcher is to complete Appendix A. Appendix A is to be attached to each of the one copy of the application that are submitted to the ORE. Information concerning studies involving a drug, biologic, natural health product, or medical devices can be found on the ORE website.

Please **check** below all appendices that are attached as part of your application package:

- Recruitment Materials: A copy of any poster(s), flyer(s), advertisement(s), letter(s), telephone or other verbal script(s) used to recruit/gain access to participants.
- Information/Cover Letter(s)*. Used in studies involving surveys or questionnaires.
- Data Collection Materials: A copy of all survey(s), questionnaire(s), interview questions, interview themes/sample questions for open-ended interviews, focus group questions, or any standardized tests.
- Feedback letter *

* Refer to sample letters.

NOTE: The submission of incomplete application packages will increase the duration of the ethics review process.

To avoid common errors/omissions, and to minimize the potential for required revisions, applicants should ensure that their application and attachments are consistent with the *Checklist For Ethics Review of Human Research Application*

Please note the submission of incomplete packages may result in delays in receiving full ethics clearance. We suggest reviewing your application with the Checklist For Ethics Review of Human Research Applications to minimize any required revisions and avoid common errors/omissions.

INVESTIGATORS' AGREEMENT

I have read the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans, 2nd Edition (TCPS2) and agree to comply with the principles and articles outlined in the TCPS2. In the case of student research, as Faculty Supervisor, my signature indicates that I have read and approved this application and the thesis proposal, deem the project to be valid and worthwhile, and agree to provide the necessary supervision of the student.

NEW As of May 1, 2013, all UW faculty and staff listed as investigators must complete the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Tutorial, 2nd Ed. (TCPS2) prior to submitting an ethics application. Each investigator is to indicate they have completed the TCPS2 tutorial. If there are more than two investigators, please attach a page with the names of each additional investigator along with their TCPS2 tutorial completion information.

Print and Signature of Project Supervisor

Date

Completed TCPS2 tutorial:
 YES NO In progress

Print and Signature of Project Supervisor

Date

Completed TCPS2 tutorial:
 YES NO In progress

Each student investigator is to indicate if they have completed the Tri-Council Policy Statement, 2nd Edition Tutorial (<http://pre.ethics.gc.ca/eng/education/tutorial-didacticiel/>). If there are more than two student investigators, please attach a page with the names of each additional student investigator along with their TCPS2 tutorial completion information.

Signature of Student Investigator

Date

Completed TCPS2 tutorial:
___YES ___NO ___ In progress

Signature of Student Investigator

Date

Completed TCPS2 tutorial:
___YES ___NO ___ In progress

FOR OFFICE OF RESEARCH ETHICS USE ONLY:

Maureen Nummelin, PhD
Chief Ethics Officer
OR
Julie Joza, MPH
Senior Manager, Research Ethics
OR
Sacha Geer, PhD
Manager, Research Ethics

Date

ORE 101
Revised August 2003

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Appendix 16: Use of mobile device applications in Canadian dietetic practice: survey

Dietitian and apps-FINAL

Title of Project: Mobile Device Applications and Dietetic Practice: A Pilot Study

You are invited to participate in a research study conducted by Jessica Lieffers MSc RD PhD student, under the supervision of Rhona Hanning PhD RD FDC, Associate Professor in the School of Public Health and Health Systems at the University of Waterloo, Ontario, Canada. The objectives of the research study are to describe the experiences of dietitians with applications for mobile devices (e.g., Smartphones (e.g., BlackBerry, iPhone), iPad etc.) in dietetic practice and to solicit input on what they would like to see in future nutrition and food applications for mobile devices. Your input will be used to inform non-profit organizations (e.g., University of Waterloo, Dietitians of Canada) of potential avenues for product development to better serve Dietitians and the general Canadian public. Those who provide input do not have any proprietary rights to any products developed by non-profit organizations using these data. This study is part of a graduate research practicum course.

