

Mount Saint Vincent University  
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**Evaluation of Practice-based Evidence in Nutrition (PEN) Service for Dietetic Practice**

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## **DEDICATION**

This is dedicated to Dale, Grace and Elek Martin, for their faith, love, hugs and support.

## **ABSTRACT**

**Objective:** The analysis of the online evaluation survey of Practice-based Evidence in Nutrition (PEN) subscribers and non-subscribers quantitatively examined dietitians' perceptions of the PEN service as a provider of evidence-based dietetic information. The purpose of the PEN evaluation was to measure the effectiveness of the PEN service as a knowledge translation and transfer tool for incorporating new knowledge into dietetic practice, and to identify barriers and facilitators that prevent users from using or enable users to use PEN to change the way they practice. Results of the evaluation were used to inform recommendations for improvements to the PEN service.

**Methods:** A validated online survey was sent to all PEN subscribers (n=1,967) and a random sample of non-subscribers (n=1,542). The 333 respondents consisted of 265 PEN subscribers (13.5%) and 68 non-subscribers (4.4%). Respondents were dietitians or dietetic students. Survey responses were analyzed using descriptive statistics, proportions, the chi-square test and the z-test. Relationships between the survey responses and various demographic characteristics of the respondents were explored. Data compared to baseline data measured the difference between proportions.

**Results:** When faced with a practice decision, 96% of PEN subscribers were likely to use PEN for practice guidance. Approximately 82% rated the PEN service as an excellent or very good practice guidance tool. Sixty-one percent indicated that when PEN was used to support decision making it led to positive health benefits for clients. This latter finding was reported by those who indicated that they also found the information in PEN to be up to date, to have sufficient detail to guide practice and to be of high quality. Problems with technology (e.g., printing difficulties and broken links); the perceived lack of resources, tools and content in some topic areas; and the amount of time available to use PEN at work were identified as barriers to using PEN for practice guidance. Being over 45 years of age was a demographic characteristic that was a barrier to frequent PEN use as well as a barrier to having sufficient time at work to use PEN. Facilitators that enabled dietitians to

use PEN to change the way they practiced were accessibility to high-quality information, the perceived benefits to dietetic practice and the dietetic profession, and having sufficient time to use PEN. Being under 35 years of age was a demographic characteristic of subscribers who were more likely to use PEN frequently. Dietitians holding or working on a graduate degree were more likely to author or review PEN content. Compared to baseline data subscribers utilized PEN more frequently, had more time to use PEN at work, asked more practice questions and experienced more printing difficulties and broken links.

**Conclusions:** Results indicate that the PEN service was effective as a KTT tool for incorporating new knowledge into dietetic practice. Barriers were related to user satisfaction with PEN features. Facilitators pertained to users' perceptions of the value of PEN to their practice and quality of PEN content. This research supports Rogers' Diffusion of Innovations Theory in that attributes of PEN influence its rate of adoption. Attributes of PEN as perceived by users can prevent dietitians from changing or enable them to change the way they practice. Recommendations that address the barriers, promote the facilitators and encourage further research were made to improve the effectiveness of the PEN service to transfer knowledge and change practice.

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## Table of Contents

1.0 INTRODUCTION .....	1
1.1 Problem Statement.....	1
1.2 Purpose of the Study .....	2
1.2.1 Research Questions .....	3
1.3 Significance of the Study.....	3
1.4 Definitions.....	5
2.0 LITERATURE REVIEW .....	7
2.1 Dietitians of Canada .....	7
2.2 Evidence-Based Practice .....	7
2.3 Knowledge Translation and Transfer.....	11
2.3.1 KTT process .....	11
2.3.2 Practice guidelines.....	13
2.4 Online Decision Support KTT Tools .....	15
2.5 Practice-based Evidence in Nutrition (PEN) .....	18
2.5.1 The goal of PEN .....	18
2.5.2 PEN features.....	19
2.5.3 Practitioner engagement.....	20
2.6 PEN Evaluation.....	22

2.7 Barriers and Facilitators to EBP and KTT.....	26
2.7.1 Barriers .....	26
2.7.2 Facilitators .....	31
3.0 THEORETICAL FRAMEWORK.....	33
3.1 PEN Evaluation Framework Logic Model .....	33
3.2 Diffusion of Innovations Theory.....	35
3.3 Pathman Awareness-to-Adherence Model.....	39
3.4 Pathman-Rogers Model for KTT Tool Use .....	43
4.0 METHODS .....	46
4.1 Respondents.....	46
4.2 Questionnaire .....	46
4.3 Procedure .....	50
4.4 Statistical Analysis .....	50
5.0 RESULTS AND DISCUSSION.....	57
5.1 Effectiveness of the PEN Service as a KTT Tool For Incorporating New Knowledge Into Dietetic Practice — Research Question 1 .....	58
5.1.1 Knowledge transfer — short term (1-3 years).....	58
5.1.2 Knowledge transfer — change in practice .....	77
5.1.3 Technology.....	86

5.2 Barriers and facilitators that enabled dietitians to use PEN or prevented them from using PEN to change the way they practiced — Research question 2 .....	99
5.2.1 PEN orientation.....	99
5.2.2 Time.....	100
5.2.3 Gaps in content.....	104
5.2.4 Cost of subscription.....	105
5.2.5 Demographics — non-subscribers.....	107
5.3 Limitations .....	112
6.0 CONCLUSIONS AND RECOMMENDATIONS.....	114
6.1 Demographics.....	114
6.2 PEN Evaluation Framework Logic Model for Data Analysis.....	115
6.3 Pathman-Rogers Model for data analysis .....	118
6.4 Recommendations .....	120
6.4.1 Technology.....	120
6.4.2 PEN Content .....	124
7.0 POSTSCRIPT.....	129
REFERENCES .....	131
Appendix A .....	135
Appendix B .....	153



Appendix C.....	155
Appendix D .....	160
Appendix E.....	161
Appendix F.....	164

**Table of Figures**

Figure 1: Knowledge to action process <sup>1</sup> .....	12
Figure 2: Timeline of PEN evaluation.....	25
Figure 3: Abbreviated PEN Evaluation Framework Logic Model.....	34
Figure 4: Characteristics of PEN that could positively influence its adoption by dietitians <sup>1</sup>	39
Figure 5: PEN and promotion of evidence-based practice <sup>1</sup> .....	42
Figure 6: Pathman-Rogers model for PEN use .....	45
Figure 7: Reasons for using PEN .....	65
Figure 8: Limits to the use of PEN tools/resources .....	72
Figure 9: Type of tools users would like to see included in PEN.....	73
Figure 10: Sources of practice information regularly used by dietitians.....	79
Figure 11: Level of agreement with “I usually have sufficient time at work to spend using PEN” .....	104
Figure 12: Reasons for not subscribing to PEN.....	106

## **Table of Tables**

Table 1: Summary of demographic characteristics of PEN subscribers.....	60
Table 2: Survey questions that measured increased pride in the quality of PEN.....	81
Table 3: Summary of results for search option survey questions.....	89
Table 4: Summary of the effectiveness of PEN as a knowledge transfer tool.....	96
Table 5: Demographic characteristics of PEN non-subscribers.....	108
Table 6: Demographic characteristics of PEN non-subscribers compared to PEN subscribers .....	109
Table 7: Barriers and facilitators of using PEN to change behaviour/ practice .....	111
Table 8: Demographic characteristics as barriers and facilitators to PEN use.....	112

## **1.0 INTRODUCTION**

### ***1.1 Problem Statement***

Evidence-based practice (EBP) is a decision-making approach that systematically integrates current best evidence into client care (1,2). Health practitioners who practice EBP read and interpret research literature and then blend the best of the available research with practice expertise and patient values to plan client care (1). While several health professions, including dietetics, have adopted the principles of evidence-based practice and have applied them to their practice (2), many have cited lack of time and skill to find and critically evaluate the large volume of published evidence as barriers to integrating the best evidence into practice (1,2,3,4). The synthesis and transfer of knowledge into a format, such as practice guidelines, that can be readily accessed and applied by decision makers addresses the barriers of lack of time and skill of practitioners to find and evaluate relevant evidence. The creation of practice guidelines as well as their application to client care is part of knowledge translation and transfer (KTT). Knowledge translation and transfer methods facilitate the uptake and application of knowledge in decision making (5). Health care practitioners consider practice guidelines to be the most influential source of knowledge that can facilitate knowledge transfer (6,7).

Dietitians of Canada (DC), the professional association and nationwide voice of dietitians, developed Practice-based Evidence in Nutrition (PEN) as an online decision support and knowledge transfer tool (1). PEN provides support for dietitians and nutritionists to stay up to date with evidence-based research and enables them to apply evidence-based

decision making by supplying practice guidance in a format that can be used by frontline dietetic practitioners to guide their practice (8). In the field of dietetics an evidence-based approach to practice enhances the credibility of dietitians as nutrition experts, standardizes nutrition care and has the potential to improve client health outcomes (1,9).

Online decision support tools require evaluation to assess their effectiveness of knowledge translation, transfer and application to practice and their impact on client health outcomes (10,11,12). Evaluations of decision support KTT services should be ongoing and identify barriers and facilitators to their use (10,12). Evaluation of PEN as an online decision support KTT tool would show whether planned outcomes were achieved in the areas of technology, knowledge translation and transfer, application to practice, and client health outcomes.

## ***1.2 Purpose of the Study***

The purpose of this study was to determine the effectiveness of the PEN service as a knowledge translation and transfer tool and whether barriers and facilitators enabled dietitians to change the way they practice or prevented them from doing so. Effectiveness of the PEN service was measured against DC's planned short-term outcomes and corresponding indicators in knowledge transfer and technology. This study, the second evaluation (Phase II) of PEN by Dietitians of Canada, used the same survey tool developed and validated for the first evaluation (Phase I) of PEN that collected baseline data the previous year. As in Phase I, PEN subscribers and PEN non-subscribers were invited to participate in an online survey that elicited demographic information and quality

assurance data. In Phase I and Phase II, PEN subscribers were asked about the barriers and facilitators that enabled them to use PEN or prevented them from using PEN to change the way they practice. Phase II data were compared to Phase I baseline data to measure the difference between the results, thus determining whether there was a change in the effectiveness of the PEN service as a KTT tool and in the barriers and facilitators associated with the PEN service over the course of one year.

### **1.2.1 Research Questions**

This research addressed two questions and two sub-questions:

1. How effective was the PEN service as a knowledge translation and transfer tool for incorporating new knowledge into dietetic practice?
  - a. How effective was the PEN service as a knowledge translation and transfer tool for incorporating new knowledge into dietetic practice compared to a year ago?
2. What were the barriers and facilitators that enabled or prevented dietitians from using PEN to change the way they practiced?
  - a. What were the barriers and facilitators that enabled or prevented dietitians from using PEN to change the way they practiced compared to a year ago?

### **1.3 Significance of the Study**

Dietitians of Canada collaborated with Mount Saint Vincent University to evaluate the impact of PEN as a medium for knowledge translation and transfer for dietetic

practitioners (13). It was important to do this independent research to assess users' perception of PEN's effectiveness at transferring knowledge to dietitians and nutritionists and whether barriers prevented them from using PEN. The research also identified demographics of users, frequency of use, barriers to use, gaps in content and technology difficulties in order to make recommendations to DC that would point to the future direction of PEN in terms of gaps in content and functionality of the technology for knowledge translation, transfer and application and to improve the operation and value of PEN to the PEN user (8). Recommendations that are addressed could ensure PEN's effectiveness as a KTT tool that integrates knowledge into dietetic practice and successfully meets the needs of users and impacts client health outcomes by providing dietitians and nutritionists with more timely and efficient access to evidence-based guidance and tools that promote sound decision making in client care (8,14,15).

This research evaluated a KTT tool for dietetic practitioners and used a theoretical framework based on Rogers' Diffusion of Innovations and Pathman's Awareness-to-Adherence models to frame and interpret the results. The current research extends what was previously known from the PEN evaluation baseline data regarding users' perceptions of PEN's importance and value, who uses PEN, and gaps in content and technology issues. In addition, it assessed whether changes made to the PEN service the previous year were positively perceived by the users. As a follow-up evaluation, this research identified trends over time in knowledge transfer and dietetic practice change as it relates to PEN. The research results established relationships among factors such as demographics and reasons for using PEN.

Practice-based Evidence in Nutrition has been acknowledged by the Health Council of Canada (HCC) as “a leading example of a useful and innovative tool that directly impacts patients’ quality of care and directly supports many more facets of the profession’s activities with the best evidence available.”(16). The recognition of PEN by this national organization whose mission it is to shine a light on what helps or hinders the well-being of Canadians (17) and the results of this evaluation will potentially inform other designers of online knowledge translation and transfer tools in terms of content and use of technology.

#### **1.4 Definitions**

Knowledge is a fluid mix of experiences, values, contextual information and expert insight and scientific research (10,13).

Knowledge translation is, according to Canadian Institutes for Health Research, “the exchange, synthesis and ethically-sound application of knowledge — within a complex system of interactions among researchers and users — to accelerate the capture of the benefits of research for Canadians through improved health, more effective services and products, and a strengthened health care system” (18).

Knowledge transfer refers to both the creation of knowledge as well as the incorporation of the knowledge into daily practice to support decision making by the intended users. It is the systematic approach to capture, collect and share tacit knowledge in order for it to become explicit knowledge. The process allows individuals and/or organizations to access and utilize essential information, which previously was known intrinsically to only one person or a small group of people (8). The systematic process to capture, collect and share

the tacit knowledge is based on the evidence-based method that begins with the formulation of a question and ends with an assessment of the outcome. Results of the assessment lead to the formulation of more questions; hence, the process becomes a cycle.

*PEN Evaluation Framework Logic Model* is a document prepared for Dietitians of Canada by an external evaluation consultant that outlines the desired short- and long-term outcomes for the PEN service and corresponding indicators to be assessed when evaluating PEN (19).



## **2.0 LITERATURE REVIEW**

The present literature review will position the research both within the broader conversations about EBP and KTT as well as within the profession of dietetics and the field of online decision support tools.

### ***2.1 Dietitians of Canada***

Dietitians of Canada (DC) is a professional association and nationwide voice of just under 6,000 dietitians. Dietitians of Canada's mission is to support and advance the profession's body of knowledge of food and nutrition and ethical, evidence-based best practice in dietetics (20). Dietitians of Canada achieves impact in its mission in two ways. One is to provide evidence-based, trusted advice to dietitians and nutritionists. The other way is to develop standards and tools to support dietitians in their practice. To meet both of these objectives, the Practice-based Evidence in Nutrition (PEN) service was launched in September 2005 as a medium for knowledge translation and transfer for dietetic professionals. PEN was designed to provide valid, applicable evidence-based information to meet the information needs of users (8). The ultimate goal of providing evidence-based information to dietitians through the PEN service is to improve clients' health outcomes (8).

### ***2.2 Evidence-Based Practice***

Evidence-based medicine is the practice of medicine based on the best obtainable scientific evidence (12). The best evidence is then blended with the practitioner's practice expertise and the patient's values to plan patient care (1). Evidence-based decision making has been

a basis of medical practice since the early 1970s (7); however, the term “evidence-based medicine” originated at McMaster University approximately 29 years ago when medical education began to rely heavily on medical literature to inform client care (1). Evidence-based decision making, also known as evidence-based practice, has branched out into other health professions including dietetics.

Evidence-based practice (EBP) follows a five-step process to find and apply the best evidence. The method outlined by Gray and Gray (1) was accepted as the standard by the Quality Management Committee of the American Dietetic Association (ADA) and is also followed by DC. The first step of the five-step evidence-based process is to formulate the practice-based question of interest. The second step is to systematically search for answers in the literature. When answers have been found, the evidence is appraised, the research results are applied and, finally, the outcome of applying the results is assessed. In the appraisal step, the evidence is assigned a grade based on the study design quality and strength of the study. The graded evidence is summarized to form guidelines, which are also given a grade. The grade of the guideline (A, B, C or D) can influence whether practitioners will use the evidence to change practice. In the field of dietetics, efforts to apply EBP to practice have focused on developing evidence-based practice guidelines (21). Evidence-based practice guidelines that are developed using the five-step process and are easily accessible to dietetic practitioners can allow practitioners to spend more time on recommended care rather than doing an extensive review of the literature to answer a question or to plan nutrition care. Gray and Gray suggest that the best graded evidence should be used in making decisions about client care, but the practitioner should also

consider if the treatment recommendation is consistent with patient values and whether it is possible to implement the recommendation in the practice setting (1).

Practitioners may change the way they practice based on strong evidence. Alternately, they may not change practice due to lack of evidence or weak evidence. In 2001, Brassey et al. invited general practitioners (GPs) to send their clinical queries to Ask Trip to Rapidly Alleviate Confused Thoughts (ATTRACT). This was a new service for GPs that provided rapid, synthesized, evidence-based summaries to their clinical questions (22). The GPs were surveyed a year after the introduction of ATTRACT to evaluate the usefulness of the service. Sixty percent of GPs changed practice as a result of the strong evidence-based answers received from ATTRACT. However, 15% of the GPs did not change practice or follow the recommended care because they felt the evidence supplied to them was too weak. The practice changes that did occur were attributed to the GPs having quick answers to clinical questions, and because GPs were able to “pull” information from a source by asking specific practice questions when and where it was needed. The “pull” approach is different from the traditional “push” of information toward the clinician with the hope that it will change practice. Like the ATTRACT service, PEN uses a pull approach to changing practice by answering practice questions posed by dietitians (8). Brassey et al. did not ask the GPs to rate ATTRACT as a practice guidance tool or whether they felt the evidence-based information they received improved the health of their clients.

Although evidence-based research is available to inform practice, there are presently many health practitioners who have not adopted EBP (23,24,25). As a result of this gap between

the recommended evidence-based practice guidance and the care provided to clients by health practitioners who have not adopted EBP, clients may achieve less than optimal health outcomes (26). To improve health outcomes, the evidence needs to be applied in client care. Evidence that is made available to practitioners could help them to apply the guidelines. McGlynn et al. investigated the level of recommended care provided to clients and conducted 13,275 telephone surveys on a random sample of adults living in urban areas of the United States. The results of the survey showed that participants received only 55% of recommended care (26). Therefore, the authors suggest that certain information should be available to practitioners to ensure more clients receive care based on evidence-based research. The information available should include the recommended practice guidance, the strength of the evidence that informs the guidance and the expected outcomes. However, McGlynn et al. did not suggest how the recommended practice guidance should be made available to practitioners. McGlynn et al.'s study raises two questions: "How is the information to be made available?" and "When recommended guidance is available, why don't practitioners utilize it?" It would be interesting to know whether the US practitioners in McGlynn et al.'s study would have provided a higher percentage of recommended care if supporting evidence for the recommended practice guidance was easily accessible online.

## ***2.3 Knowledge Translation and Transfer***

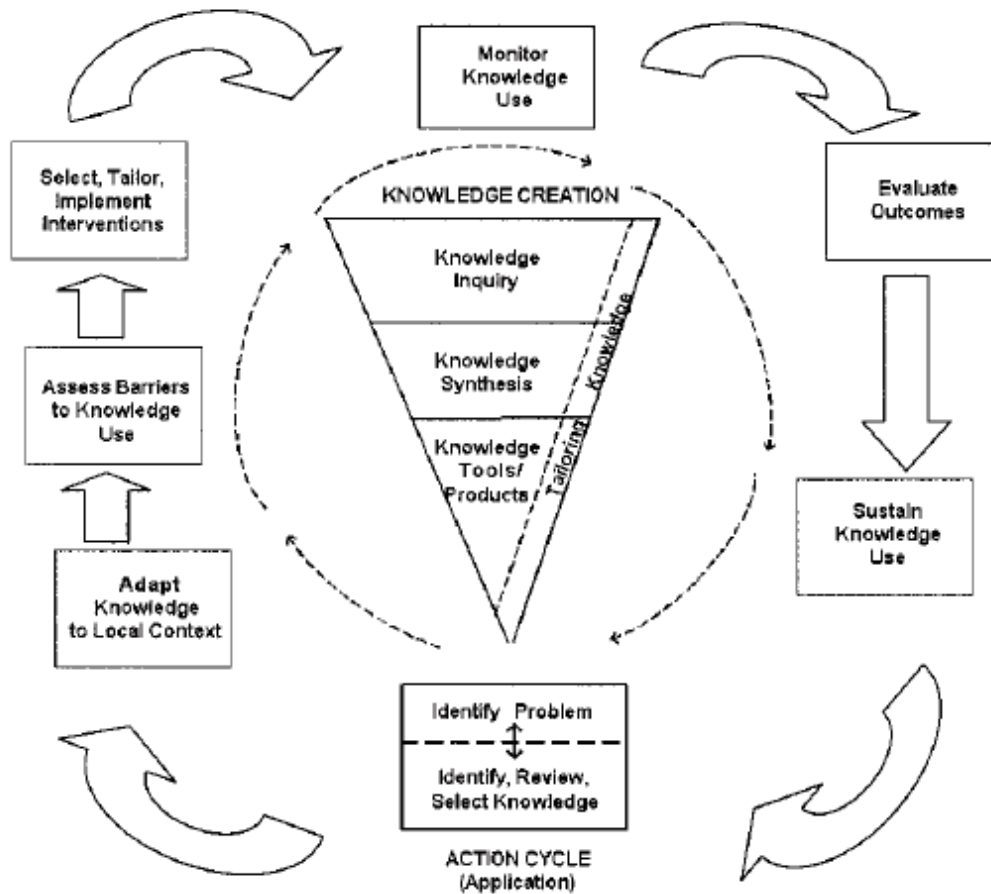
### **2.3.1 KTT process**

The KTT process involves moving scientifically sound and useful knowledge (tacit knowledge) from research to information that can be used by decision makers to improve health (explicit knowledge) (5). The KTT process is depicted in the knowledge to action process by Graham et al. (**Figure 1**) (10). The process begins with knowledge inquiry, and ends with sustained knowledge use. In knowledge inquiry, engagement between researchers and practitioners can help both groups recognize where gaps in knowledge exist and what future research is required to influence practice change (3,5). Knowledge tools/resources are developed from the knowledge synthesized through the EBP method to fit the needs of the users or to answer specific problems or questions. The purpose of the tools/resources is to present knowledge in a clear, concise, user-friendly format with recommendations that can influence what the knowledge users do (10). The evidence in the tools must be simplified to the degree that it can be understood by the intended user, such as practitioner, client or policy maker. The action cycle also includes implementation or application of knowledge. The phases of the action cycle are based on planned action theories with the objective of influencing change. Adapting knowledge to the local context encompasses the blending of knowledge, practice experience and practice setting to determine the appropriateness of the knowledge to the circumstance. Barriers to knowledge use may be related to the knowledge, the adopter of the knowledge or the setting in which the knowledge is to be used (10). Several of the steps in the knowledge-to-

action process, including assessing barriers and evaluating outcomes, are part of the current evaluation of PEN.

Assessment and evaluation of the outcomes can determine whether the practice change positively impacted the outcomes of client health processes and may lead to more practice questions that would initiate the KTT process again, thus creating a cycle. Essentially, KTT

Figure 1: Knowledge to action process <sup>1</sup>



<sup>1</sup> Reproduced from Graham et al. (10)

is the process of applying knowledge to practice to address the gap between what is known from research, knowledge synthesis and implementation to improve health outcomes (10). Often, the knowledge creation process uses scientific research to develop actionable messages such as practice guidelines, which inform decisions and actions (8,14,27).

### **2.3.2 Practice guidelines**

Many health care practitioners change the way they practice in response to practice guidelines while other practitioners do not. Pappano et al. surveyed 119 paediatric health care providers in New York to understand which information sources they perceive as the most influential to promote change in their clinical practice (6). The majority (92%) felt that the American Academy of Paediatrics (AAP) practice guidelines were a major influence and 44% felt they were the single most influential information source that changed how they practiced. The guidelines reduce the amount of time it takes for time-strapped paediatric health care providers to review the large amount of complex research available for review.

Paediatric dietitians feel similarly about the positive influence of practice guidelines on practice change. Thomas et al.'s 2003 cross-sectional survey of 59 paediatric dietitians measured their knowledge and use of evidence-based nutrition. Half of the surveyed dietitians ranked practice guidelines as the best quality information source available to respond to therapy questions, while 20% of the dietitians thought systematic reviews, 12% thought randomized control trials and less than 1% thought textbooks or colleagues to be

the best (7). Although 90% of the dietitians supported the principles of EBP, almost 75% did not practice evidence-based nutrition and felt they did not have the skills to use it in practice. However, it can be inferred that if the paediatric dietitians who ranked practice guidelines as the best quality information applied the practice guidelines, then they actually practiced evidence-based nutrition and changed their practice without doing extensive research and interpreting the results of the studies. It may be that the dietitians thought that practicing evidence-based nutrition meant having to do their own extensive research. The practice of evidence-based nutrition can merely utilize practice guidelines to support decision making. For example, practice guidelines may be used to guide the development of client tools/resources such as educational materials. When these tools/resources are used in practice, the practitioners would be practicing evidence-based nutrition.

Tools and resources based on evidence-based practice guidance are included in the PEN service. The end users of the knowledge synthesized into PEN tools/resources include health care professionals as well as clients. For example, health care practitioners would use the practice guidance and resources while clients would receive client tools/resources such as handouts that are consistent with the evidence-based practice guidance. The tools for both health care practitioners and clients must be easily accessible and shared in order to change practice and impact health outcomes. Tools and resources can be made more relevant to the end users when practitioners and clients are part of the practice guidance creation process.



## ***2.4 Online Decision Support KTT Tools***

The purpose of online decision support KTT tools is three-fold: 1) to present current, relevant and important knowledge in a clear, concise and user-friendly format to support the adoption of EBP; 2) to provide precise practice guidelines; and 3) to meet the information needs of users. A factor that leads to successful transfer of knowledge is the tool linking the source of knowledge to the recipient (14). Online decision support tools can quickly diffuse new evidence to practitioners and reduce the time it takes for research to impact practice (28) by providing the synthesized evidence summaries that reduce the time required to critically read and assess research articles. Several health professional organizations have developed online decision support KTT tools. For instance, Physicians' Information and Education Resource (PIER), an electronic, evidence-based decision support tool for physicians, was developed by the American College of Physicians. National Association of Pharmacy Regulatory Authorities (NAPRA), a pharmaceutical database, was created for Canadian pharmacists. Directors of multilayered information systems need to monitor and evaluate how information is accessed, interpreted and used (29) to ensure the KTT tools are effectively serving their purpose.

An evaluation of PIER and four other evidence-based information tools found that online decision support resources should be easy-to-use, comprehensive tools that provide levels of evidence to support conclusions (30). Farrell's study of Canadian health librarians' satisfaction of online decision support KTT tools showed that PIER provided evidence to answer all of the practice questions posed by the librarians. However, the librarians did not agree that PIER was easy to use and, therefore, indicated that practitioners may be less

likely to use it (30). Farrell's study suggests that an easy-to-use, comprehensive, evidence-based information tool may be used more frequently than a complex tool that contains equally comprehensive evidence. However, the subjects were librarians, not practitioners who are the usual users of evidence-based information tools and who may have different information needs, skills and experience at using online tools of this nature. Farrell acknowledges that future studies using practitioners instead of librarians as evidence searchers would provide more information on the usefulness and impact of evidence-based information tools.

Use of online decision support tools can change practice decision making and influence KTT. For instance, Alper et al. included 52 primary care clinicians in a randomized trial to investigate whether clinicians would answer more clinical questions, change their decision making and alter search time using DynaMed in addition to their usual information sources. The clinicians could enter clinical questions for searching during practice and choose to use either DynaMed, a database of synthesized and critically appraised evidence, or their usual online information sources to answer clinical questions (31). No restrictions on information sources were made except that DynaMed could not be one of the usual information sources used to answer the clinical question. Practitioners who used DynaMed answered more practice questions, answered more questions correctly and changed clinical decisions more often without increasing overall search time than by using their usual information sources. Likewise, Westbrook et al. conducted a pre-/post-intervention experimental design by involving hospital-based doctors, family practitioners and clinical nurse consultants (11). The research results indicated that the use of an online

information retrieval system that provided access to six sources of evidence (five of the six sources presented evidence in a summarized form with links to references) improved clinicians' answers to clinical questions by 21% (11). Alper's and Westbrook's studies show that use of databases, including online decision support tools that contain synthesized evidence, allowed clinicians to eliminate the critical appraisal step of EBP and quickly implement the new knowledge. The two studies also show that the tools changed practice, resulted in the uptake of new knowledge and improved the accuracy of clinicians' responses to clinical inquiries. Synthesized evidence that is available online can be a feasible way to meet the information needs of those in primary care and change clinical decisions. It is likely that practitioners would be more confident in using a resource if it has been positively evaluated, and the results of the evaluation found the resource to be relevant and effective.

Online knowledge transfer and translation tools impact decision making and practice, but continual, regular use of the tools will create sustainable practice change and keep practitioners current with the latest research (32). Magrabi evaluated the long-term use of Quick Clinical, an online evidence system designed to address the specific needs of general practitioners (GPs) (32). The author used a twelve-month prospective cohort study to analyze GPs' patterns of use of Quick Clinical and the results indicated that GPs conducted 9.9 searches per month in the first two months. In the remaining ten months each GP in the study used the evidence retrieval system to conduct an average of 0.7 searches per month. The usage rates showed that GPs' pattern of usage rates dropped after several months of use; however, the study did not investigate why usage rates dropped or whether barriers

influenced the short-term use of the tool. Results from Armstrong's evaluation of evidence resources indicated that resources that regularly add the most recent, up-to-date evidence to grow the content may be consulted more frequently (24). Therefore, if Quick Clinical content was regularly updated it may have increased the GPs' pattern of usage rates. Magrabi states that a long-term evaluation is required to assess overall uptake and integration of the knowledge provided in an online evidence-based tool into practice. Few evaluations have been done to assess the patterns of use beyond the initial period of introduction when the novelty of the tool may influence patterns of use (32). In contrast, the PEN evaluation was initiated three years after the launch of the tool and assessed users' frequency of use and the quality of content at two different times.

## ***2.5 Practice-based Evidence in Nutrition (PEN)***

### **2.5.1 The goal of PEN**

Practice-based Evidence in Nutrition is an online decision support KTT tool that was created by DC to provide support to nutrition professionals to stay up to date with research literature, enable them to apply evidence-based decision making to practice and position them as evidence-based practitioners (8). The practice guidance in PEN is applicable to the wide scope of dietetic practice including clinical, education, public health and food service administration (18). Practice-based Evidence in Nutrition addresses the need of health professionals for quick access to timely, current and authoritative guidance and can reduce barriers to EBP such as the burden of sorting the volumes of information (33,34). The PEN service can provide users with an effective method of translating nutrition

research into practice guidance (8). The ultimate goal of PEN is to provide evidence-based research in a format that can be used by frontline dietetic practitioners to improve the health outcome of the public (8).

Dietitians seek evidence to answer practice questions. Thomas et al. reported that 95% of surveyed paediatric dietitians did their own literature search when they encountered a knowledge gap (7). Similarly, in a survey of 500 dietitians by Byham-Gray, 55% reported that a literature search influenced their practice (2). This shows that many dietitians are doing literature searches to seek evidence and gain knowledge to answer practice questions; however, the quality of the research they found is not reported, nor how many sources they consulted. Practice-based Evidence in Nutrition's multilayered information system presents the best available evidence to guide dietetic practice and is designed to provide practitioners with relevant, up-to-date evidence and be the first source used by practitioners to answer practice questions in clinical, food service administration, public health and education. It is important that PEN provides the best available evidence to guide dietetic practice so that dietitians may spend less time searching for and critically evaluating literature, dietitians may spend more counselling time on treatments and approaches that are known to improve outcomes, and clients may receive optimum treatment.

### **2.5.2 PEN features**

Practice-based Evidence in Nutrition transfers knowledge to decision makers using a unique knowledge pathway approach that perhaps most resembles the knowledge transfer

processes within organizations that use other online knowledge portals. The features of a knowledge pathway are comprehensive and begin with practice questions submitted by users. The answers to the practice questions become part of a knowledge pathway which consists of key practice points graded by the strength of the evidence, evidence syntheses, background information, evidence summaries, practice guidance summaries, links to references and professional/client tools. Knowledge pathways are grouped under four categories: Population Health/Lifecycle, Health Condition/Disease, Food/Nutrients and Professional Practice (35). The structure of a knowledge pathway provides the flexibility to enable the busy practitioner to quickly find an answer to a specific question as well as to drill down to review the evidence in more detail (34). When practitioners need a quick answer to their practice question they can go to the guidance statements or practice recommendations or read the background information on the topic. When practitioners have more time, they can link through to the references, evidence summaries, websites or databases, and read the biography and credentials of the pathway authors and reviewers, which adds credibility to the content. Practitioners can review and/or print the related tools and resources, tables, calculators or algorithms to use as resources or to share with clients or colleagues.

### **2.5.3 Practitioner engagement**

Practitioner engagement is important to the growth and sustainability of PEN. Engaging practitioners, who are one group of end users of PEN content, by contributing to the knowledge pathways can accelerate the interactive shared learning of practical experience as well as research findings (36). Engaging practitioners also improves the relevancy of

the information for practice, which can be linked to increased uptake or use of the information. Practitioner engagement is congruent with the research literature that states that interactive engagement may be the most effective way to transfer knowledge (3,5,27,36). Practice-based Evidence in Nutrition uses several strategies to engage practitioners in developing PEN content. Users can ask practice questions that arise from everyday practice. Users can also be engaged as authors or reviewers of knowledge pathway information. Practice-based Evidence in Nutrition content benefits from practitioner engagement as authors or reviewers since knowledge translation needs to take into account the contextual factors of decision making by dietitians (5). In terms of knowledge content, this means that diverse types of evidence, knowledge or information are required to address the concerns of dietetic practitioners in the context in which the decision is being made (5). Dietitians who develop the knowledge pathways in PEN are familiar with the type of knowledge and information sought by practitioners and the contexts in which decisions are made. Also, dietitians have an understanding of the decision-making process in dietetic practice, which helps them as authors and reviewers to select the type and sources of knowledge to use. Having a dietitian author and review PEN content can facilitate the adoption of the knowledge to the local context within daily practice, which is a step in the knowledge to action process.

Dietetic practitioners may be more likely to rely on PEN practice guidance as a source of practice information when it has been written by dietitians. Weiss et al. explored determinants of physicians' decisions to change practice habits and found that discussion with colleagues, especially subspecialists, was most commonly named as the most

important source of practice information to advise them before they changed practice (37). Background information on PEN authors and reviewers is already in PEN. Greater promotion of the authors could lead to a greater reliance on PEN practice guidance to change practice.

To answer practice questions, PEN authors, most of whom are dietetic practitioners, are guided by a standardized PEN Writers' Guide developed by DC. The authors do a literature search and select the literature for review from "filtered" sources such as well-designed systematic reviews, meta-analyses and synopses as well as authoritative "grey" literature and individual research articles (45). After the literature search, the authors critically appraise the pertinent literature, synthesize the evidence and develop key practice points, which are graded according to a standardized evidence protocol. Dietitians of Canada offers authors and reviewers a tutorial on evidence-based decision making. Dietitians of Canada collaborated with the Centre for Health Evidence, University of Alberta, to develop an online interactive tutorial called Evidence-based Decision Making to support dietitians' understanding and use of evidence in practice, and provide opportunities for research improvement (34). This tutorial provides skill building in all of the five evidence-based practice steps: 1) formulate the question, 2) search for answers, 3) appraise the evidence, 4) apply the results and 5) assess the outcome (1).

## **2.6 PEN Evaluation**

In the knowledge to action process (**Figure 1**), "evaluate outcomes" is the step that determines the impact of using the knowledge (10). To evaluate outcomes is to evaluate



whether using the knowledge makes a difference in health outcomes or changes practice. Evaluating the impact of knowledge use is one way to determine whether the efforts to promote its uptake were successful (10). The KTT process has an explicit hypothesis that suggests that when good evidence is put into a context to facilitate knowledge translation, such as usable action steps or practice guidance, it can improve the delivery of health care and improve the outcomes of the population (38). To measure the impact of using knowledge on client outcomes would require a long time; therefore, this researcher, along with DC, tested the hypothesis by assessing short-term indicators. The selected indicators, such as whether PEN is perceived by users to enable them to take an evidence-based approach to their practice, to be a valuable tool for their practice or to have positively influenced the way they work, would suggest PEN is a successful KTT tool for PEN users.

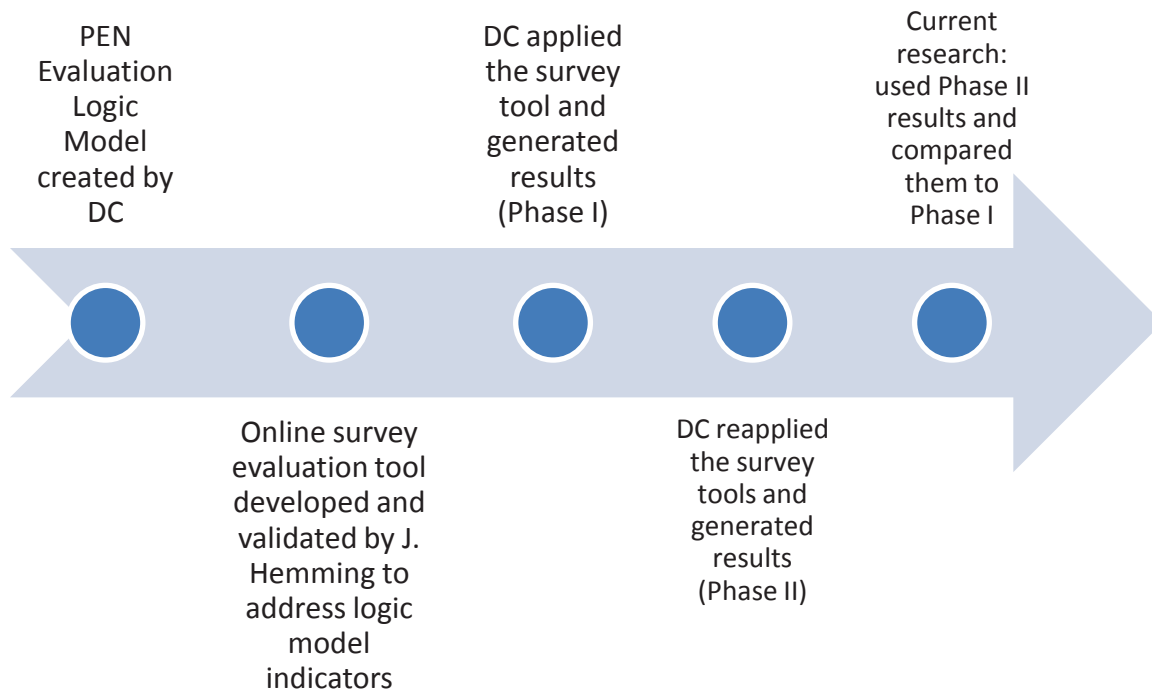
These short-term indicators are part of Dietitians of Canada's strategic document titled PEN Evaluation Framework Logic Model. The PEN logic model is similar to the Canadian Institutes of Health Research's (CIHR) knowledge translation strategy for 2004 - 2009, which planned short- and long-term outcomes that will be evaluated to measure the success of their mandate. Both logic models had short and long-term outcomes to measure knowledge translation. The CIHR's mandate is "to develop a systematic, integrated approach to accelerate optimal use of the best available research evidence in the interest of the health of Canadians" (18). The PEN Evaluation Framework Logic Model sets forth planned outcomes that will be evaluated regarding knowledge transfer and technology to measure the success of the goal of PEN, which is "to provide evidence-based research in a format that can be used by frontline dietetic practitioners in a timely and efficient manner

so as to improve the health outcomes of the public and position dietitians as evidence-based practitioners” (8). Each outcome in the PEN logic model corresponds to specific indicators and each indicator corresponds to methods and data sources that measure whether the outcome has been achieved. In this research, the survey is the method and the responses to the survey questions are the data sources. Hence, the responses are the measures used to assess the level of success of meeting the criteria of the indicators and achieving the outcome. This current research was the second evaluation of PEN and assessed whether the KTT service achieved selected outcomes identified in the PEN Evaluation Framework Logic Model. A comparison of the data between the first and second evaluation also indicated if and where there were improvements in PEN as a KTT tool.

Previous groundwork was laid to prepare for this evaluation of PEN. Development of validated evaluation tools for Practice-based Evidence in Nutrition, including an online survey that addressed selected indicators outlined in the PEN logic model, was completed by a Mount Saint Vincent University master’s candidate, Janet Hemming. The survey was used to collect baseline data in December 2007 (Phase I). The data subsequently collected in Phase I was analyzed using descriptive statistics. The evaluation survey was reapplied in November 2008 (Phase II) and analyzed using the same methods as used in Phase I. The reapplication of the survey, Phase II, was the focus of this present research. The timeline of the PEN evaluation is summarized in **Figure 2**. This study used the baseline Phase I data for comparison and to assess changes and trends in KTT (as applied to PEN) and dietetic

practice. In addition, this study identified barriers and facilitators to the use of PEN as a KTT tool in dietetic practice.