If you decide to volunteer, you will be asked to complete a 20-minute online survey that is completed anonymously. The questions are quite general and include for example: 'do you currently use a Smartphone in your dietetic practice?', 'what do you like about the non nutrition/food related apps that you currently use in your dietetic practice?', 'have you ever had a client who asked you about or used a nutrition/food app for a mobile device?'. 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).

This survey uses Survey Monkey™ whose computer servers are located in the USA. Consequently, USA authorities under provisions of the Patriot Act may access this survey data. If you prefer not to submit your data through Survey Monkey™, please contact one of the researchers so you can participate using an alternative method (such as through an email or paper-based questionnaire). The alternate method may decrease anonymity but confidentiality will be maintained.

Dietitian and apps-FINAL

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 five years and then erased.

Should you have any questions about the study, please contact either Jessica Lieffers MSc RD PhD Student (jlieffer@uwaterloo, 780-490-8480) or Dr. Rhona Hanning (rhanning@uwaterloo.ca, 519-888-4567 ext. 35685). Furthermore, 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 the Office of Research Ethics at the University of Waterloo. 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 Dr. Susan Sykes, Director, Office of Research Ethics, at 519-888-4567 ext. 36005 or by email at ssykes@uwaterloo.ca.

Thank you for considering participation in this study.

Consent to Participate:

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).

Dietitian and apps-FINAL

Are you a dietitian?

Yes

No

Dietitian and apps-FINAL

Which of the following phrases best describes your current dietetic practice? Please check all that apply.

If you are currently on leave, please pick your most recent area(s) of dietetic practice before your leave.

- | | |
|--|---|
| <input type="checkbox"/> Hospital- Inpatients | <input type="checkbox"/> Sports/Recreation Centre |
| <input type="checkbox"/> Hospital- Outpatients | <input type="checkbox"/> Private Practice |
| <input type="checkbox"/> Home Care | <input type="checkbox"/> Food Industry |
| <input type="checkbox"/> Long Term Care | <input type="checkbox"/> Foodservice Management |
| <input type="checkbox"/> Primary Care | <input type="checkbox"/> Research/Academic |
| <input type="checkbox"/> Community Health Centre | <input type="checkbox"/> Not Currently Working in Dietetic Practice |

Other (please specify)

Dietitian and apps-FINAL

Do you currently use a Smartphone in your dietetic practice (e.g., for personal needs such as organization or reference, or for use with clients such as diet assessment)?

Yes

No

Dietitian and apps-FINAL

How long have you been using a Smartphone in your dietetic practice?

- <1 month
- 1 month to <6 months
- 6 months to <1 year
- 1 year to <2 years
- 2 years or more

How frequently do you use a Smartphone in your dietetic practice?

- Everyday (or almost everyday)
- 1-2 times/week
- 1-2 times/month
- 1-2 times/year
- Less than 1 time/year

What type of Smartphone do you currently use in your dietetic practice? If you currently use more than one, please choose the one that you use the most often.

- Android
- BlackBerry
- iPhone
- Windows
- Do not know what type

Other (please specify)

Dietitian and apps-FINAL

Do you currently use an Apple iPod touch in your dietetic practice (e.g., for personal needs such as organization or reference, or for use with clients such as diet assessment)?

Yes

No

Dietitian and apps-FINAL

How long have you been using an Apple iPod touch in your dietetic practice?

- <1 month
- 1 month to <6 months
- 6 months to <1 year
- 1 year to <2 years
- 2 years or more

How frequently do you use an Apple iPod touch in your dietetic practice?

- Everyday (or almost everyday)
- 1-2 times/week
- 1-2 times/month
- 1-2 times/year
- Less than 1 time/year

Dietitian and apps-FINAL

Do you currently use a tablet computer (e.g., Apple iPad, BlackBerry PlayBook) in your dietetic practice (e.g., for personal needs such as organization or reference, or for use with clients such as diet assessment)?

Yes

No

Dietitian and apps-FINAL

How long have you been using a tablet computer in your dietetic practice?