**Figure 2: Timeline of PEN evaluation**



The white paper by Sim et al. states that evaluators of clinical decision supports should use both quantitative and qualitative methodologies several times after the launch of the tool to identify barriers and facilitators to the use of the decision support tool (12). This current PEN evaluation uses an iterative quantitative approach and identifies barriers and facilitators. The study of barriers in this PEN evaluation can advance actions to improve the ability of PEN to support the achievement of intended PEN Evaluation Framework

Logic Model outcomes. It is anticipated that this evaluation of PEN will increase DC's understanding of the demographic characteristics of users and non-users, how and why they use PEN and how PEN impacts their practice. It is also anticipated that it will direct future development and promotion of the tool, which will lead to an improved service, extended reach and higher approval and utilization rates, and will ultimately help dietitians and others improve health outcomes by using the best available evidence.

## ***2.7 Barriers and Facilitators to EBP and KTT***

### **2.7.1 Barriers**

A barrier is any factor that limits or restricts practitioner adherence to practice guidance or implementation of evidence into practice (30). One of the steps in the knowledge to action process (**Figure 1**) by Graham et al. (10) is to assess potential barriers to knowledge use. Barriers may exist anywhere in the knowledge to action process. Hence, barriers must be identified and addressed in all steps of the knowledge to action process to promote and sustain knowledge use and to clear the way for a more fluid application of knowledge to evidence-based interventions that ultimately enhance positive client health outcomes (39).

Although dietitians believe in an evidence-based approach to practice and recognize the value of research, many lack the time, ability and skill to critically read research (4,6,7). Three separate studies of health practitioners reported they experienced similar barriers to EBP. In three separate surveys of 500 registered dietitians by Byham-Gray et al. (2), 119 paediatric health care providers by Pappano (6) and 59 paediatric dietitians by Thomas et al. (7), the results indicated that the health practitioners all agree that finding

evidence and evaluating its quality and relevance to patients requires significant skill and is time-consuming. Important changes in practice can result when obstacles such as the labour-intensive steps of the evidence-based method including literature searches and critical appraisal are removed (22). Practice-based Evidence in Nutrition removes for the user the lengthy steps of critical appraisal, grading and synthesis of the evidence. However, even when these lengthy and time-consuming steps are done for users, they may still perceive other barriers to EBP such as factors both internal and external to the practitioner.

Dietitians' ability to integrate an evidence-based approach is influenced, and often impeded, by external factors such as their education and training, work experience and professional association involvement (2). For example, dietitians who had no training in research, were not employed as researchers in nutrition and/or dietetics or as faculty members, and belonged to less than two professional associations had a lower perception, attitude and knowledge of EBP (2), which may be due to a lack of confidence or experience in applying evidence to practice. External factors that are gathered in the demographic information section of surveys and then analyzed can establish relationships among demographic characteristics and barriers to EBP and KTT.

Personal experience and personal caution are internal factors that are potential barriers to how clinical evidence is implemented. Thomas et al.'s survey of 59 paediatric dietitians showed that when dietitians consider applying research literature they contemplate whether the studied population differed significantly from the population they were

treating, whether there will be resistance from other health professionals and whether they will experience difficulty applying results that differ from their personal experiences (7). When GPs apply research literature their concerns are related to the interaction between practitioner and patient. Freeman et al. conducted three focus groups with established GPs. The authors identified six themes that were barriers to GPs' implementation of best evidence: their personal and professional experiences, the patient-doctor relationship, the GPs' feelings about their patients and the evidence, logistical problems and a perceived tension between primary and secondary care (23). The results of these two studies indicate that although practitioners are aware of the best available evidence, the barrier to changing practice behaviour is often the internal factors that influence the blending of the evidence with practice expertise and patient values, which are the foundation of evidence-based practice.

Knowledge must be transferred and shared in a timely manner to close the gap between what we know to be effective and what we practice daily. Research indicated that on average, in 2007, it took twelve years to incorporate proven medical advances into practice (with the exception of pharmaceuticals and new technologies) (28). It is desirable to reduce the time lag between the publication of evidence and the application of evidence to practice. In 2007, Armstrong et al. had consultations with forty-seven stakeholders and practitioners to evaluate a series of six published evidence-based health promotion resources (EBHPR) (24). Some of the resources had online databases. Discussions included issues of currency, accessibility, relevance and dissemination. There was limited use of EBHPRs in planning interventions and guiding implementation due to barriers,

including diminishing use of the resources as time elapsed after the initial publication, time constraints, lack of skills in knowing how to use evidence to inform practice and potential lack of awareness of the EBHPRs among new staff. This study shows that evidence-based resources that contained outdated research were used less frequently and that out-of-date evidence is perceived as a barrier to use. Armstrong et al. suggested that the key processes to adequately link research, practice and policy into consequential knowledge translation and transfer were the development of EBHPR and dissemination strategies (22). Timely sharing of abbreviated, concise summaries of up-to-date, relevant, graded research that resonates with dietetic practice can accelerate the application of research to practice and provision of optimal care to clients.

Health care professionals experience barriers to guideline adherence and integration of evidence into practice. Cochrane et al.'s systematic review identified many barriers to knowledge translation, evidence implementation and diffusion of innovation (30). The barriers from 256 articles were put into seven categories: cognitive/behavioural; attitudinal or rational-emotional; professional; barriers embedded in the guidelines or evidence; patient barriers; support or resources; and system and process. Looking more closely at the barriers embedded in the guidelines or evidence, forty-one studies identified the nature of the guideline or evidence itself as the barrier to implementation. For instance, barriers identified within a guideline or evidence were lack of local applicability and lack of convincing evidence. Health care professionals need to have clear guidelines, strong evidence and resources to integrate evidence into practice (30). However, there is not always strong evidence upon which to base practice. Within the support or resources

category of barriers, sixty-nine studies identified lack of material support, resources, funding or time as the major barriers to implementing evidence-based care or guidelines. These barriers impede evidence implementation and knowledge translation. The cognitive/behavioural barriers included lack of knowledge, which refers to reported deficiencies in information such as lack of knowledge about indications and dosages. Another cognitive/behavioural barrier was lack of awareness of a guideline or recommendation from a guideline or evidence. These barriers indicate poor diffusion of innovation because the diffusion of the guideline did not use the proper channels to reach the health care professional. The communication about guidelines should originate from a credible, professional organization; contain a clear statement of the guideline; and explain where to access the guideline. Alternatively, the health care professional did not take the time to read the message regarding the new guideline. These barriers show the importance of detailed guidelines and clear, frequent communication to the health care profession.

Cochrane et al.'s systematic review of research on barriers included research articles that used quantitative survey type data collection, focus groups or key informant interviews. Survey methods were used most often (n=178) to identify barriers (39). The authors stated that a limitation to barrier studies is that they do not look at any theoretical framework to guide the design and analysis. As a result, most barrier studies examine only a few barriers and questions are primarily closed questions. Consequently, survey results from only closed questions and no open ended questions are biased by the researcher's choice of identified barriers, which may be a limitation in the research design. The survey



questions used for both the Phase I and Phase II PEN evaluation were framed by two theoretical frameworks. The two frameworks directed the development of survey questions pertaining to eleven themes including access to PEN, search strategies and tools, and the importance of PEN and impact on practice. To identify barriers the PEN evaluation survey used closed questions with an open ended option to provide comments.

### **2.7.2 Facilitators**

Evidence-based practice is influenced by the demographic characteristics of the practitioners. External factors such as education, training and age influence practitioners' attitudes toward EBP and facilitate adoption of innovations. Adoption of innovations by physicians was associated to a greater extent with those who were younger, in group practice, board certified, involved in academics, saw a greater number of patients per week, published in medical journals and were responsible for teaching (37). Likewise, dietitians with a higher level of education and training had a more positive perception, knowledge and attitude toward EBP (40).

In two separate studies by Byham-Gray et al. and Thomas et al., they cite the best facilitators to progress toward an evidence-based approach by dietitians and paediatric health care providers were access to databases, access to courses that teach evidence-based decision making, learning the skills of applying evidence to practice, assistance with search strategies, and seeking and applying evidence-based practice guidelines and summaries (2,7). Although the studies identified facilitators to EBP, they did not evaluate whether the facilitators enabled dietitians and paediatric health care providers to apply the

evidence and change the way they practice. Byham-Gray et al. suggest that resources and educational programs should be made available to dietitians to facilitate and support dietitians' application of evidence to clinical practice (2). Dietitians of Canada supports EBP by offering online courses on critical appraisal and applying evidence to practice, and by providing resources in the PEN service.

The critical step that leads to practitioners' adoption of a practice guideline is their agreement with the practice guideline or recommendation. Pathman et al. found that when physicians complied with evidence-based practice guidelines they progress through four cognitive steps: awareness, agreement, adoption and adherence (41). The results of the study indicate that practitioners who have progressed through the cognitive steps of awareness and agreement are more likely to adopt and adhere to evidence-based practice guidelines. Practitioners who had higher levels of agreement with a guideline adopted the guideline and applied it in their practice. As PEN users adopt PEN content, they can build knowledge and credibility (47). The questions in the PEN evaluation survey were designed to gather information regarding how well PEN facilitates agreement, adoption and adherence of practice-based guidance, which can identify facilitators to using PEN to change practice. Useful, applicable and relevant knowledge translation and transfer tools that incorporate active practitioner engagement positively influence uptake of knowledge. The results from Armstrong et al.'s qualitative evaluation of a series of evidence-based tools indicated that KTT tools are likely to change practice when they are linked to a knowledge translation process that includes active practitioner engagement (24). Useful, applicable and relevant KTT tools were perceived to be easier to navigate and locate key

practice points when they had the following attributes: clear, short summaries; updated evidence; plain language instructions on how to use the tool effectively to inform practice; searchable databases; attractive, well-presented format; explicit links between the evidence and recommendations for policy and practice; and active dissemination strategies that facilitate their use. Conversely, tools that were too general or too difficult to navigate were less likely to be used by practitioners. This study illustrates the importance of evaluating online decision support tools' usefulness, attributes and level of practitioner engagement to ensure they positively influence the uptake of knowledge and facilitate practice change.

### **3.0 THEORETICAL FRAMEWORK**

The use of theoretical models guides research design including the evaluation tools. The models also guide data analysis. Examination of data through the lens of the frameworks helps the researcher understand the data and interpret the research.

#### ***3.1 PEN Evaluation Framework Logic Model***

The PEN logic model was based on the two theories used in the current research, Rogers' Diffusion of Innovations Theory and Pathman's Model of Awareness-to-Adherence, as well as Wenger's Community of Practice Model. The questions in the validated PEN Evaluation Questionnaire (**Appendix A**) developed by Janet Hemming were based on the PEN Evaluation Framework Logic Model. During the design of the survey, questions were linked to logic model outcomes. The links between the logic model and the survey

questions are in **Appendix B**. The PEN Evaluation Framework Logic Model outlined outcomes, indicators, methods and data sources to collect the data for evaluating the PEN service. For the current research, only the outcomes for knowledge transfer and technology that could be collected using the PEN Evaluation Questionnaire were assessed to answer the research questions. Hence, the PEN Evaluation Framework Logic Model was abbreviated for this research (**Appendix C**). The abbreviated logic model is summarized in **Figure 3**. Analysis of the survey data assessed whether the PEN service achieved the outcomes (19).

**Figure 3: Abbreviated PEN Evaluation Framework Logic Model**

<b>PEN Evaluation Framework Logic Model Outcomes</b>	<b>Logic Model Indicator(s)</b>	<b>Data Sources (Measures)</b>
<i>Knowledge Transfer — Initial Stages</i> · Subscribers use PEN to meet their information needs	Demographic information on users	Survey responses
	Frequency of use	Survey responses
	Reasons for use	Survey responses
· PEN is a source of valid and applicable evidence-based dietetic information	Quality of content*	Survey responses
	Availability and use of practical tools/resources for clients	Survey responses
<i>Knowledge Transfer — Change in Practice</i> · Individual practitioners base aspects of their practice on the evidence from PEN	Percentage of practice based on PEN	Survey responses
	Increased pride in quality of PEN**	Survey responses
<i>Technology</i> · Technology supports optimal use of PEN	Ease of access	Survey responses
	Responsive and interactive***	Survey responses

\* "Quality" was defined as useful, up to date and applicable to practice settings/clients.

\*\* Interpreted as "increased recognition of the benefits/usefulness of PEN" which included positive impact on practice and enhanced credibility of the profession.

\*\*\*"Responsive and interactive" was defined as user's ability to shape content and timely updating of existing information and addition of new topics.

<sup>1</sup>Reproduced from Hemming (19)

The PEN logic model is the framework that was designed by DC to link short and long-term outcomes to program activities/processes. It identifies the indicators that will demonstrate whether the intended knowledge transfer and technology outcomes were met. The level of achievement of the outcomes would answer research question 1 and the sub-question. The PEN logic model allows one to understand how data collected in the survey responses measures the success of the outcomes. Outcomes that were not successfully met show DC where changes to PEN can improve the planned outcomes.

### ***3.2 Diffusion of Innovations Theory***

Everett Rogers defines diffusion as “the process by which an innovation is communicated through certain channels over time among the members of a social system” (43). In this research, the social system is dietitians. Rogers’ theory explains why it is difficult to get a new idea adopted, even when it has obvious advantages. Rogers’ Diffusion of Innovations Theory states that innovations with certain characteristics (attributes), as perceived by individuals, are more likely to be adopted; that is, the rate of adoption will be increased (43). Rogers has postulated five perceived attributes of an innovation that explain the rate of adoption and why there is variability in the adoption rate. The five characteristics and how they could positively influence PEN’s adoption by dietitians are summarized in **Figure 4**. These attributes explain about half of the variance in innovations’ rate of adoption (43). The other half of the variance depends on four variables: 1) the type of innovation-decision process (optional, collective or authority), 2) the nature of communication channels (mass media or interpersonal), 3) the nature of the social system in which the innovation is being diffused, and 4) the extent of the change agent’s promotion efforts (43).

Rogers recommended that all diffusion research should measure perceptions of the five attributes. Rogers' Diffusion of Innovations Theory applied to the current research describes the correlation of the five attributes to the adoption of PEN as an innovative KTT technology. Rogers' theory guided the development of the evaluation tool used in this research. In the PEN evaluation the survey questions addressed concepts of the five innovation attributes to measure whether PEN users positively or negatively perceived the attributes in the PEN service. Respondents answered survey questions about the mechanics of the PEN service, the quality of PEN and its importance to practice. The theory can guide the researcher during data analysis to understand dietitians' perceptions of the five attributes in the PEN service. This knowledge can be used to identify PEN attributes that are perceived either negatively or positively and interpret how that will affect the adoption of PEN, which can inform the recommendations to DC to guide the future direction of PEN.

Listed below are the five characteristics that Rogers says positively influence the rate of adoption of innovations, their application to the PEN evaluation and how they are linked to the survey questions.

- *Relative Advantage* means the superiority of an innovation when compared to those that precede it. The greater the relative advantage, the faster the rate of adoption. Diffusion researchers have found this attribute to be the strongest predictor of an innovation's rate of adoption. The specific type of relative advantage (e.g., economic, social) is important to the adopters in a group, but the characteristics of the potential adopters may dictate which type of relative advantage is the most important. Does the PEN user see PEN as having

more advantages and more benefits than what they were using prior to PEN or what they are continuing to use as sources of practice information? Practice-based Evidence in Nutrition's relative advantage is that it offers dietitians easy access to credible evidence-based guidance and tools, which is an advantage over searching for, evaluating and synthesizing relevant research and deciding if it is relevant to their practice or clients (19). The list of resources, tools and handouts in PEN continues to grow and replaces handouts that were previously available. Survey questions related to relative advantage addressed ease of access, the use of search options, participation in developing PEN content, tools and resources, and users' perception of the quality of PEN content and its impact on practice.

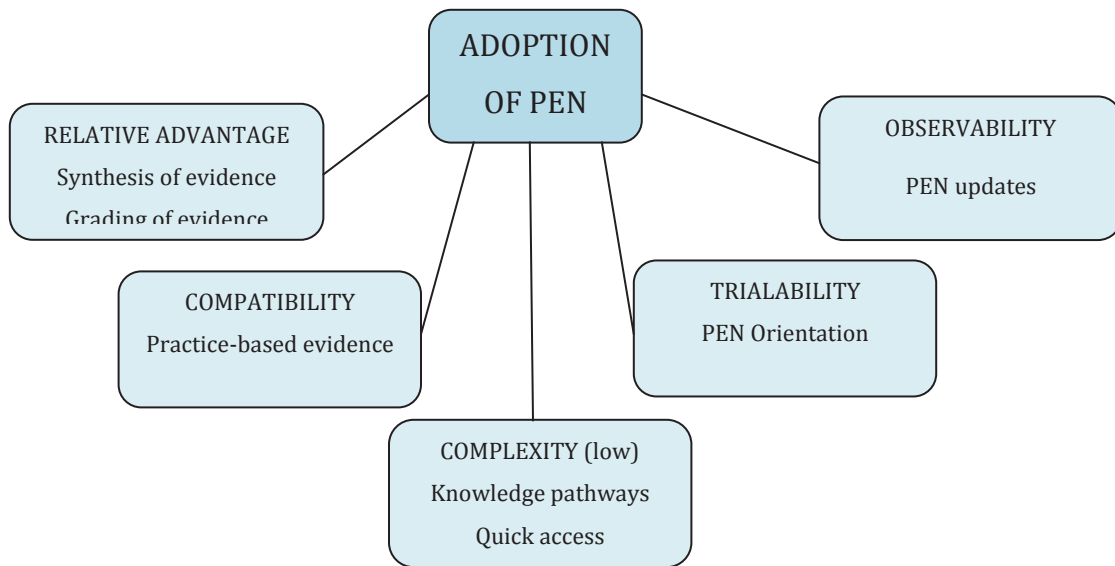
- *Compatibility* "is the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (43). The more compatible PEN is to a group's values and beliefs, previously introduced ideas and/or a group's need for the innovation, the faster the rate of adoption. Dietitians value research and EBP and believe that the best way to move toward EBP is to use evidence-based guidelines, seek and apply evidence-based summaries and learn evidence-based decision-making skills (2). However, dietitians cited lack of time and skill to read and critically evaluate research as a barrier to EBP (7). The PEN service facilitates EBP by offering timely access to up-to-date practice-based evidence and tools. Survey questions that investigated compatibility pertained to users' knowledge and use of PEN features based on EBP, such as evidence grading, links to referenced articles, information on PEN contributors, and features that facilitate EBP such as access to useful tools and relevant, up-to-date information with sufficient detail to guide practice (19).

- *Complexity* refers to the possible adoption of innovations that are simple to use and implement versus innovations that are perceived as difficult to understand and use. An innovation that is perceived to have low complexity has a faster rate of adoption. Complexity is a very important barrier to adoption. How difficult is PEN to understand, use and implement? Ease of use plays an important role in increasing the rate of adoption of PEN. Ease of use and quick access were considered in the design of PEN with its knowledge pathway framework of practice questions, graded key practice points, evidence synthesis and links to references and clients' and professionals' tools. Adoption of PEN can be affected by access to computers, type of connection, printing difficulties, page layout, the users' understanding of knowledge pathways, and so forth. The survey questions that pertained to complexity evaluated the mechanics of the PEN service such as ease of access to the site and user satisfaction with search options and printing functions (19).
- *Trialability* is defined as the ability to try an innovation before adoption. The trialability of an innovation as perceived by the society members is positively related to its rate of adoption. Can PEN be used on an experimental or temporary basis prior to purchase so users can try it under their own conditions? Potential users can explore PEN by participating in an orientation session offered by DC. The survey question related to trialability pertained to the PEN orientation session offered by DC to PEN non-subscribers as a way of promoting the service (19).
- *Observability* is the measure to which the successes and failures of an innovation are seen by others. The observability of an innovation is positively related to its rate of adoption. How easy is it for others to see the results of using PEN? The service's observability could



increase when users discuss successes with others and when user satisfaction with the results of using PEN is measured and then diffused to dietitians and health care professionals. The shared success stories may increase the rate of PEN adoption. Dietitians of Canada promotes the PEN service and evidence-based courses to its members and updates users on the growth of PEN. Survey questions pertaining to observability addressed communication about growth in content and subscribers to the PEN service.

**Figure 4: Characteristics of PEN that could positively influence its adoption by dietitians<sup>1</sup>**



<sup>1</sup>Reproduced from Hemming (51)

### **3.3 Pathman Awareness-to-Adherence Model**

The Pathman Model of Awareness-to-Adherence tracks four stages for incorporating new knowledge that lead to behaviour change (41). Pathman et al. proposed that concurrent with compliance to national practice guidelines, physicians take cognitive and behavioural

steps — awareness, agreement, adoption and adherence. Pathman et al.'s study measured physicians' responses to national paediatric vaccine recommendations (32). The study found that when physicians comply with the vaccine recommendations, they must be aware of the guidelines, then intellectually agree with them, then adopt them in the client care they provide and then regularly adhere to them at appropriate times. As the Awareness-to-Adherence Model predicted, Pathman and colleagues found that where physicians' guideline adoption rates were high, awareness and agreement rates also were high. Disagreement with practice guidelines is a barrier to adhering to recommended care. In fact, progression through the steps can stop at any time for any reason, which results in non-compliance of the guideline. The cognitive/behavioural steps and how they apply to PEN users are (19):

- *Awareness* — familiarity with PEN and its function in daily practice.
- *Agreement* — acknowledgement that PEN is a credible source of evidence-based information.
- *Adoption* — use of PEN in practice to build capacity and knowledge.
- *Adherence* — use of PEN as “best process” for practice guidance, regular use of PEN, improvement of health outcomes.

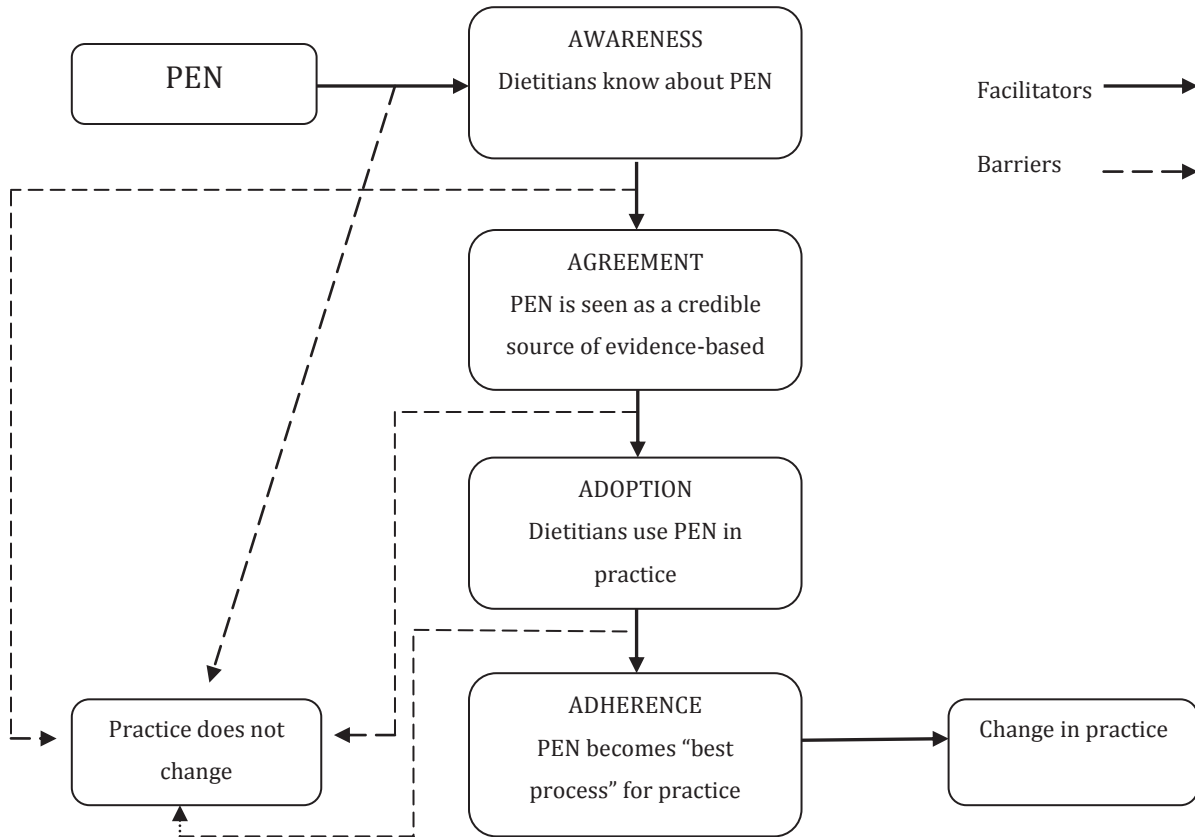
Pathman et al. indicated the Awareness-to-Adherence Model would be useful in identifying underlying adherence issues to other guidelines (32). This theory guided the development of the PEN evaluation survey. During the survey development, Hemming adapted the

Pathman model to relate to user satisfaction with PEN features and content and considered barriers and facilitators related to PEN use and to potential adopters of PEN (**Figure 5**) (19). Links between the PEN Evaluation Questionnaire and the Pathman model are in **Appendix B**. The survey questions were designed to be indicators of behaviour change. Pathman's model will guide analysis of the Phase II PEN evaluation data related to quality of PEN content, importance of PEN and impact on practice to understand whether or not PEN users agreed with, adopted or adhered to the evidence-based information in PEN; also, whether perceptions of PEN were barriers and facilitators that influenced their progress to the next step of the model. The outcome will be knowing the current cognitive/behavioural stage dietitians have attained. Knowing the current stage of dietitians in the process can reveal the current impact of PEN on practice. Dietitians at the stage of adoption or adherence are incorporating new evidence-based knowledge from PEN into dietetic practice. Consequently, PEN would be considered an effective KTT tool.

The model will also guide analysis to discover barriers and facilitators that prevent or enable dietitians to move to the next step of practice behaviour change. Barriers perceived by users at any point in the Awareness-to-Adherence Model can prevent users from incorporating new knowledge to change practice behaviour. On the other hand, facilitators of awareness, agreement, adoption and adherence can lead to application of EBP and change in practice. The identification of specific barriers and facilitators can inform the recommendations to DC. The Pathman model in this research has the same application as in Pathman et al.'s study. It is supposed by the present researcher that if PEN users have a

high level of agreement with the service, its attributes, the importance of PEN and impact on practice, then the adoption and adherence rates will be high and users will be using PEN frequently.

**Figure 5: PEN and promotion of evidence-based practice<sup>1</sup>**



<sup>1</sup>Reproduced from Hemming (19).

### **3.4 Pathman-Rogers Model for KTT Tool Use**

The Pathman model suggests that factors may facilitate or hinder movement along the cognitive/behavioural steps of the Awareness-to-Adherence Model. Pathman et al. also suggest that the model can be used to identify physicians whose backgrounds and work settings place them at greater risk for stalling at one or more of the steps (41).

Consequently, those characteristics can become barriers. Alternatively, characteristics of practitioners can become facilitators (37,40). Rogers' Diffusion of Innovations Theory outlines characteristics that may influence adoption of an innovation. It is proposed by the present researcher that the five innovation characteristics outlined in Rogers' Diffusion of Innovations Theory can be the factors that facilitate or hinder movement along Pathman's Awareness-to-Adherence Model. In this present research, the five attributes — relative advantage, compatibility, complexity, trialability and observability — are barriers or facilitators and for that reason, can impact an individual's progress through the cognitive and behavioural steps that lead to continued use of PEN. Therefore, a combined model (**Figure 6**) can predict the impact of factors that facilitate or hinder dietitians' movement along the steps to adhering to PEN use and subsequent change in dietetic practice.

Features of the PEN service and characteristics of current and potential users of PEN may become barriers or facilitators, as they relate to the five attributes, along the path to adherence. Applied to this research, the combined model of Pathman-Rogers Model of KTT Tool Use identifies PEN attributes and user characteristics that may cause users to stall at one or more of the steps to adherence. It is expected by the present researcher that if dietitians positively perceive the attributes of PEN as facilitators to EBP by providing

access to up-to-date evidence-based practice guidance that address their concerns of time and skill required to critically review research, they would have high levels of agreement, adoption and adherence to PEN's practice information. Inversely, if dietitians negatively perceive the attributes of PEN, they will have low levels of agreement, adoption and adherence. As discussed in section 2.7.2, the critical step that leads to practitioners' adoption of a practice guideline is their agreement with the practice guideline or recommendation (41). How the Rogers and Pathman model guides data analysis was discussed above. The combined model does not change the data analysis, but it will allow the researcher to more clearly interpret the data to identify factors that were barriers and facilitators to behaviour change. The insight this model provides will answer the research question regarding barriers and facilitators and ensure that the recommendations to DC are data driven. Dietitians of Canada designed PEN to have favourable attributes so that dietitians and other health professions would adopt and adhere to the evidence-based PEN content, apply their knowledge and, as a result of knowledge to action, develop positive health benefits for their clients. Research that identifies barriers and facilitators would benefit from a model to frame and inform the design and interpretation; however, testing of the model's value is required (30). This current research will test of the value of the Pathman-Rogers model to identify barriers and facilitators of PEN use for KTT and dietetic practice change.

Figure 6: Pathman-Rogers model for PEN use

PEN Attributes	Stages of Behaviour Change			
	Awareness	Agreement	Adoption	Adherence
<b>Relative Advantage</b> <ul style="list-style-type: none"> <li>· cost</li> <li>· ease of access to PEN site</li> <li>· use of search options</li> <li>· use of PEN tools/resources</li> <li>· responsiveness and interactivity</li> <li>· quality of PEN content</li> <li>· PEN's importance to practice</li> <li>· social status (credibility, PEN authors)</li> </ul>		↑	↑	n/m
<b>Compatability</b> <ul style="list-style-type: none"> <li>· users' knowledge and utilization of tools, up-to-date information with sufficient detail to guide practice</li> <li>· perceived credibility of the PEN service</li> <li>· perceived usefulness to practice</li> </ul>	n/m	n/m	↑	↑
<b>Complexity</b> <ul style="list-style-type: none"> <li>· ease of access to PEN site</li> <li>· user satisfaction with search options</li> <li>· user satisfaction with printing functions</li> </ul>	n/m	↑	n/m	↑
<b>Trialability</b> <ul style="list-style-type: none"> <li>· PEN orientation</li> </ul>	↑	n/m	n/m	n/m
<b>Observability</b> <ul style="list-style-type: none"> <li>· communication of user satisfaction</li> <li>· number of subscribers</li> </ul>	↑	n/m	n/m	n/m

n/m = not measured

↑ = predicts the impact of the PEN attributes on the stages of behaviour change

## **4.0 METHODS**

This research utilized a quantitative methodology employing the survey method and a validated questionnaire to collect data, which was analyzed using descriptive statistics. A survey is research designed to describe and quantify characteristics of a population (44).

### **4.1 Respondents**

Potential respondents were randomly selected from the DC membership list of non-subscribers to PEN; additionally, all PEN subscribers were invited to participate in the survey. The survey was sent to 3,509 potential respondents, which consisted of 1,967 PEN subscribers and 1,542 non-subscribers. The final sample of 333 consisted of 265 PEN subscribers and 68 PEN non-subscribers.

### **4.2 Questionnaire**

A questionnaire can provide important information about knowledge, perceptions and characteristics of a population. It is an important tool in survey research because it can advance knowledge and provide the framework for constructive action or recommendations (44). Surveys can be useful for establishing associations among factors. Surveys can be designed for quality assurance and when repeated periodically can help researchers to monitor service, observe trends and make recommendations for actions to improve service (44). The questionnaire used in the current research was developed in 2007 by Janet Hemming, MScAHN candidate, for her thesis *Development of Evaluation Tools for Dietitians of Canada's Practice-based Evidence in Nutrition (PEN) Service*. At that time



the questionnaire was face and content validated by a panel of ten dietetic professionals, pilot tested by approximately fifteen dietitians and assessed for reliability by a statistician. The questionnaire, titled PEN Evaluation Questionnaire (**Appendix A**), was designed to address concepts from two theoretical frameworks underpinning the research, Rogers' Diffusion of Innovations Theory and Pathman's Model of Awareness-to-Adherence, as per indicators in the PEN Evaluation Framework Logic Model (19). The questionnaire designer selected PEN logic model indicators based on the following criteria: suitability for quantitative assessment, compatibility with the evaluation goal of collecting demographic and quality assurance data on the PEN service, and answerability by all non-specialized PEN users (19). A closed-ended question format was used throughout the questionnaire except for the open-ended format that was used in the comment section at the end of many questions where respondents could freely share an opinion (19). The online questionnaire collected answers to the questions using categorical responses and Likert scale responses. Question types included dichotomous, multiple choice (check all that apply) and interval (which had a neutral position). Questions were designed to extract eleven themes. The questionnaire themes were as follows:

**PEN Subscriber — Section 1:** This section identified subscribers and non-subscribers and the reasons why the non-subscribers did not subscribe, and elicited information from the subscribers about their profession, PEN use and participation in PEN orientation.

**Ease of Access to PEN — Section 2:** Respondents were asked whether they had exclusive or shared access to a computer and the Internet, how frequently they encountered broken

links, whether they printed information from the PEN website, and whether and how frequently they encountered printing difficulties when printing PEN documents.

**PEN Search Strategies and Tools — Section 3:** Respondents were asked to describe their experience in using four different search options including key word search, advanced search, table of contents search and practice category search. The questions inquired how frequently each type of search was used, whether the search option was effective and whether the search results were organized in such a way that users can find the information in a reasonable amount of time.

**General PEN Use — Section 4:** This section asked respondents to list their reasons for using PEN and the likelihood of using PEN when faced with a practice decision. As well, questions inquired about the frequency of linking to available reference abstracts/articles, evidence grades for key practice points and information about knowledge pathway contributors.

**Participation in Developing PEN Content — Section 5:** Respondents were asked if they had submitted practice questions or had been a reviewer or author of PEN content. Questions also inquired whether authors/reviewers received sufficient support in those roles.

**Use of PEN Tools/Resources — Section 6:** Questions in this section inquired how often the participants distributed or shared the tools/resources included in PEN with clients or

colleagues, if something limited the use of tools/resources and what kind of tools the respondents would like to see in PEN.

**Quality of PEN Content — Section 7:** Respondents were asked to rank their level of agreement in regard to whether they received satisfactory answers to practice questions, the knowledge pathways provided sufficient detail to guide practice, the information was up to date and they were confident in the quality of the information PEN provides.

**Importance of PEN and Impact on Practice — Section 8:** Respondents were asked what sources of practice information they used regularly. As well, respondents were asked whether PEN was a valuable tool for practice, had influenced the way they work, had enabled an evidence-based approach to practice and led to positive health benefits for clients.

**Overall Rating of PEN — Section 9:** This section asked whether respondents recommended PEN to colleagues, how the PEN service rated as a practice guidance tool and whether anything would make PEN more useful as a knowledge translation tool.

**Communication About PEN Updates — Section 10:** Respondents were asked about the preferred method to receive updates about PEN and the preferred frequency of PEN updates.

**Demographic Information — Section 11:** This section asked respondents about their DC region, age, level of education, employment status, employment setting, years in practice and rating of computer skills.

### **4.3 Procedure**

This research was approved by the Mount Saint Vincent University, University Research Ethics Board (**Appendix D**). Respondents were invited to participate in DC's PEN evaluation survey and have an opportunity to play an anonymous role in facilitating further development of the PEN service (**Appendix E**). To maximize the response rate, the reminder notices, which were very similar to the original invitation, were emailed at one and two weeks following the initial invitation and included a link to the survey. Miller and Smith state that a follow-up procedure that includes reminder notices can encourage response to questionnaires (45). The survey was administered by Market Link Solutions in November 2008. Dietitians of Canada's technology consultants created a comprehensive report and a spreadsheet of raw data, which was coded to ensure participant anonymity and confidentiality and then forwarded to the researcher for analysis.

### **4.4 Statistical Analysis**

Statistical analysis of the secondary data was completed in Microsoft Excel using descriptive statistics. The analysis was done to answer whether the outcomes of the PEN Evaluation Framework Logic Model were met and to answer the two research questions and two sub-questions formulated for this research, which are as follows:

1. How effective was the PEN service as a knowledge translation and transfer tool for incorporating new knowledge into dietetic practice?
  - a. How effective was the PEN service as a knowledge translation and transfer tool for incorporating new knowledge into dietetic practice compared to a year ago?

2. What were the barriers and facilitators that enabled or prevented dietitians from using PEN to change the way they practiced?
  - a. What were the barriers and facilitators that enabled or prevented dietitians from using PEN to change the way they practiced compared to a year ago?

To answer the first research question regarding the effectiveness of the PEN service as a KTT tool for incorporating new knowledge into dietetic practice, responses to survey questions that were linked to knowledge transfer and technology were analyzed. Response variables from every question type in the survey provided information on the effectiveness of PEN as a KTT tool in short-term knowledge transfer, in knowledge transfer to change practice and in technology. Response variables included yes/no; always, usually, sometimes, seldom, never; often, occasionally, never; daily, not daily but at least once per week, not weekly but at least once per month, sometimes but less often than once per month, never; strongly agree, agree, neither agree nor disagree, disagree, strongly disagree; excellent, very good, average, fair, poor; very likely, somewhat likely, not very likely; and multiple choice. The response variables measured 1) the level of agreement with statements regarding quality of PEN content, the importance of PEN and impact on practice measured on a five-point scale — strongly agree to strongly disagree, and 2) the level of frequency users experience or use PEN attributes regarding ease of access to PEN, PEN search strategies and tools, and general PEN use measured on a three- or five-point scale — always, usually, sometimes, seldom, never; often, occasionally, never. On the five-point

scales the two positive response options were reported together. For instance, strongly agree and agree informed the positive level of agreement.

The response variables were summarized by computing the proportions of responders from the overall sample who gave positive responses — for example, strongly agree or agree — to the Likert scales. Since the overall sample included a wide variety of demographic groups who may have different experience with PEN use, the respondents were grouped into categories by each of the six demographic variables — DC region, age, level of education, employment (work status and employment setting), years in practice and computer skills — and then viewed by demographic.

The chi-square test can evaluate the relationship between two variables. The chi-square statistic is used to test whether there is a relationship between two variables. The relationship is not a causal relationship. When there are significant differences between the variables it means that there is a consistent, predictable relationship between them. For instance, a predictable relationship would respond as follows: if one variable increases, it would be expected that the other variable in the relationship would also go up (or down depending on the relationship). This research will use the term 'dependent on' to describe the relationship, which means that one variable is influenced by the other variable. Chi-square tests for independence ( $\chi^2$ ) were used to identify significant differences between the agreement levels of the response variables by demographic category. The chi-square test for independence was used to test whether there was a dependent relationship between variables that could identify barriers and facilitators and evaluate whether there

was a relationship between variables in regards to knowledge translation and transfer. This analysis identified demographic characteristics as barriers or facilitators based on statistical significance. Statistical significance was set at  $p=0.05$ . The researcher also selected positively worded response variables to evaluate the relationship between the variables and identify barriers or facilitators to KTT or practice change as it relates to PEN.

The response rate to the Phase II PEN Evaluation was low. Respondents consisted of 265 subscribers (13.5%) and 68 non-subscribers (4.4%). Based on the small number of respondents who were subscribers in some demographic categories, the small demographic categories were merged or eliminated to meet the conditions for chi-square validity. The condition for chi-square validity is that no more than 20 expected frequencies be less than 5 and none be less than 1 (46). Rows or columns of demographic groups with fewer than 10 respondents that caused the expected frequencies count to be low and could not reasonably be combined with other groups were merged or eliminated. For example, respondents in the food service/hospitality employment setting were merged with those in administrative to create a food service/administrative category. The only demographic group that was eliminated from the analysis were the individuals who were outside the specified demographic categories — the individuals who selected the response “other,” “I don’t know” or did not respond at all to the demographic survey questions. For that reason, between eight and seventeen people were excluded from the chi-square analysis using the demographic groups. All sixty-eight PEN non-subscribers were included in the overall results because all respondents answered the demographic survey questions.

To satisfy the sub-question that compared the effectiveness of PEN as a KTT tool to baseline data, the 2008 Phase II PEN evaluation survey data was compared to the 2007 Phase I baseline survey data by calculating the percent change over baseline. Baseline data was compared for the overall sample as well as for each demographic category.

Comparative analysis showed to what extent the modifications, if any, that were made to the PEN service improved Practice-based Evidence in Nutrition as a KTT tool. The two-tailed z-test for difference between population proportions was used to determine whether or not differences between the proportion of positive responses was statistically different from zero. Statistical significance was set at  $p=0.05$ .