- <1 month
- 1 month to <6 months
- 6 months to <1 year
- 1 year to <2 years
- 2 years or more

How frequently do you use a tablet computer in your dietetic practice?

- Everyday (or almost everyday)
- 1-2 times/week
- 1-2 times/month
- 1-2 times/year
- Less than 1 time/year

What type of tablet computer do you currently use in your dietetic practice? If you use more than one, please choose the one that you use the most.

- Apple iPad
- BlackBerry PlayBook
- Motorola Xoom
- Samsung Galaxy Tab
- Do not know what type
- Other (please specify)

Dietitian and apps-FINAL

Applications or “apps” are small programs that perform different tasks (e.g., weather forecast look-up, banking, restaurant look-up, games). Apps can be downloaded for free or for a small fee directly onto mobile devices including Smartphones (e.g., iPhone, BlackBerry, Android), tablet computers (e.g., iPad), or the Apple iPod touch from application stores (e.g., Apple App Store, BlackBerry App World, Android Market). Some apps are also already installed on mobile devices in the factory (e.g., voice recorder) or following a software update.

When thinking about apps for mobile devices, please only consider programs downloaded from an App Store directly onto a mobile device (e.g., Smartphone, tablet computer, iPod touch), those already installed on the device when received from the factory, or those installed following a software update. Please do not consider programs accessed from a net book, laptop or desktop computer as mobile device apps. Please also do not consider any websites, text messaging or the phone as mobile device apps.

Do you currently use mobile device apps (either nutrition/food related or non nutrition food related) in your dietetic practice?

- Yes
 No

Dietitian and apps-FINAL

Please list and explain reasons for not using apps for mobile devices in your current dietetic practice.

Dietitian and apps-FINAL

Would you be interested in using apps for mobile devices in your dietetic practice in the future?

- Yes
 No
 Unsure

Please explain why you would or would not be interested in using apps in the future.

Dietitian and apps-FINAL

How often do you use the following non nutrition/food related apps for mobile devices in your dietetic practice? (Nutrition/food apps for mobile devices will be discussed in future questions).

Please answer this question thinking only about apps for mobile device(s) (i.e., smartphone, tablet computer, Apple iPod Touch), and not internet websites, or programs accessed on a laptop or desktop computer.

	Never Used	Less than 1 time/year	1-2 times/year	1-2 times/month	1-2 times/week	Everyday or almost everyday
Calendar/Agenda	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Clock/Timers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Contact lists/Address book	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
To do lists	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Notes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Camera	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
GPS/Maps (e.g., Google Maps)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Voice/Video calling apps (e.g., Skype, Facetime)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Meeting apps	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Voice recording apps	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Social media apps (e.g., Twitter, Facebook)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Electronic charting/Progress tracking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Client scheduling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Staff scheduling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Inventory tracking	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Finance apps (e.g., budgeting, expense tracking)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Word processing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Spreadsheets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PDF/document readers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Medical/Drug reference and databases	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify category and indicate how often you use them)

Dietitian and apps-FINAL

Please list the name(s) of the non nutrition/food apps for mobile devices that you currently use in your dietetic practice.

What do you like about the non nutrition/food related apps for mobile devices that you currently use in your dietetic practice?

What do you dislike about the non nutrition/food related apps for mobile devices that you currently use in your dietetic practice?

What has been your overall satisfaction with non nutrition/food apps for mobile devices used in your dietetic practice? Have they changed your practice? Please explain.

Dietitian and apps-FINAL

How often do you currently use the following nutrition/food apps for mobile devices in your dietetic practice?

Please answer this question thinking only about apps for mobile device(s) (i.e., smartphone, tablet computer, Apple iPod touch), and not internet websites, or programs accessed on a laptop or desktop computer.