To answer research question 2 regarding the barriers and facilitators that enabled dietitians to use PEN or prevented dietitians from using PEN to change the way they practiced, all question types and response variables in sections 1 to 9 provided information. The response variables included the same ones listed earlier in this section, for example, always, usually, sometimes, seldom, never. Analysis of the responses that provided information on the PEN Evaluation Framework Logic Model, Rogers' Diffusion of Innovations Theory and the Pathman Theory of Adult Learning uncovered barriers and facilitators to components of the models. Barriers and facilitators were identified based on the knowledge transfer and technology components of the PEN Evaluation Framework Logic Model. For instance, low levels of agreement (user satisfaction) with the response variables that addressed a PEN logic model indicator such as quality of content may have indicated that a barrier to knowledge transfer exists in a PEN feature pertaining to quality of content. The response variables that provided information on Rogers' Diffusion of



Innovations Theory indicated whether the respondents positively perceived the attributes of PEN (relative advantage, compatibility, complexity, trialability and observability), for instance, levels of frequency that respondents shared PEN tools and resources. A high frequency of sharing tools would be a facilitator to KTT and practice change. The response variables were daily, not daily but at least once per week, not weekly but at least once per month, sometimes but less often than once per month, never; yes/no; multiple choice; strongly agree, agree, neither agree nor disagree; excellent, very good, average, fair, poor; very likely, somewhat likely, not very likely. The same response variables provided information regarding Pathman's Awareness-to-Adherence Model. The responses informed whether or not PEN users agreed with, adopted or adhered to PEN content, such as levels of agreement that PEN information is typically up to date. Open-ended questions provided textual information and rich detail that helped to answer the research question. For several survey responses, comments were categorized into themes. For example, for the question "Is there anything that would make PEN more useful to you as a knowledge translation tool?" the 108 comments were divided into three themes and the frequency of each comment theme was calculated to summarize the comments listed. The researcher applied an arbitrary rule for including qualitative data. If there were at least ten comments and at least a quarter of them had the same theme, the comments were tallied, categorized and reported. All respondents' comments are in **Appendix F**.

The response variables that pertained to barriers and facilitators were summarized by computing proportions of respondents from the overall sample who selected each multiple choice option and who gave positive responses to "strongly agree" or "agree" to the Likert

scales or “always” and “usually” to the interval level of frequency question types. Chi-square tests for independence were used to identify significant differences between the agreement levels and proportions of the response variables by demographic category. Statistical significance was set at  $p=0.05$ .

To satisfy the sub-question that compared the barriers and facilitators that enabled dietitians to use PEN or prevented dietitians from using PEN to change the way they practiced compared to a year ago for the overall sample as well as for each demographic category, the 2008 Phase II PEN evaluation survey data were compared to 2007 Phase I baseline survey data by calculating the percent change over baseline. Comparative analysis showed to what extent the modifications, if any, that were made to the PEN service impacted facilitators and barriers to PEN use. The two-tailed z-test for difference between population proportions was used to determine whether or not differences between the proportion of positive responses was statistically different from zero. Statistical significance was set at  $p=0.05$ .

## 5.0 RESULTS AND DISCUSSION

Invitations to complete an online survey were distributed to all 1,967 PEN subscribers and a randomly selected group of 1,542 non-subscribers who were members of Dietitians of Canada. There were 265 responses from subscribers giving a response rate of 13.5%. Non-subscribers returned 68 completed surveys giving a response rate of 4.4%. The higher response rate from subscribers is likely because subscribers have a more vested interest in responding to the survey whereas non-subscribers may be less inclined. The Phase I baseline response rate was higher than Phase II. In Phase I there were 3,509 respondents; subscribers response rate was 22% and non-subscribers response rate was 5.3%. Respondents provided comments to open-ended survey questions. All comments were tabled in **Appendix F**.

The purpose of this section is to present and discuss the results of the Phase II PEN Evaluation Questionnaire and the comparison to the Phase I results. The results of the analysis of the survey were grouped to answer the two research questions and their sub-questions. Survey questions that measure the outcomes of the PEN Evaluation Framework Logic Model answer research question 1. As discussed in sections 3.2 and 3.3, the objective of the analysis of the responses was to identify users' perceptions of the PEN attributes and features while examining whether there was a significant relationship between demographic variables and other variables that influence KTT. The same survey questions that answer research question 1 were also linked to Rogers' theory and Pathman's model, which are used to answer research question 2. The presentation and discussion of results

to answer research question one regarding PEN's effectiveness as a KTT tool may also identify barriers or facilitators. If barriers or facilitators were identified while answering research question one they were recognized as such and listed in section 5.2 in **Table 7** and **Table 8**, which summarize barriers and facilitators of using PEN to change practice/behaviour.

### ***5.1 Effectiveness of the PEN Service as a KTT Tool For Incorporating New Knowledge Into Dietetic Practice — Research Question 1***

The presentation and discussion of the results of the survey related to the effectiveness of the PEN service as a KTT tool for incorporating new knowledge into dietetic practice will be framed by the PEN Evaluation Framework Logic Model. The discussion will focus on how the proportions of responses to the survey questions measure the logic model indicators and outcomes, how significant relationships between demographics and other variables influence KTT, and how significant changes in perceptions from baseline to Phase II identify trends.

#### **5.1.1 Knowledge transfer — short term (1-3 years)**

In the PEN Evaluation Framework Logic Model (**Appendix C**), there were two expected outcomes of short-term knowledge transfer. The first outcome was “subscribers use PEN to meet their information needs.”. The outcome indicators pertained to who uses PEN, frequency of PEN use and reasons for using PEN. The second outcome was “PEN is a source of valid and applicable evidence-based dietetic information.”. The outcome indicators pertained to quality of PEN content, and availability and use of practical tools/resources for

clients. The indicators were measured by the proportion of survey respondents who selected positive options specified in detail below to the relevant survey questions.

### ***5.1.1.1 Subscribers use PEN to meet their informational needs***

#### ***5.1.1.1.1 Who uses PEN***

Approximately 92% of survey respondents were members of DC. Respondents who were not DC members indicated they were dietitians (86%), students (10%) and “other” (5%). In Phase I, 95% of respondents were members of DC.

The demographic characteristics of Phase II and Phase I survey respondents are summarized in **Table 1**. The largest demographic groups of Phase II PEN subscribers who responded to the survey can be described as being from Ontario and Quebec, being under 45 years of age, and having attained a bachelor’s degree as the highest level of education. Most had full-time work status, worked in a clinical employment setting, worked for more than 10 years and had beginner/intermediate computer skills. Compared to other research involving dietitians, EBP and knowledge transfer, demographic characteristics are similar. The dietitians in Thomas et al.’s study had a mean age of 37 years and most worked in a clinical setting either full or part time (7). The difference between Thomas’ sample and the PEN Evaluation sample is that the dietitians in Thomas’ study were all specialized, pediatric dietitians and the dietitians in this research were employed in various employment settings.

**Table 1** also summarizes the significant differences between the proportions of respondents in Phase II and Phase I in three demographic categories. The differences were

that, compared to Phase I respondents, fewer Phase II respondents had a higher level of education, fewer respondents were employed in community and food service settings and more respondents had greater than two years in practice. This means that compared to a year ago, PEN users were less educated, have practiced as a dietitian for more years and fewer work in more varied settings other than clinical.

**Table 1: Summary of demographic characteristics of PEN subscribers**

Demographic Characteristic	Description	% of Sample Phase II	% of Sample Phase I	Difference Between Proportions*
<b>Region</b> (N=248)	Central/Southern Ontario	27%	25%	
	Saskatchewan/Manitoba/NW ON	18%	17%	
	Alberta/Territories	16%	14%	
	Quebec/NE&E Ontario	15%	12%	
	British Columbia	12%	16%	
	Atlantic	12%	16%	
<b>Age</b> (N=250)	25-34 years	33%	29%	
	45-54 years	28%	31%	
	35-44 years	20%	22%	
	55 years and over	12%	13%	
	Under 25 years	6%	4%	
<b>Highest Level of Education Attained</b> (N=245)	Bachelor's degree*	77%	68%	(z=2.3, p=0.02)
	Working on or holding a graduate degree	23%	32%	
<b>Employment Work Status</b> (N=250)	Full time	67%	67%	
	Part time	29%	29%	
	Occasional/Student/Not working	4%	4%	
<b>Employment Setting</b> (N=250)	Clinical	45%	41%	
	Other/Not working/Not applicable	19%	4%	
	Public Health	17%	14%	
	Private practice	7%	7%	
	Community*	5%	9%	(z=-2.1, p=0.04)
	Research/Academic/Practicum Administrative/Food service*	4% 3%	3% 7%	(z=-2.3, p=0.02)
<b>Years in Practice</b> (N=265)	More than 10 years	54%	63%	
	2-5 years	18%	13%	
	Fewer than 2 years*	16%	10%	(z=2.3,p=0.02)
	Between 5 and 10 years	13%	14%	
<b>Computer Skills</b> (N=250)	Beginner/Intermediate	69%	69%	
	Advanced	32%	32%	

**N=Total number that reported valid demographic characteristics**

### ***5.1.1.1.2 Frequency of use***

Approximately 10% of survey respondents used PEN daily, 34% used it at least once per week and 37% used it at least once per month. Thus, 81% of PEN subscribers used PEN at least once per month. Since lack of time to find and critically review research is a barrier to EBP (1,2,3,4), it is not surprising that dietitians used PEN frequently. In addition, PEN may have been used frequently by practitioners because they perceive it to be a credible source of evidence-based information and a very good practice guidance tool. Compared to a study evaluating the use of online evidence systems by physicians, dietitians who responded to the PEN survey used PEN more frequently to meet their information needs than general practitioners used Quick Clinical, an online evidence system. An evaluation of the long-term use of Quick Clinical by Magrabi showed that GPs used it 9.9 times per month in the first two months and less than one time in the following ten months (32). On average, GPs did one search every two months. Quick Clinical did not use a KTT process to synthesize the evidence, but PEN did. Respondents may have used PEN more frequently than GPs used Quick Clinical in order to access graded evidence summaries, practice guidelines or tools/resources. In PEN, the synthesized, graded evidence eliminates the critical appraisal step and dietitians can quickly implement the new knowledge into their practice (30).

Frequency of use was dependent on two demographic characteristics, which were years of practice ( $\chi^2(12)=32.0, p=0.001$ ) and age ( $\chi^2(16)=29.7, p=0.02$ ). In regards to age, PEN was used at least once a month by more than 90% of respondents under 35 years of age compared to less than 79% of subscribers over 35 years of age. Looking at years in

practice, PEN was used at least once per month by 95% of respondents who had less than 2 years in practice compared to 75% of respondents with more than 10 years in practice. Therefore, survey respondents who were younger and had fewer years in practice used PEN more frequently. These results are similar to Magrabi's study of Quick Clinical, which showed that practitioners under the age of 45 years were in the high-use group (32). Also similar, Byham-Gray, Thomas and Weiss found that age influenced attitudes toward EBP and facilitated adoption of innovations (2,7,37). In those studies, the practitioners who were associated to a greater extent with EBP and adoption of innovations were younger and sought and applied evidence-based practice guidelines and summaries. In the current research, age and years in practice may have influenced frequency of use because younger dietitians with fewer years in practice and less experience applying evidence-based decision making in practice may have a greater need for practice guidance. Also, the younger dietitians may have a greater comfort with technology. Consequently, younger dietitians with fewer years in practice may be more likely to adopt PEN as an EBP innovation. Older dietitians with more years in practice may be experts in their area and feel less need to consult a tool such as PEN. Age is both a facilitator and barrier to KTT as it relates to PEN.

Frequency of PEN use was related to the strength of the perception that PEN led to positive health benefits for their clients ( $\chi^2(12)=97.0, p<0.0001$ ) and to the likelihood of using PEN when faced with a practice question ( $\chi^2(6)=58.8, p<0.0001$ ). A randomized trial by Alper et al. showed that physicians who used DynaMed, an evidence-based resource that contained graded and synthesized evidence, answered more practice questions, answered



more questions correctly and changed clinical decisions more often without increasing overall search time than when they used more traditional resources (31). As a result, resources that used critically appraised evidence brought about changes in physicians' practice more frequently (31). Considering Alper's study and the strength of the relationship between frequency of use and positive perceptions of PEN's impact on practice and client health outcomes, dietitians who responded to the PEN Evaluation Questionnaire may have perceived that PEN positively impacted their practice because it answered their practice questions with credible information, met their information needs, changed their practice and positively influenced the health of their clients, and consequently used PEN more frequently.

In Phase I, approximately 4% of the respondents reported using PEN daily compared to 10% in Phase II. The difference between these proportions was significant ( $z=2.8$ ,  $p=0.005$ ). As well, 27% of Phase I respondents indicated they used PEN sometimes but less than once a month, compared to 17% of respondents in Phase II. The change in percentages was also significant ( $z=-3.2$ ,  $p=0.002$ ). This shows the frequency of PEN use increased significantly over one year. The number of PEN knowledge pathways and tools/resources increased between Phase I and Phase II. In 2007, when the baseline data were collected, there were 78 pathways. In 2008, when Phase II data were collected, there were 108 pathways. An expanding information base and resource base may contribute to more frequent usage because there is an expanded pool of resources to draw from particularly by respondents with less than 2 years in practice and who were under 35 years of age. Given that PEN was used more frequently compared to a year ago, it may be

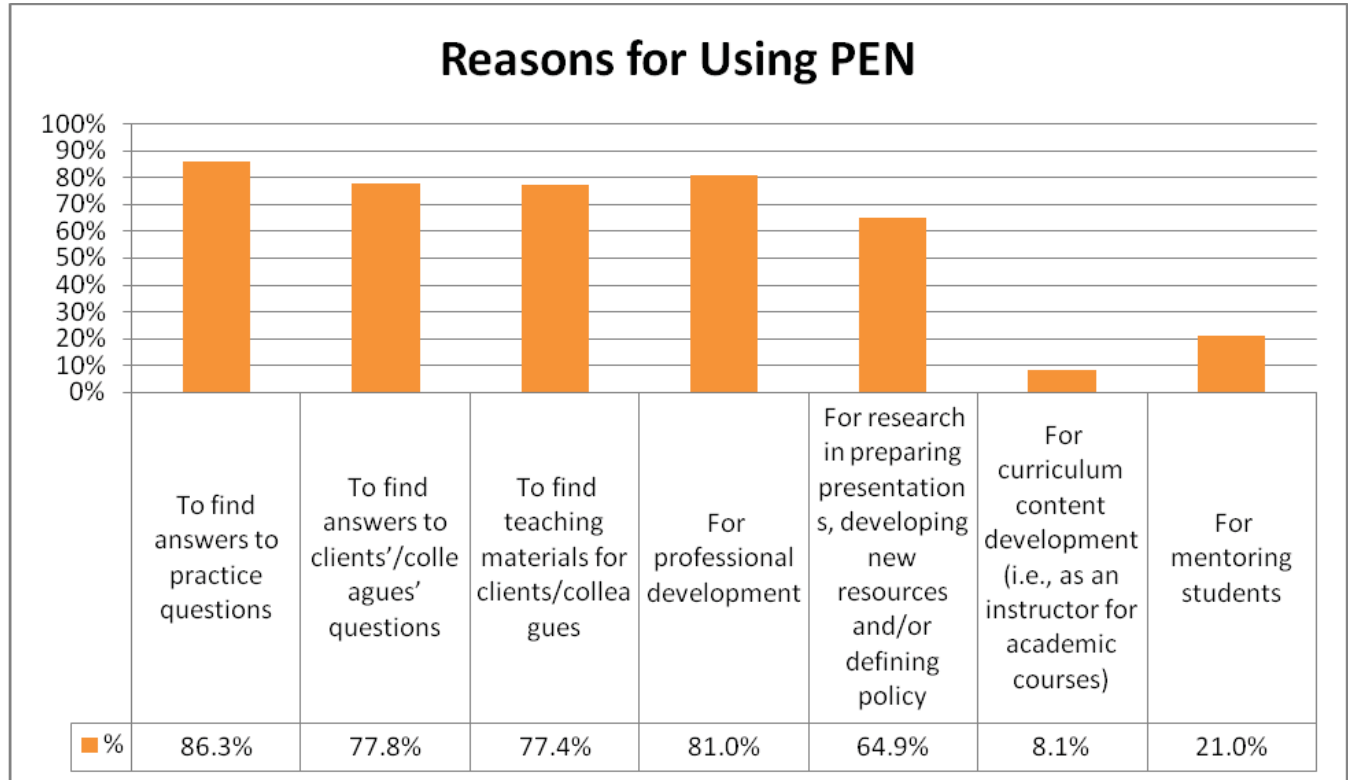
suggested that continual, regular use of PEN kept practitioners current with the latest research (32).

#### ***5.1.1.1.3 Reasons for use***

Respondents were asked their reasons for using PEN. They selected reasons from a multiple choice list. Respondents' reasons for using PEN were summarized in **Figure 7**. The number 1 reason for using PEN was to find answers to practice questions (86%), followed by for professional development (81%). These results are similar to Byham-Gray's results, which showed that dietitians did literature searches to answer questions and the searches influenced practice (2). Moreover, Westbrook found that online decision support databases improved practitioners' answers to clinical questions by 21% (11). When dietitians frequently seek evidence-based information in PEN to answer practice questions, the information in PEN may change their dietetic practice as the information is utilized in evidence-based decision making.

In the research literature, Thomas et al. found that 95% of paediatric dietitians did literature searches when they encountered a knowledge gap, and 75% encountered a knowledge gap less than five times per week (7). Dietitians who responded to the PEN survey may not have used PEN for some of the reasons listed in the survey because they did not have a knowledge gap in those areas. The current research included dietitians in every area of dietetic practice who would have different reasons for using PEN. For example, clinical dietitians may not use PEN often for curriculum content. Nonetheless,

Figure 7: Reasons for using PEN



most dietitians used PEN for the main reasons PEN was developed, which was to answer practice questions, for professional development and for disseminating evidence to clients.

Reasons for using PEN were dependent on years in practice ( $\chi^2(3)=9.9, p=0.02$ ). Sixty-four percent of respondents used PEN to prepare presentations, develop new resources and/or define policy; 80% of these respondents had fewer than 2 years experience compared to 55% of respondents with more than 10 years experience. This is not surprising as dietitians with more years of experience may be familiar with the research in their area of practice; therefore, they may not consult PEN for dietetic information in that topic area.

Having fewer than 2 years in practice is considered a facilitator to KTT in regards to PEN use.

From Phase I to Phase II there was no significant difference between the proportions of respondents who used PEN for every reason listed in the survey question. Therefore, the reasons for using PEN did not change over one year.

In summary, the evaluation of the findings indicated that the outcome of “subscribers use PEN to meet their information needs” was met. PEN met the information needs of the survey respondents who were mostly dietitians, under 45 years of age, worked full-time in a clinical setting, had worked for more than 10 years and had a bachelor’s degree as the highest level of education. Practice-based Evidence in Nutrition was used frequently to answer questions and find tools/resources. By meeting respondents’ information needs, new knowledge was incorporated into dietetic practice, which may have impacted decision making and changed practice. Compared to Phase I respondents, PEN was used more frequently, but for the same reasons.

### ***5.1.1.2 PEN is a source of valid and applicable evidence-based dietetic information***

#### ***5.1.1.2.1 Quality of content***

Survey respondents strongly agreed or agreed that they usually received a satisfactory answer to their practice questions (78%), the knowledge pathways provided sufficient detail to guide practice (78%), the information in PEN was typically up to date (91%) and they were confident in the quality of the information PEN provided (91%). The responses

to these closed survey questions indicated that survey respondents had high levels of agreement in the quality of PEN content since they thought the information in PEN was up to date and were confident in the quality of the information. The survey questions regarding quality of content were also open-ended and provided respondents an opportunity to comment. In response to the four survey questions about quality of PEN content, fifty-four comments were made (**Appendix F**). Nineteen of the comments (35%) indicated that the respondent thought that PEN content in the knowledge pathways was limited. The comments provided suggest that the respondents felt that the evidence in some of the knowledge pathways was insufficient or too weak to guide practice. For example, comments provided include “sometimes the information is not available on the topic I am searching” and “A fair amount of the time my question is not answered at all on PEN.” The views of the respondents who provided comments concur with GPs’ responses in Brassey’s study of Ask Trip to Rapidly Alleviate Confused Thoughts (ATTRACT), a service that provided rapid, evidence-based summaries to GPs’ practice questions. Fifteen percent of GPs did not change practice due to the weakness of evidence they received from the service (22), which would be expected. One would not expect practice to change based on weak evidence. Considering that respondents perceived that PEN contained a high quality of content, the comments provided may suggest that there were gaps in PEN content. To fill the gaps, more high-quality research may need to be conducted and more evidence should be available in PEN in areas where there is insufficient or weak evidence to guide practice. However, sometimes there is not enough high quality research or any research available to answer a practice question. PEN users who may only consult the practice

guidance in a knowledge pathway when looking for evidence would be unaware that there is no available evidence to answer their practice question. To know there is no available evidence, users would have to consult the PEN evidence summaries, which explain that no evidence from clinical studies or authoritative studies was found, list the topics that have no supporting evidence and apply a grade of D. When there is no new evidence to add to the PEN pathways, perhaps a footnote with the review date would inform users that a recent literature review had been done, but no new evidence was found. In this way, users could visit only one area of the knowledge pathway to know whether no evidence is available or whether PEN content has not been updated to include recent research.

Survey questions pertaining to quality of content were linked to PEN attributes of relative advantage and compatibility. Respondents positively perceived the relative advantage of using PEN's evidence-based practice guidance and that it was compatible with dietitians' belief in the principles of EBP. Respondents' high level of agreement with the survey questions also indicates that they agree that PEN is a credible source of evidence-based practice information and that they adopted PEN in practice. Respondents' positive perceptions that PEN contains quality content were facilitators to agreement that PEN was a valuable source of practice information and adoption of PEN in practice, which may change the way respondents practice.

Respondents' level of agreement that the information in PEN was typically up to date ( $\chi^2(3)=8.9, p=0.030$ ) and that they were confident in the quality of the information PEN provided ( $\chi^2(3)=9.0, p=0.029$ ) was dependent on level of education. Approximately 84% of

respondents working on or holding a graduate degree agreed or strongly agreed that the information was typically up to date compared to 93% of those with a bachelor's degree; 89% of respondents who were working on or held a graduate degree agreed or strongly agreed that they were confident in the quality of PEN information compared to 91% of those with a bachelor's degree. This is different from the results of Byham-Gray et al., who found that dietitians working on or holding a doctoral degree had a significantly higher perception, attitude and knowledge (PAK score) of EBP than those with a master's or bachelor's degree (2). However, in the current research, those working on and holding a master's degree were reported with those who held a doctoral degree. Waller reported that an allied health professional with a doctorate was more likely to be involved in a higher level of research activity based on greater knowledge (47). The survey respondents in the current research who had a higher level of education may also have been more involved in research and, therefore, more aware of newly published evidence, which is a plausible reason for why they had lower levels of agreement that PEN was up to date and that they were confident in the quality of PEN information compared to those with a bachelor's degree. This statement is supported by the results that show level of education was not dependent on the level of agreement with the other two questions regarding quality of content, which asked if respondents usually received a satisfactory answer to their practice questions and if the knowledge pathways provided sufficient detail to guide practice.

The level of agreement that PEN contained sufficient detail to guide practice was also related to variables pertaining to impact on practice including the strength of the

perception that PEN positively influenced the way respondents worked ( $\chi^2(12)=96.7$ ,  $p<0.0001$ ), enabled them to take an evidence-based approach to their practice ( $\chi^2(9)=81.6$ ,  $p<0.0001$ ) and led to positive health benefits for their clients ( $\chi^2(9)=62.3$ ,  $p<0.0001$ ).

There were the same relationships with respondents' confidence in the quality of information. The level of agreement that respondents were confident in the quality of information in PEN was related to the strength of perception that PEN positively influenced the way they worked ( $\chi^2(6)=91.1$ ,  $p<0.0001$ ), enabled them to take an evidence-based approach to their practice ( $\chi^2(6)=100.3$ ,  $p<0.0001$ ) and led to positive health benefits for their clients ( $\chi^2(6)=91.1$ ,  $p<0.0001$ ). Respondents' level of agreement that PEN information was up to date was also related to the level of agreement that PEN led to positive health benefits for clients ( $\chi^2(6)38.2$ ,  $p<0.0001$ ).

These strong relationships between quality of content indicators and pride in the quality of PEN indicators show that when dietitians positively perceived that the information in PEN was up to date and provided sufficient detail to guide practice, and they were confident in the quality of information in PEN, their level of agreement positively influenced their perception of PEN's impact on practice. This indicates that survey respondents who reported that PEN information was of high quality felt that PEN enabled them to change their practice and positively influence the health benefits of their clients. Users' high perception of the quality of PEN content indicates that they see quality of content as a relative advantage of PEN.



In Phase I, the proportion of respondents who indicated that PEN contained quality content was equally high (77-94%); therefore, there was not a significant change in survey respondents' levels of agreement with the survey questions pertaining to the quality of content indicator from Phase I to Phase II. With such high levels of agreement it was not expected by the researcher that there would be a significant change over one year.

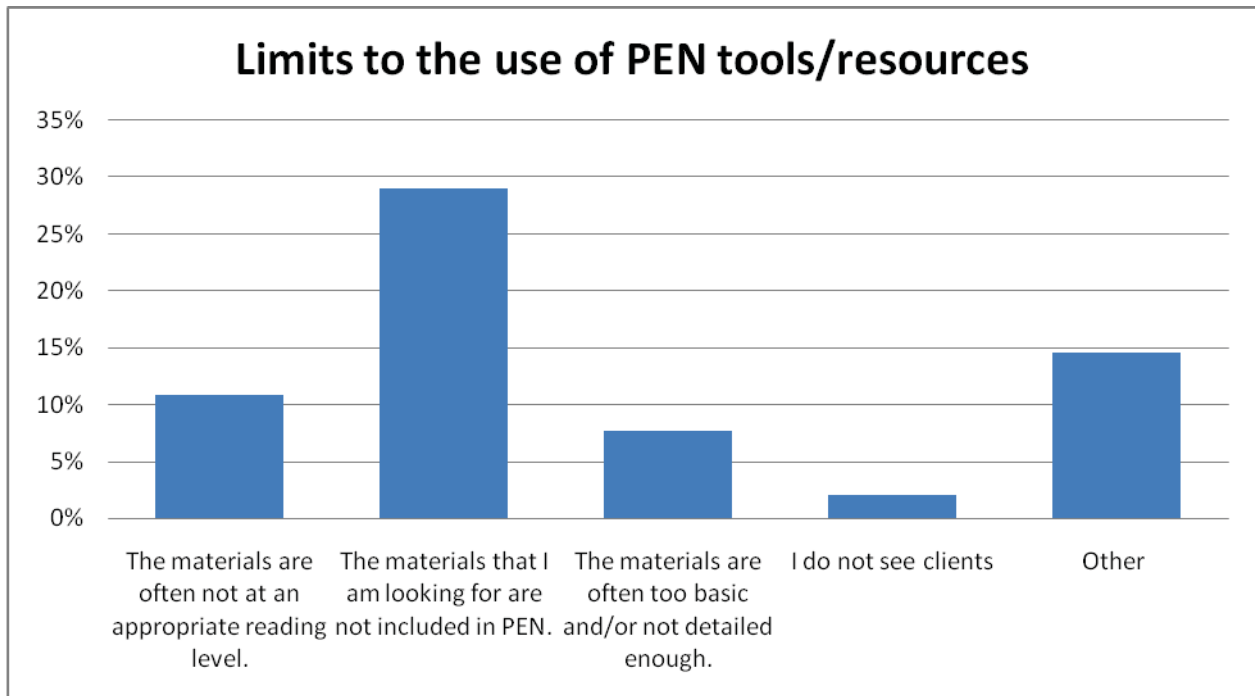
In summary, the analysis of the PEN evaluation survey results indicate that respondents had high levels of agreement that PEN contained satisfactory answers to practice questions and provided sufficient detail to guide practice. Survey respondents also agreed that PEN information was up to date and they were confident in the quality of information PEN provided. As such, the level of agreement regarding quality of content was a facilitator to KTT as it relates to PEN. Therefore, the quality of content indicator was met in the Phase II PEN evaluation and was maintained from Phase I.

#### ***5.1.1.2.2 Availability and use of practical tools/resources for clients***

Survey respondents were asked how often they share the tools in PEN with clients/colleagues. Approximately 48% of respondents shared the tools/resources at least once per month. Respondents were asked if anything limited their use of the PEN tools/resources for their clients and were asked to choose any or all of the limits from the list provided. Fifty-six percent of respondents indicated that nothing limited the use of PEN tools/resources for clients. For the 44% who indicated that something did limit their use of PEN tools and resources, the greatest limit was that the materials they were looking for were not included in PEN (**Figure 8**).

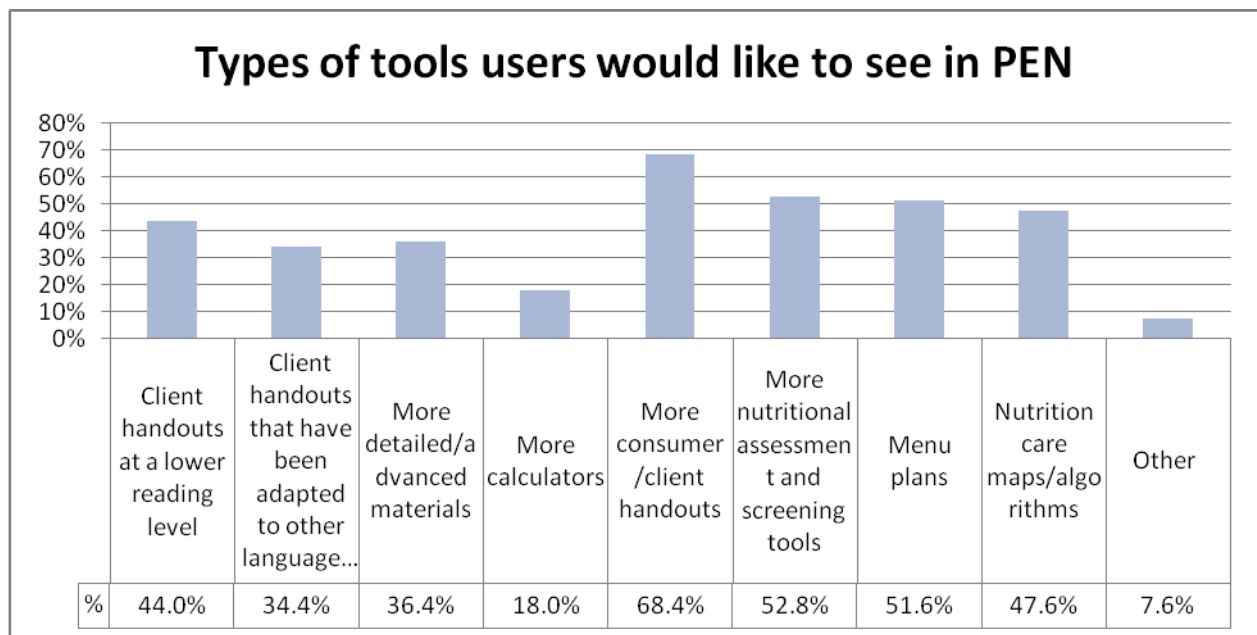
In response to the question “what limits your use of the PEN tools/resources for your clients?” 35 comments were made in the “other” response option (**Appendix F**). Nine of the comments (26%) were related to the appearance of the tools/resources. The comments indicated that the respondents wanted more pictures, more space to write in and larger font for older clients in the current tools/resources. Other comments were related to culture/language (n=8), computer and PEN site access/use (n=5), level of information (n=6) and support by employer (n=5). For instance, respondents commented there were not as many resources in French as English, PEN resources were difficult to locate, sometimes the info was too detailed for some patients and they must use employer-approved handouts.

**Figure 8: Limits to the use of PEN tools/resources**



Respondents were asked what kind of tools they would like to see in PEN that were currently missing. The tools/resources that respondents would most like to see in PEN were more consumer/client handouts, more nutritional assessment and screening tools, and menu plans (Figure 9). Rogers' Diffusion of Innovations Theory states that compatibility is the degree to which an innovation is perceived as consistent with the existing values, past experiences and needs of potential adopters (43). With PEN, 29% of survey respondents found that the materials they were looking for were not included in PEN. These survey respondents may not have seen PEN as compatible with other sources of practice information because PEN did not contain the materials they were looking for.

Figure 9: Type of tools users would like to see included in PEN



The Pathman-Rogers model shows that the relative advantage in use of PEN tools/resources is linked to awareness, agreement and adoption, while compatibility in users' knowledge and utilization of tools is linked to adoption. Therefore, respondents' perception that tools/resources were not available in PEN knowledge pathways may have been a barrier to them seeing PEN's relative advantage and compatibility with its predecessors or other sources of practice information, hence a barrier to agreement that PEN offers easy access to evidence-based tools and resources and adoption of PEN. It may have been that the tools/resources were not available at the time of the survey or that respondents were not aware that they were in PEN. This is similar to Cochrane et al.'s results that identified the lack of material support and resources as a major barrier to implementing evidence-based care or guidelines (30). Tools and resources that disseminate knowledge connect the KTT process to the knowledge users. Therefore, the perceived lack of tools and resources may also be a barrier to the KTT process of disseminating new knowledge to clients and changing their practice. Increasing users' awareness of the tools and improving ease of access to tools/resources may increase sharing.

The frequency of sharing PEN tools/resources was dependent on four variables. The first one was respondents' ability to find the information wanted by using only one search strategy ( $\chi^2(4)=11.49, p<0.022$ ). Sixty-nine percent of respondents usually found what they were looking for in PEN by using only one search strategy. Therefore, to increase the sharing of resources, the searchability of PEN may need improvements. Frequency of sharing tools was also dependent on the second, third and fourth variables, which

influenced the sharing of resources. Chi-square analysis showed a significant relationship between the frequency of sharing tools/resources with clients and colleagues and the level of agreement that they were confident in quality of information in PEN ( $\chi^2(12)=22.06$ ,  $p=0.04$ ), agreed they received a satisfactory answer to practice questions ( $\chi^2(12)=39.5$ ,  $p<0.0001$ ) and agreed that PEN enabled them to take an evidence-based approach to their practice ( $\chi^2(12)=38.0$ ,  $p=0.0002$ ). Hence, PEN tools were shared more often when the users were confident in the quality of content, and they perceived that PEN was an enabler of evidence-based practice. Evidence-based consumer/client resources are an integral part of the KTT process, which includes dissemination of customized messages that summarize knowledge. Clients who implement the knowledge they gain from the PEN tools/resources may improve their health outcomes (10). Therefore, more easily accessed PEN tools and resources could be added to PEN to facilitate dissemination and transfer of dietetic knowledge to clients/colleagues through PEN tools/resources. Dietitians of Canada has already responded to the survey results by creating more consumer/client handouts that addressed respondents' comments. Since agreement with those statements was high and there was a relationship with sharing tools, it is expected by the researcher that the frequency of sharing tools and resources would be higher in a future PEN evaluation when the limits to their use are addressed (i.e., more handouts available on more topics and printing issues and broken links addressed).

Compared to Phase I there was no change in the proportion of survey respondents who shared the tools/resources up to once per month. There was also no change in the proportion of respondents who perceived that there were limits to the use of

tools/resources. However, compared to Phase I, a lower proportion of Phase II respondents indicated they would like to see each kind of tool that was listed in the survey question added to PEN. The survey asked respondents, “What kind of tools would you like to see included in PEN that are currently missing?” The response variables were multiple choice, check all that apply, which meant that the proportions exceeded 100%. In Phase I, 335% of the survey respondents selected the seven listed types of tools they would like to see added to PEN, compared to 222% in Phase II.

In summary, PEN tools/resources were shared at least once per month by less than half of the respondents. Survey respondents’ main limit to the use of PEN tools/resources was that what they were looking for was not included in PEN. Respondents would like to see more client handouts, more nutritional assessment and screening tools, and menu plans. Respondents’ perception that PEN did not contain the tools/resources they were looking for was identified as a barrier to users seeing PEN’s relative advantage over other sources of practice information. Hence, lack of tools in PEN is a barrier to use. The indicator “availability and use of practical tools/resources for clients” was partially met in Phase II, which was maintained from Phase I.

Looking at the logic model, the results of the analysis of the responses pertaining to tools/resources suggest that the first outcome for short-term knowledge transfer “subscribers use PEN to meet their information needs” was met and the second outcome “PEN is a source of valid and applicable evidence-based dietetic information” was partially met in the Phase II PEN evaluation. Therefore, the researcher infers that PEN was effective

in short-term knowledge transfer. Compared to a year ago, subscribers used PEN more frequently to meet their information needs. This is the only trend in short-term knowledge transfer that was identified.

### **5.1.2 Knowledge transfer — change in practice**

Knowledge transfer — change in practice is described in the PEN Evaluation Framework Logic Model as “intended users implement knowledge.”. In the abbreviated logic model used for this present research there was one expected outcome for knowledge transfer — change in practice, which was “individual practitioners base aspects of their practice on the evidence from PEN.”. The outcome indicators were percentage of practice based on PEN, percentage of practice based on PEN increases over time and increased pride in the quality of PEN. The logic model set a target of 30% of practice being based on PEN. The measures of the indicators were proportions of survey respondents who selected positive response options to the respective survey questions detailed below.

#### ***5.1.2.1 Individual practitioners base aspects of their practice on the evidence from PEN***

##### ***5.1.2.1.1 Percentage of practice based on PEN***

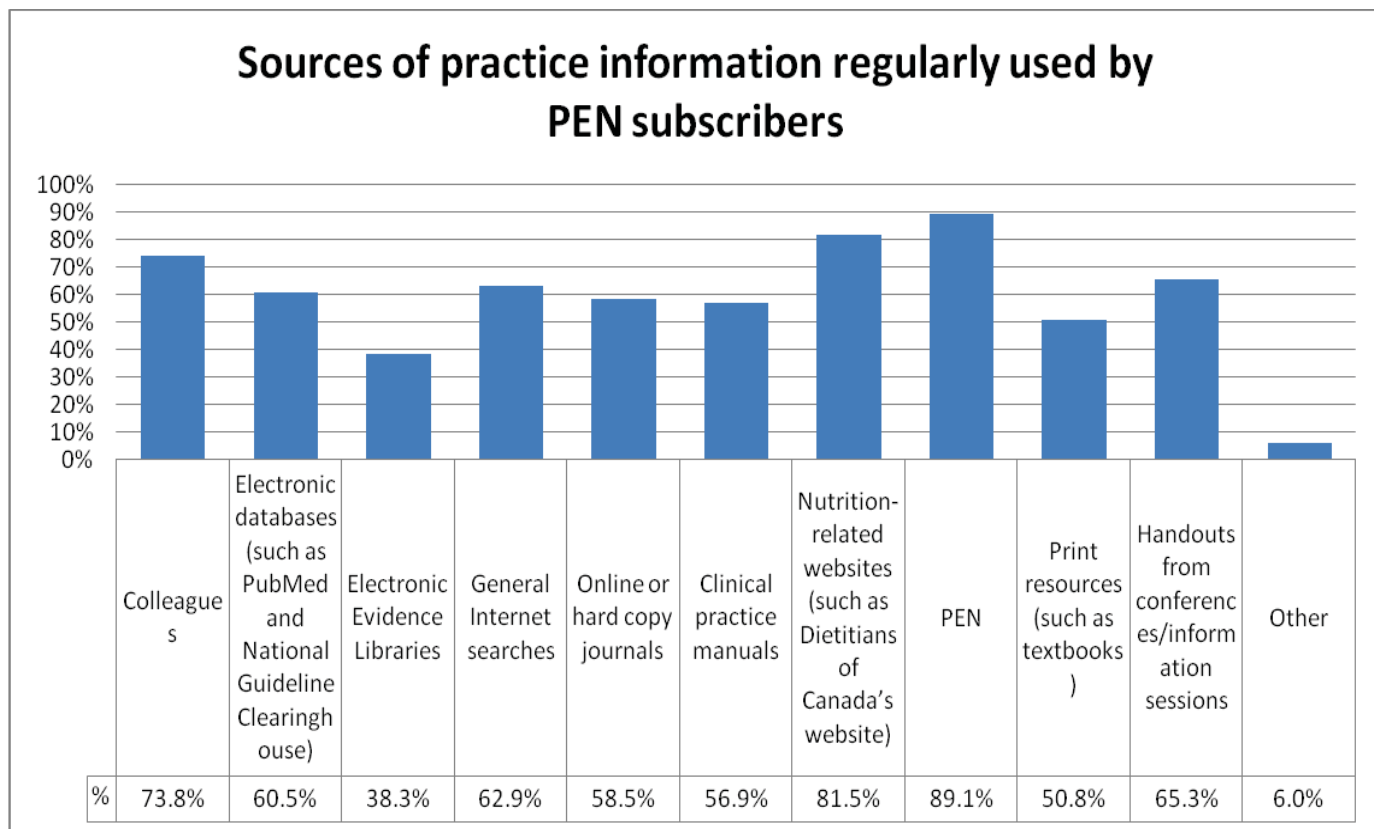
Ninety-six percent of users were likely or somewhat likely to use PEN when faced with a practice decision. Sixty-six percent of survey respondents sometimes, seldom or never had to consult a source other than PEN to answer their practice questions or make a practice decision. Pappano et al. and Thomas et al. found that 44% of health care practitioners and 50% of paediatric dietitians felt practice guidelines were an influential source of

information that promoted change in their practice and answered questions (6,7). As discussed previously, the results of the Phase II PEN evaluation showed that the evidence-based, graded and synthesized practice guidance in PEN met the information needs of users. Since dietitians who responded to the survey were likely to use PEN and sometimes used only PEN to make practice decisions and answer practice questions it may be concluded that the practice guidance in PEN promoted change in their practice.