	Never Used	Less than 1 time/year	1-2 times/year	1-2 times/month	1-2 times/week	Everyday (or almost everyday)
Dietitian apps (e.g., Nutrition Workbench, Dietitian Tool, Dietitian App Box)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrition support apps	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calorie/nutrient/food group trackers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Body weight/composition trackers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food nutrition information look-up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food allergen information look-up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Restaurant nutrition information look-up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recipe/Cookbook	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Menu planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Dieting/quick weight loss plans	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrition and/or food education/information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrition education games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calculators (BMI, caloric needs, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Grocery shopping list	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lab value monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diabetes monitoring apps	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fitness/Exercise	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Other (please specify category and indicate how often you use them)

Dietitian and apps-FINAL

Please list the names of the nutrition/food apps for mobile devices that you currently use in your dietetic practice.

What do you like about the nutrition/food apps for mobile devices that you currently use in your dietetic practice?

What do you dislike about the nutrition/food apps for mobile devices that you currently use in your dietetic practice?

What has been your overall satisfaction with nutrition/food apps for mobile devices that you have used in your dietetic practice? Have they changed your practice? Please explain.

Dietitian and apps-FINAL

In your opinion, what would help you to more effectively use applications (whether or not nutrition/food related) for mobile devices in your dietetic practice?

Dietitian and apps-FINAL

Have you ever had a client who asked you about or used a nutrition/food app for a mobile device?

Yes

No

Dietitian and apps-FINAL

How often do you encounter a client who asks about or uses a nutrition/food app for a mobile device? Please choose the best answer.

- Everyday (or almost everyday)
- 1-2 times/week
- 1-2 times/month
- 1-2 times/year
- Less than 1 time/year

Dietitian and apps-FINAL

Which of the following statements is true about the group of clients who ask you about or use nutrition/food apps for mobile devices?

- Mainly they are female clients
 Mainly they are male clients
 The distribution between male and female clients is similar
 I don't know

How old are your clients who have asked about or used nutrition/food apps for mobile devices? (Please check all that apply).

- Children (0-12 years) (or their parents)
 Youth (13-18 years) (or their parents)
 Adults (19-64 years)
 Seniors (65+ years)

Of the clients who have asked you about or used nutrition/food apps for mobile devices, for what concerns are they seeking help? Please select your top 3 choices.

	Most common concern	Second most common concern	Third most common concern
General Healthy Eating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Overweight/Obesity/Weight Loss	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Heart Healthy Eating	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diabetes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Renal Disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Cancer	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gastrointestinal Disease (except Celiac Disease)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Celiac Disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gerontology Nutrition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food Allergies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Eating Disorders	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vegetarian	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sports Nutrition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pregnancy/Breastfeeding	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If other, please specify concern here

Dietitian and apps-FINAL

What type(s) of nutrition/food apps for mobile devices have your clients asked you about or used? (Please check all that apply)

- | | |
|---|---|
| <input type="checkbox"/> Calorie/nutrient/food group trackers | <input type="checkbox"/> Nutrition and food reference/Education |
| <input type="checkbox"/> Body weight/composition trackers | <input type="checkbox"/> Nutrition education games |
| <input type="checkbox"/> Food nutrition information look-up | <input type="checkbox"/> Calculators (BMI, caloric needs, etc.) |
| <input type="checkbox"/> Food allergen information look-up | <input type="checkbox"/> Grocery shopping list |
| <input type="checkbox"/> Restaurant nutrition information look-up | <input type="checkbox"/> Diabetes monitoring |
| <input type="checkbox"/> Recipe/Cookbook | <input type="checkbox"/> Fitness/Exercise |
| <input type="checkbox"/> Meal planning | <input type="checkbox"/> Unknown |
| <input type="checkbox"/> Dieting/quick weight loss plans | |

Other (please specify)

Dietitian and apps-FINAL

Please name the nutrition/food apps for mobile devices your clients have asked about or used. Which are the one's they use most often?

Dietitian and apps-FINAL

Have you ever recommended using nutrition/food apps for mobile devices to clients in your dietetic practice?

Yes

No

Dietitian and apps-FINAL

Please list any specific nutrition/food apps for mobile devices you have recommended in your dietetic practice? Please list the reasons for recommending those apps.