The PEN Evaluation Questionnaire asked respondents to select from a multiple choice list all sources of practice information that they regularly used. In total, respondents selected 1,596 sources. The sources of practice information regularly used by PEN subscribers are summarized in **Figure 10**. PEN was the most regularly used source of practice information as indicated by 89% of respondents. This is different from the results of a survey of senior health professionals, where the least used route to accessing the evidence-based guidance was the internet (48). However, that study was published in 2001 when electronic sources of practice information were not as common as they are today. Yet, the results are similar to dietitians who ranked evidence-based practice guidelines as the best quality information source available (7) and paediatric health care providers who said AAP guidelines were a major practice source that influences change - more than any other practice source (6). Practice-based Evidence in Nutrition may be used more regularly than any other sources of practice information because users perceive that PEN contains high quality, credible information, positively impacts their practice and answers their practice questions.



Figure 10: Sources of practice information regularly used by dietitians



Regular use of PEN as a source of practice information was dependent on employment setting ( $\chi^2(6)=26.68, p=0002$ ). Approximately 92% and 93% of respondents in community and public health, respectively, used PEN compared to 60% of those in “other”. Percentage of practice based on PEN met the 30% target set by DC in the logic model. To generalize the results to all dietitians, one may say that 89% of dietetic practice is informed by the evidence-based information in PEN.

**5.1.2.1.2 Percentage of practice based on PEN increases over time**

Approximately 94% of the respondents in Phase I were very likely or somewhat likely to use PEN when faced with a practice question compared to 96% of respondents in Phase II.

Sixty-one percent of respondents in Phase I sometimes, seldom or never had to consult a source other than PEN to make a practice decision or answer a practice question compared to 66% in Phase II. In Phase I, 80% of respondents used PEN regularly as a source of practice information compared to 83% of respondents in Phase II. The change in the percentages was not significant between the Phase I and Phase II results that measured the indicator of percentage of practice based on PEN. These results indicate that the percentage of practice based on PEN did not increase over one year. It may be difficult to increase the percentage of practice based on PEN when baseline results showed a high percentage of respondents' practice was already based on PEN.

In summary, the survey respondents were likely to use PEN when faced with a practice decision and often did not have to consult a source other than PEN to answer practice questions or make practice decisions. Respondents used PEN regularly as a source of practice information. Based on these results, more than 30% of practice was based on PEN. However, percentage of practice based on PEN did not increase over one year.

#### ***5.1.2.1.3 Increased pride in the quality of PEN***

In the PEN Evaluation Framework Logic Model, increased pride is explained as increased recognition of the benefits/usefulness of PEN, which included positive impact on practice and enhanced credibility of the profession. The level of agreement with the seven survey questions that measured increased pride in the quality of PEN are presented in **Table 2**. The results indicate that the dietitians who responded to the survey had a high level of pride in the quality of PEN.

**Table 2: Survey questions that measured increased pride in the quality of PEN**

<b>PEN Evaluation Questionnaire Question</b>	<b>Response Variable</b>	<b>% of Respondents Phase II</b>	<b>% of Respondents Phase I</b>
PEN is a valuable tool for my practice.	Strongly agree, agree	89%	88%
PEN has positively influenced the way I work.	Strongly agree, agree	75%	72%
PEN enabled me to take an evidence-based approach to my practice.	Strongly agree, agree	86%	87%
PEN has led to positive health benefits for my clients.	Strongly agree, agree	61%	55%
By promoting evidence-based practice, PEN can enhance dietitians' credibility with other health professionals.	Strongly agree, agree	94%	94%
Have you recommended PEN to colleagues?	Yes	76%	77%
Overall, how do you rate the PEN service as a practice guidance tool?	Excellent, very good	82%	79%
Is there anything that would make PEN more useful to you as a knowledge translation tool?	Yes	44%	50%

Sixty-one percent of dietitians agreed that PEN led to positive health benefits for their clients. There may have been a higher level of agreement if the statement had been worded as “PEN has *contributed* to positive health benefits for my clients.”. Regardless of the wording of the survey question, dietitians may not see a direct link between the PEN service and health benefits for their clients since dietitians were the intermediary in the knowledge to action process. Dietitians selected the knowledge from PEN, and implemented it with their unique blend of style and practice experience. Another reason dietitians may not have indicated there was a direct link between PEN and client health

outcomes is that if dietitians adopted and adhered to the practice guidance in PEN there may not have been any repeat visits and, therefore, no opportunity for the dietitian to monitor, track and evaluate the health outcomes of their client and whether there were health benefits. For instance, 45% of survey respondents were clinical dietitians who may not have seen their clients on a regular basis to follow up on outcomes. Another consideration is that even when good quality evidence is available, clinical judgement and client values/preferences still play an important role in practice decisions. After dietitians review the evidence, they must determine the usefulness of the evidence in planning care for a client or population (4). Also, when 44% of dietitians agree that they have sufficient time at work to use PEN, it is less likely that they would perceive that PEN led to positive health benefits for clients.

The proportion of respondents who recommended PEN to colleagues may not have increased compared to Phase I because the number of subscriptions to PEN increased between Phase I and Phase II. Also, if respondents had worked with the same dietetic colleagues since the Phase I evaluation and had already recommended PEN to them, there would be a smaller group of colleagues to whom they could recommend the service.

Recommending PEN to colleagues was dependent on a high rating of the PEN service as a guidance tool ( $\chi^2 (3)=60.08, p<0.0001$ ). The PEN service was recommended to colleagues by 76% of respondents and 82% of respondents rated PEN as an excellent or very good practice guidance tool. Since there was a relationship between the perception that PEN was an excellent or very good practice guidance tool and recommending PEN to colleagues, the researcher expected that if the rating of PEN as a practice guidance tool increased, so

would the proportion of dietitians who recommended PEN to colleagues. Both proportions did not change significantly from Phase I to Phase II which follows the researcher's expected influence of a positive rating of the PEN service on users' recommendation of the PEN service to colleagues.

The survey questions that measured increased pride in the quality of PEN content were linked to characteristics of PEN and the PEN user in the theoretical frameworks including relative advantage, compatibility, agreement, adoption and adherence (**Appendix B** - links between survey tool questions and theoretical frameworks). The results indicate that the respondents positively perceived the relative advantages and compatibility of using PEN's EBP features compared to sources of practice information that preceded it and, therefore, positively perceived the benefits to practice and the profession. Respondents' level of agreement that PEN led to positive health benefits for their clients may have been influenced by time. Time may have impacted respondents' perceived effect of the application of new knowledge, that is, the time it takes for new therapies to impact health and the dietitian's relationship with a client perhaps not being long enough to measure impact. Respondents' level of agreement that PEN positively impacted practice and the dietetic profession may be influenced by the practice setting and the blending of practice experience and patient values in EBP. Therefore, practice experience, patient values or practice setting may have impacted the application of PEN's evidence-based guidelines when advising a client. The results also indicate that respondents agreed PEN is a credible source of practice information, adopted PEN and adhered to regular use of PEN in their practice. Respondents' strong agreement that PEN benefitted practice and profession

indicates agreement, adoption and particularly adherence to PEN use and behaviour and practice change. Based on the positive responses to the survey questions linked to increased pride in the quality of PEN, it is inferred by the researcher that the benefits to clients, practice and profession facilitated KTT and dietetic practice change as it relates to PEN.

Respondents were asked, “Is there anything that would make PEN more useful to you as a knowledge translation tool?” Approximately 44% (n=108) indicated “yes” and then provided comments regarding what would make PEN more useful as a knowledge translation tool. Three common themes were identified within the numerous comments. The first theme was to add more content, with 51% (n=55) of the comments related to this topic. Comments included “continue adding as much information as possible on as many nutrition-related topics as possible” and “More pathways. It’s meant to replace the Manual of Clinical Dietetics but PEN is not yet complete enough to accomplish that.”. The second theme was to add more tools/resources, with 16% (n=17) of the comments requesting an increase in the number of handouts and tools. Some of the resources that were requested included assessment tools, more workshop modules and more client handouts. The third theme was improvement in technology with 14% (n=15) of the comments asking for improvements in the searchability, layout, links, navigation, function and user-friendliness of PEN. For instance, comments included “making the site easier to navigate,” and “improve layout/search functions.”. The PEN survey questions asked for input from PEN users on how to make PEN a more useful knowledge translation tool. The comments made by respondents that suggest increasing the breadth and depth of current knowledge

pathways, adding more tools/resources and improving the layout/search function of the service can inform DC as they continue to grow PEN content. The remaining comments that were not in one of the three themes (n=21) were related to information on foods and food products, peer review of PEN pathways, email updates, cost, up-to-date information and time to use PEN.

The difference between the proportions of respondents who agreed or strongly agreed with the relevant survey questions in Phase I and Phase II was not significant. Therefore, compared to one year ago the measures for the indicator “increased pride in the quality of PEN” did not change significantly. The indicator measures for the baseline Phase I results were high, thus making it difficult to have significant increases over one year in the Phase II evaluation.

Overall, two of the three outcome indicators for the knowledge transfer — change in practice outcome “individual practitioners base aspects of their practice on the evidence from PEN” were met. The indicators of “percentage of practice based on PEN” (target 30%) and “increased pride in the quality of PEN” were met, while the indicators of “percentage of practice based on PEN increased over time” were not met because there was no significant increase in the already high percentage of practice based on PEN in Phase I. Therefore, the outcome of “individual practitioners base aspects of their practice on the evidence from PEN” was partially met. It may be understood from the results that intended users implemented knowledge over the last year which led to change in practice due to knowledge transfer.

### **5.1.3 Technology**

Technology is a category of outcomes in the PEN Evaluation Framework Logic Model. The technology outcome was “technology supports optimal use of PEN.”. The two indicators of the outcome were “ease of access (speed, navigation, finding needed information, ease of printing, competency of linkages)” and “responsive and interactive (user’s ability to shape content and timely updating of existing information and addition of new topics).”.

#### ***5.1.3.1 Technology supports optimal use of PEN***

##### ***5.1.3.1.1 Ease of access***

The majority of subscribers (96%) had high-speed access to the internet and less than 1% had dial-up. Approximately 71% of respondents seldom or never encountered a broken link while 29% of respondents usually or sometimes did. Eighty-two percent of respondents found the PEN site was designed to make it easy to find what they were looking for. Approximately 88% of survey respondents printed information from the PEN website and 33% of respondents experienced printing difficulties. Approximately 12% of respondents reported that documents always, usually or sometimes would not print at all and 21% reported that the document printed, but the text was out of alignment, a portion of the text was cut off and/or graphics were missing from the document. The survey question pertaining to internet access was linked to barrier identification. Based on the results, dial-up internet access did not negatively affect the speed or responsiveness of the PEN site; therefore, it was not a barrier to respondents’ use of PEN.



Since approximately 33% of combined survey respondents experienced broken links and printing difficulties, the technology issues may have interrupted dietitians' access to evidence-based guidance, reference articles or client tools/resources. As a result, dietitians who responded to the survey may have perceived PEN as complex because the printing and link problems could affect their satisfaction with the mechanics of the site. Respondents' experiences with printing difficulties, broken links and the effectiveness of PEN's search options may have lowered their perceived relative advantage in ease of access and use of search options and increased their perceived complexity of PEN attributes including ease of access to the PEN site, user satisfaction with printing functions and user satisfaction with search options. These perceptions of PEN attributes may have stalled adoption of PEN in daily use. Technology issues such as these are important to address quickly in online decision support tools because successful knowledge transfer links the source of knowledge to the users (14).

The difference between the proportions of respondents in Phase I and Phase II who never encountered broken links was significant ( $z=-2.4$ ,  $p=0.02$ ) as fewer Phase II respondents "never" encountered broken links. Approximately 33% of Phase I respondents never encountered broken links compared to 25% of respondents in Phase II. Similarly, the difference between the proportions of respondents in Phase I and Phase II who indicated that a document would "never" not print at all was significant ( $z=-2.3$ ,  $p=0.02$ ). In Phase I, 64% of respondents indicated that a document would "never" not print at all compared to 55% in Phase II. The results indicate that printing difficulties and broken links in the PEN service significantly increased over one year. A plausible reason for increased broken links

and printing difficulties may be that as PEN content grew over the year, the quality assurance measures did not find and fix broken links and printing issues. Compared to a year ago, the barrier of broken links and printing difficulties has increased.

In the PEN site there are several options to search for information including key word search, advanced search and topic search by table of contents or practice category.

Responses to the survey questions pertaining to search options are summarized in **Table 3**.

Less than 64% of survey respondents perceived each of the four search options was effective. Approximately 69% of respondents could usually find what they were looking for using only one search option. In response to the survey questions in **Table 3** about the search options, 145 comments were made. Nineteen (13%) of the comments indicated that the respondent thought that the PEN site did not contain information on the topic they were searching for. For instance, one respondent commented, “not a lot of health topics to search for.”. Based on the results, respondents felt that the search options were not highly effective and there was low user satisfaction with the search functions. The results and comments combined indicate that a low proportion of respondents could not find what they were looking for because the information was not in PEN’s database. Therefore, the perceived effectiveness of the search options may be related to the amount of content.

Armstrong et al.’s research on the nature of evidence resources and knowledge translation found evidence-based KTT tools that have searchable databases and an attractive and well-presented format were easier to navigate and locate key practice points in (24).

Respondents perceived a low effectiveness of the search options and a deficiency in

content, which may have influenced their opinion of PEN’s relative advantage compared to innovations that preceded it, such as electronic databases, online journals or clinical manuals. When PEN users cannot find or perceive they cannot find the information they are looking for due to the effectiveness of the search options or related to the amount of

**Table 3: Summary of results for search option survey questions**

SURVEY QUESTION	Response Variable	Proportion
<b>KEY WORD</b>		
How often do you use this search option?	Often	69%
Do you find this search option to be effective?	Yes	51%
Are the search results organized in such a way that you are able to find the information you are looking for in a reasonable amount of time?	Yes	83%
<b>ADVANCED SEARCH</b>		
How often do you use this search option?	Often	10%
Do you find this search option to be effective?	Yes	57%
Are the search results organized in such a way that you are able to find the information you are looking for in a reasonable amount of time?	Yes	84%
<b>TABLE OF CONTENTS</b>		
How often do you use this search option?	Often	28%
Do you find this search option to be effective?	Yes	63%
Are the search results organized in such a way that you are able to find the information you are looking for in a reasonable amount of time?	Yes	89%
<b>PRACTICE CATEGORY</b>		
How often do you use this search option?	Often	30%
Do you find this search option to be effective?	Yes	60%
Are the search results organized in such a way that you are able to find the information you are looking for in a reasonable amount of time?	Yes	89%
Are you usually able to find the information that you want by using only one search option?	Yes	69%

content, users may not fully utilize the PEN features that facilitate EBP such as useful evidence-based tools/resources and practice guidance where available.

The frequency of finding the information using only one search option was dependent on age ( $\chi^2(4)=11.6, p=0.021$ ). One hundred percent of respondents under 25 years of age (n=16) indicated they were able to find what they sought in PEN by using only one search option compared to 58% of respondents aged 45-54 years (n=69). Perhaps younger dietitians have more experience with search engines, are more accepting of what they find or search for less detailed information compared to older dietitians. Being under 25 years of age may have increased respondents' satisfaction with the mechanics of the site, hence, may have facilitated access to credible evidence-based guidance and tools. User satisfaction was linked to relative advantage and complexity, which may have facilitated users' adoption of PEN. Being under 25 years of age was a facilitator to users perceptions of PEN's searchability.

Compared to Phase I survey results there was no significant difference between the proportion of respondents in Phase II who reported the search options were effective; their frequency of using the options; agreement that the search results were well organized; and they could find the information they were looking for in a reasonable amount of time. Before the Phase II PEN evaluation, DC made changes to the search strategies and tools. The improvements made to the searchability of PEN did not significantly improve dietitians' perception of the search options.

In summary, the respondents thought the PEN site made it easy to find what they were looking for and thought the search results were organized in such a way that they were able to find what they were looking for in a reasonable amount of time. However, respondents indicated they did not find the four search options to be very effective, which may be related to the amount of content and experiencing access issues due to broken links and printing difficulties. Therefore, based on these results, the technology outcome indicator “ease of access” was not met.

#### ***5.1.3.1.2 Responsive and interactive***

Twenty-three percent of survey respondents submitted practice questions (n=56), 4% authored content (n=23) and 9% were reviewers (n=10). Approximately 7% of respondents were not aware they could submit a practice question (n=17). Eighty-three percent of reviewers and 89% of authors felt they had sufficient guidance in the respective roles of reviewer and author. Ninety-one percent of survey respondents indicated the information in PEN was typically up to date. The results of the survey indicate that participation in developing PEN content was low, but the guidance provided to authors and reviewers was perceived to be sufficient and the information in PEN was perceived to be up to date. The PEN Evaluation Framework Logic Model describes the responsiveness and interactivity indicator as “user’s ability to shape content and timely updating of existing information and addition of new topics.”. Interactive engagement in the form of submitting practice questions or writing or reviewing PEN content leads to effective knowledge transfer (3,5,27,36). Asking practice questions identifies gaps in PEN content. Authors and reviewers fill the content gap with knowledge pathways using research that

exists on the topic. This process also keeps the information up to date. However, dietitians may not feel that adding content to a KTT service they subscribe to is their responsibility. Respondents' low perception of the relative advantage of PEN's ability to be responsive and interactive may have been a barrier to agreement that PEN is a credible source of dietetic information and adoption of PEN in daily use. Since less than 10% of respondents were authors or reviewers and approximately 23% asked practice questions the indicator "responsive and interactive" was not met.

Armstrong et al.'s study found that evidence-based KTT tools were more likely to change practice when they were linked to a process that involved active practitioner engagement (24). A low proportion of practitioners who contribute to the knowledge pathways can slow the interactive shared learning of practice experience as well as research findings (36). The research literature highlights the need to increase the participation in developing PEN content. Practice-based Evidence in Nutrition's KTT process relies on practitioner engagement and is designed to change practice. Participation may be low because respondents may not have perceived the relative advantage of users' ability to shape PEN content by asking practice questions and contributing content to the knowledge pathways compared to other static practice information sources. Another reason participation may be low is that dietitians lack time and confidence in their ability to critically appraise research literature. PEN requires more participation from dietitians to increase PEN content and the likelihood of practice change.

Currently, dietitians who volunteer to author a pathway are offered free access DC's evidence-based tutorial. Ways to engage more dietetic practitioners in developing PEN content could include: 1) a week-long promotion and incentive for PEN users to submit practice questions that are not answered by current PEN content, 2) increasing awareness of the benefits of practitioner engagement in shaping PEN content, 3) promoting the learning and capacity-building opportunities in authoring and reviewing through the evidence-based decision-making course and mentors and 4) posting the time lag between when practice questions were asked and answers were provided.

Compared to a year ago, more respondents submitted practice questions. Although overall the percentage of members who write and review for PEN will remain small, compared with the membership overall and the number of PEN subscribers the level of participation in developing PEN content was low. The degree of participation in reviewing PEN content was dependent on the highest level of education attained ( $\chi^2(1)=5.6, p=0.02$ ). The degree of participation in authoring PEN content was also dependent on education ( $\chi^2(1)=7.2, p=0.005$ ). Approximately 18% of respondents who reviewed PEN content were working on or holding a graduate degree compared to 7% who held a bachelor's degree. Similarly, 11% of the respondents who authored PEN content were working on or holding a graduate degree compared to 2% who held a bachelor's degree. This is not surprising considering more dietitians with a higher level of education would have a higher level of skill at critically appraising the literature or may be involved in policy development or management and may be accustomed to writing and reviewing articles or policies.