Dietitian and apps-FINAL

Please explain the reasons for recommending or not recommending nutrition/food apps for mobile devices in your dietetic practice.

Dietitian and apps-FINAL

Applications or “apps” are small programs that perform different tasks (e.g., weather forecast look-up, banking, restaurant look-up, games). Apps can be downloaded for free or for a small fee directly onto mobile devices including Smartphones (e.g., iPhone, BlackBerry, Android), tablet computers (e.g., iPad), or the Apple iPod touch from application stores (e.g., Apple App Store, BlackBerry App World, Android Market). Some apps are also already installed on mobile devices in the factory (e.g., voice recorder) or following software updates.

Which of the following capabilities would interest you in future nutrition/food apps for mobile devices? Please assume they would be reliable, credible, Canadian.

	Not at all interested	Not interested	Neutral	Somewhat interested	Very interested	Unsure
Restaurant nutrition information look up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food nutrition information look up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food product allergen information look up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calorie monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Carbohydrate monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fat monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sodium monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Potassium monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fibre monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Body weight monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Physical activity monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diabetes monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Portion size training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrition education games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Meal planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrition/food reference information access	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recipe information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Grocery shopping lists	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrition tips	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If other, please specify details here

Dietitian and apps-FINAL

Which of the following capabilities would interest you in future nutrition/food apps for mobile devices? Please assume they would be reliable, credible, Canadian.

	Not at all interested	Not interested	Neutral	Somewhat interested	Very interested	Unsure
Restaurant nutrition information look up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food nutrition information look up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Food product allergen information look up	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Calorie monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Carbohydrate monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fat monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Sodium monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Potassium monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Fibre monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Body weight monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Physical activity monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Diabetes monitoring	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Portion size training	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrition education games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Meal planning	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrition/food reference information access	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Recipe information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Grocery shopping lists	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Nutrition tips	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If other, please specify details here

Dietitian and apps-FINAL

Do you have any other advice for our teams working on developing apps for mobile devices relevant to dietetic practice?

Dietitian and apps-FINAL

If one new mobile device app were to be designed to support dietetic practice, please describe what would it be. Who is the target audience?

Dietitian and apps-FINAL

Would you be interested in continuing education on apps for mobile devices in dietetic practice?

- Yes
- No

Dietitian and apps-FINAL

What is your level of interest for each of the following continuing education topics?

	Not at all interested	Not interested	Neutral	Somewhat interested	Very interested	Unsure
Mobile device nutrition/food app demonstrations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mobile device non nutrition/food app demonstrations (these apps would be relevant to dietetic practice)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Current research using nutrition/food apps for mobile devices in dietetic practice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How to incorporate nutrition/food apps for mobile devices into dietetic practice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information about current nutrition/food apps for mobile devices available in app stores (e.g., BlackBerry App World, Apple App Store, Android Market)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Information about current non nutrition/food apps for mobile devices available in app stores that would be relevant to dietetic practice	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mobile device nutrition/food app design and development for dietitians	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

If other, please specify details here

Dietitian and apps-FINAL

Are you:

- Female
 Male

Please indicate which group best represents your age:

- Younger than 25
 25-34
 35-44
 45-54
 55-64
 65 or older

What is your province or territory of residence?

- | | |
|--|---|
| <input type="radio"/> Alberta | <input type="radio"/> Prince Edward Island |
| <input type="radio"/> British Columbia | <input type="radio"/> Quebec |
| <input type="radio"/> Manitoba | <input type="radio"/> Saskatchewan |
| <input type="radio"/> New Brunswick | <input type="radio"/> Northwest Territories |
| <input type="radio"/> Newfoundland | <input type="radio"/> Nunavut |
| <input type="radio"/> Nova Scotia | <input type="radio"/> Yukon |
| <input type="radio"/> Ontario | |

Country (if outside of Canada)

Dietitian and apps-FINAL

If you have any additional comments on this topic, please state them below.