Working on or holding a graduate degree was also significantly dependent on developing PEN content as reviewers and authors. A higher proportion of respondents with a higher level of education were reviewers and authors of PEN content compared to respondents with a bachelor's degree. Shaping PEN content may have increased respondents' perception of the relative advantage of PEN and as a result facilitated agreement and adoption. Therefore, holding or working on a graduate degree may have been a facilitator to adoption of PEN.

In Phase I, 19% of respondents submitted practice questions compared to 23% of respondents in Phase II. The difference between these proportions is significant ( $z=2.1$ ,  $p=0.03$ ). Compared to one year ago there was an increase in the proportion of respondents who submitted practice questions. More practitioner engagement can improve the relevancy of the information for practice, which in turn can increase uptake and use of the information. Hence, the increase in asking practice questions may have led to a more effective transfer of knowledge over one year. The trend in knowledge transfer as it relates to PEN technology was that PEN was more responsive and interactive because more dietitians asked practice questions to increase content and there were fewer ease-of-access issues.

In summary, participation in developing PEN content was low. The indicator "responsive and interactive" was not met. As well, the other technology indicator "ease of access" was not met. Therefore, the technology outcome "technology supports optimal use of PEN" was not met.



The effectiveness of the PEN service as a knowledge translation and transfer tool for incorporating new knowledge into dietetic practice was summarized in **Table 4**. Based on the survey responses, outcome indicators were described as effective, somewhat effective or slightly effective. Six out of nine indicators were effective and the remaining three were somewhat or slightly effective. Although there was a somewhat low user satisfaction with ease of access to PEN, PEN search strategies and tools as well as low participation in developing PEN content, the information in PEN provided new knowledge to dietetic practice and enabled change in dietetic practice. Based on the results of the Phase II PEN evaluation survey, research question 1, “How effective was the PEN service as a knowledge translation and transfer tool for incorporating new knowledge into dietetic practice?” may be answered, “PEN is an effective KTT tool.”

The sub-question of research question 1 was, “How effective was the PEN service as a knowledge translation and transfer tool for incorporating new knowledge into dietetic practice compared to a year ago?” The Phase I and Phase II results showed that PEN was effective as a KTT tool for incorporating new knowledge into dietetic practice. In Phase II, three of the eight indicators of short-term knowledge transfer positively changed over one year (**Table 4**). The three indicators that positively changed over one year had a low proportion of positively worded responses in Phase I; in Phase II they were still low. The remaining five indicators that did not change over one year did not have a lot of room for improvement because they were positively perceived in Phase I. Therefore, the sub-

**Table 4: Summary of the effectiveness of PEN as a knowledge transfer tool**

<b>PEN Evaluation Framework Logic Model Outcomes</b>	<b>Logic Model Indicator(s)</b>	<b>Effective Somewhat / Slightly</b>	<b>Change Over One Year</b>
Knowledge Transfer — Short Term <ul style="list-style-type: none"> <li>Subscribers use PEN to meet their information needs</li> </ul>	Demographic information on users	Effective	Yes
	Frequency of use	Effective	Increased frequency of use
	Reasons for use	Effective	No change
<ul style="list-style-type: none"> <li>PEN is a source of valid and applicable evidence-based dietetic information</li> </ul>	Quality of content*	Effective	No change
	Availability and use of practical tools/resources for clients	Slightly effective	No change
Knowledge Transfer — Change in Practice <ul style="list-style-type: none"> <li>Individual practitioners base aspects of their practice on the evidence from PEN</li> </ul>	Percentage of practice based on PEN	Effective	No change
	Increased pride in quality of PEN**	Effective	No change
Technology <ul style="list-style-type: none"> <li>Technology supports optimal use of PEN</li> </ul>	Ease of access	Somewhat effective	Increase in printing difficulties and broken links
	Responsive and interactive***	Slightly effective	Increase in asking practice questions

\* “Quality” was defined as useful, up to date and applicable to practice settings/clients.

\*\* Interpreted as “increased recognition of the benefits/usefulness of PEN” which included positive impact on practice and enhanced credibility of the profession.

\*\*\* “Responsive and interactive” was defined as users’ ability to shape content and timely updating of existing information and addition of new topics.

remaining five indicators that did not change over one year did not have a lot of room for improvement because they were positively perceived in Phase I. Therefore, the sub-question to research question 1 may be answered, “PEN was more effective as a knowledge translation and transfer tool for incorporating new knowledge into dietetic practice in three indicators of short-term knowledge transfer due to positive changes in technology

and frequency of use over one year. The remaining five indicators of short-term knowledge transfer did not change over one year.” The factors that hindered and facilitated dietitians to incorporate new knowledge into dietetic practice and change the way they practiced are discussed in section 5.2.

Answering the sub-question of research question 1 identified trends in knowledge transfer and dietetic practice change as they relate to PEN (**Table 4**). Trends were identified by significant changes in the proportion of responses in Phase I and Phase II. A trend in short-term knowledge transfer was more frequent use of PEN by dietitians under 35 years of age with less than 2 years in practice. Dietitians may not use PEN to its full potential to stay up to date with evidence-based research to enable them to apply evidence-based decision making. Increased promotion of PEN features and its potential to improve client health outcomes may increase the reasons that users access PEN content and their frequency of PEN use. For instance, dissemination of the PEN evaluation research results that show that users perceive that PEN positively impacts health outcomes. An opportunity for future research is a long-term evaluation of PEN.

It is not surprising that there were no strong trends over one year based on the positive perceptions of PEN users in Phase I. However, the researcher expected an increase in the sharing of tools/resources with clients and colleagues based on the large increase in PEN content and tools/resources over the year. Promotion of the tools/resources, easy access to them and a searchable database of tools/resources may increase sharing.

The researcher applied a subjective measure to the success of the logic model outcomes by stating the PEN service was somewhat or slightly effective since the models used in this research did not have a standard to indicate achievement. In future PEN evaluations, to more conclusively answer whether the outcomes of the PEN Evaluation Framework Logic Models were achieved and answer the research questions, a standard of achievement (benchmark) for the outcomes could be set. Rubin et al., in their paper that outlines the steps in developing and implementing measures of quality, state that “To determine what is acceptable performance, the assessment team must develop a protocol for scoring the measure” (49). An objective of the PEN evaluation was to identify areas of PEN that needed improvement. Thus, a benchmark would define acceptable performance based on a standard, would enable the researcher to clearly answer the research questions, would inform recommendations to DC directing quality improvement efforts for PEN and would permit comparative reporting of PEN results by DC researchers and similar organizations with a similar service. A dichotomous scale is clear and easy for any audience to interpret. Positive achievement of the dichotomous scale benchmark would indicate that PEN enabled its users to achieve, in their self-reported opinion, the indicators of the logic model, which translates into achievement of the outcomes. Phase I and Phase II results could inform the setting of the benchmark for future evaluations of the service that measure long-term outcomes.

## ***5.2 Barriers and facilitators that enabled dietitians to use PEN or prevented them from using PEN to change the way they practiced — Research question 2***

The purpose of this section is to answer research question 2, “What were the barriers and facilitators that enabled dietitians to use PEN or prevented them from using PEN to change the way they practiced?” and the sub-question that compared barriers and facilitators to a year ago. In some cases, this section presents results that have already been discussed to answer research question 1. In other cases, the results and discussion are new. This discussion about barriers and facilitators is framed by the Pathman-Rogers model (**Figure 6**). As discussed in sections 3.2 and 3.3, the objective of the analysis of the responses was to identify users’ perceptions of the PEN attributes and features while examining whether there was a significant relationship between demographic variables and other variables that influence KTT. This section will focus on how the proportions of the responses to the survey identified barriers and facilitators and whether the PEN attributes impacted the awareness, agreement, adoption and adherence as predicted in the Pathman-Rogers Model of KTT Tool Use (**Figure 6**). Barriers and facilitators that were identified in section 5.1 have been added to **Table 7** and **Table 8**.

### **5.2.1 PEN orientation**

Fifty-three percent of survey respondents participated in a teleconferenced or in-person PEN orientation offered by DC. The PEN orientation sessions reportedly enhance subscribers’ understanding of the benefits of PEN and their ability to navigate the site (19). Therefore, this survey question was linked to awareness and identified as a possible facilitator of awareness. The PEN orientation would have increased participants’

awareness of PEN by enhancing familiarity with PEN and its function in daily practice. Also, the in-person PEN orientation may have positively influenced users' perception of the trialability. The Pathman-Rogers model would suggest that PEN's trialability increased users' awareness of the EBP features of PEN, hence taking the PEN orientation was a facilitator to awareness. Awareness of PEN's content and knowledge pathway structure may eventually lead to adoption of PEN.

Participation in a PEN orientation was influenced by years in practice ( $\chi^2(3)=18.4$ ,  $p=0.0004$ ). Approximately 23% of respondents who had less than 2 years in practice participated in a PEN orientation compared to 64% of those who had 5-10 years in practice. Practice-based Evidence in Nutrition orientation tutorials are offered on the PEN website. There are four modules to watch and users can also print tips. The printed tips provide users with a quick reference to using PEN (50). Dietitians of Canada can continue to increase trialability and awareness of PEN by reminding users to view the online PEN modules to understand the benefits of the features of PEN. Compared to Phase I, there was no significant change in the proportion of respondents who took the PEN orientation.

### **5.2.2 Time**

Fifty-six percent of respondents agreed or strongly agreed they had sufficient time at work to spend using PEN. This result is similar to other research that found practitioners lack the time to find and critically evaluate the large volume of published evidence and the lack of time was a barrier to integrating the best evidence into practice (6,7). If PEN was not used due to dietitians' lack of time, they could not access the evidence-based guidance and

it would not influence how they practice. The reason that the proportion of respondents who agreed they had sufficient time at work to spend using PEN was not higher may be that barriers to EBP may go beyond the area of influence of PEN, for example the barriers categorized by Cochrane such as system process barriers, which include support of PEN use and PEN tools by administrators (30).

Having sufficient time at work to spend using PEN was significantly dependent on age ( $\chi^2(16)=29.52, p=0.021$ ). Respondents under 25 years of age had the highest level of agreement that they had sufficient time at work to spend using PEN compared to respondents over 45 years of age. Other results showed that all respondents under 25 years of age were also able to find what they were looking for using only one search option. Considering the factors dependent on age, perhaps respondents under 25 years of age perceived they could navigate the PEN site more easily and more quickly than the respondents over 25 years. Their ability to navigate the site may have positively influenced their perception of having sufficient time to spend at work using PEN. As the age of the respondent increased over the age of 45 the level of agreement with the question about having sufficient time at work to use PEN decreased: 81% of respondents under the age of 25 years; 61% of respondents 25-34 years; 65% of respondents 35-44 years; 45% of respondents 45-54 years; and 36% of respondents over 55 years agreed or strongly agreed that they had sufficient time at work to spend using PEN. Lack of time was a common barrier to EBP in the research literature, and was a barrier to PEN use in the current research. The current research shows that age influenced the perceived amount of time available at work to spend using PEN. Therefore, age may have been a barrier to dietitians

adopting PEN and using it regularly. Being under 25 years of age could be a facilitator to having sufficient time at work to spend using PEN since the younger respondents' perceived that they had adequate time to use PEN. Younger PEN users may have higher computer skills or older, more experienced dietitians may be looking for more complex information.

Having sufficient time at work to spend using PEN was also significantly influenced by computer skills ( $\chi^2(4)=11.59, p=0.021$ ). Fifty-three percent of respondents with beginner/intermediate computer skills agreed or strongly agreed they had sufficient time to spend using PEN at work compared to 61% of those with advanced computer skills. A plausible reason is that respondents with beginner or intermediate computer skills may not be as quick or comfortable navigating the PEN site and their low skill level at computer use influences the time it takes them to navigate PEN.

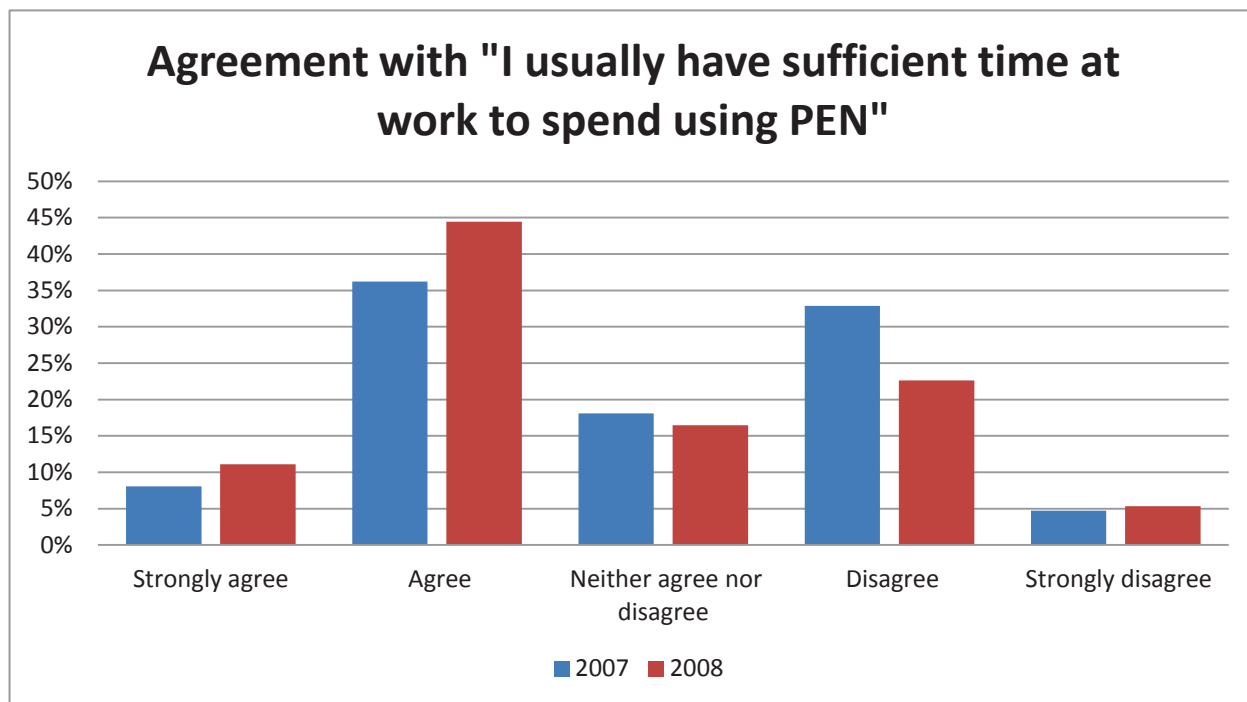
The level of agreement with having sufficient time at work to spend using PEN was significantly dependent on the level of agreement that PEN impacted practice.

Respondents who had sufficient time at their work setting to spend using PEN agreed that PEN positively influenced the way they worked ( $\chi^2(16)=29.52, p=0.021$ ), was a valuable tool for their practice ( $\chi^2(12)=43.42, p=0.0002$ ) and led to positive health benefits for their clients ( $\chi^2(12)=60.15, p<0.00001$ ). These results indicate that having sufficient time at work to spend using PEN may have been a facilitator that enabled dietitians to change the way they practiced and enhanced their perception of the benefits of using PEN in their practice and with clients' health.



There was a statistically significant change in the percentage of dietitians who agreed that they had enough time at work to use PEN in Phase II compared to Phase I ( $z=2.02, p=0.043$ ) **(Figure 11)**. In Phase I, 36% of respondents strongly agreed and agreed with the statement compared to 44% of respondents in Phase II. Compared to Phase I, a higher proportion of Phase II survey respondents agreed they had enough time at work to use PEN. Dietitians may have had more time to spend at work using PEN in Phase II because they were more familiar with PEN and recognized the time-saving features of the evidence-based process. The level of agreement that dietitians had sufficient time to spend using PEN may continue to increase in future PEN evaluations as dietitians become more familiar with the mechanics and the features of PEN and when improvements are made to the service in the areas of ease of access, searchability, and tools and resources. Also, perhaps as administrators become more supportive of PEN and allow dietitians to use PEN resources instead of only employer-approved resources, a higher proportion of dietitians will agree that they have sufficient time at work to use PEN. Insufficient time to spend using PEN at work may have been a barrier to the perception of the relative advantage and compatibility of PEN and as a result adoption of PEN. However, having sufficient time at work to spend using PEN may have been a facilitator that enabled dietitians to change the way they practiced.

Figure 11: Level of agreement with "I usually have sufficient time at work to spend using PEN"



### 5.2.3 Gaps in content

These results were discussed in sections above. In response to the survey questions about the search options, nineteen (13%) of the comments indicated that the respondent thought that there was no information available in the PEN site on the topic they were searching for. Similarly, 51% of the respondents who provided comments regarding how to make PEN more useful as a knowledge transfer and translation tool indicated more content would make PEN more useful as a KTT tool. Also similarly, 34% of respondents always or usually had to consult a source other than PEN to answer their practice questions/make a practice decision. Respondents' most common limitation to sharing tools/resources was that the tool/resource they were looking for was not in PEN (29%). These combined results indicate that respondents suggest that PEN requires more content. Therefore,

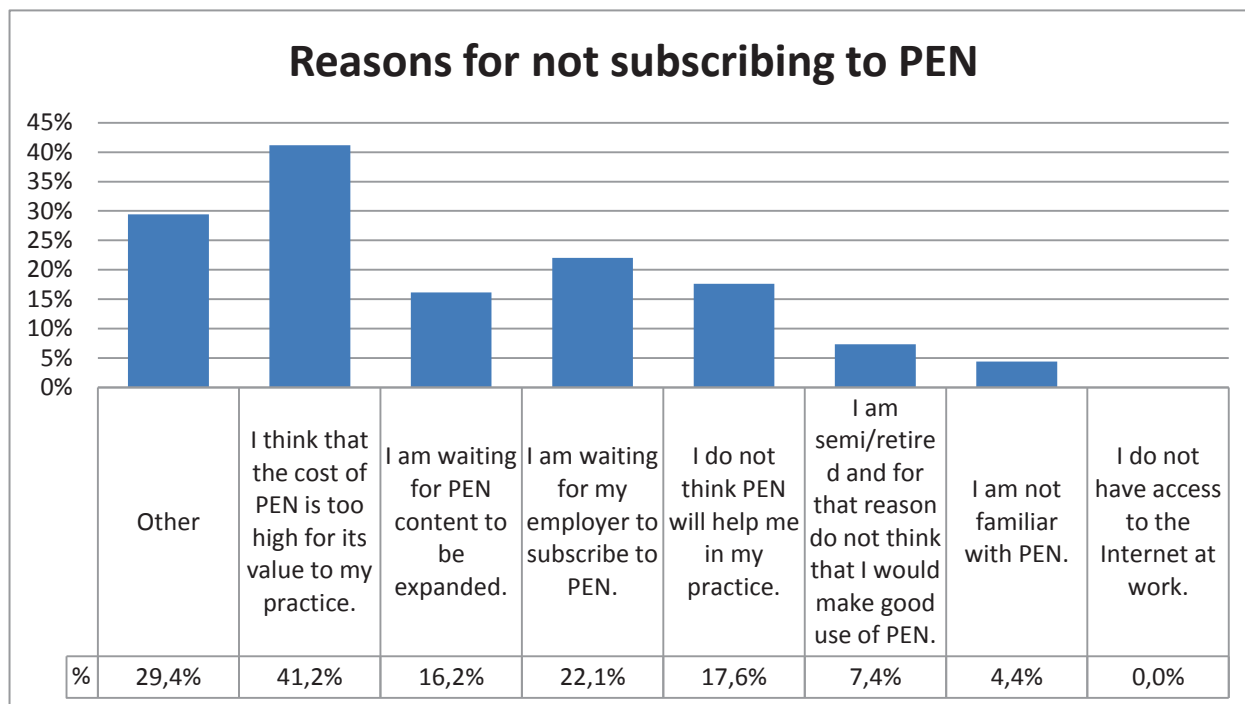
respondents' opinion that PEN lacks content in certain areas may mean they perceived the relative advantage and compatibility of PEN to other sources of practice information was not very strong, which could be a barrier to agreement and adoption of PEN and to changing the way they practiced.

Armstrong found that the same themes listed by PEN survey respondents above were facilitators to navigating KTT tools and locating practice guidance. The facilitators included updated evidence (content), searchable databases (technology) and dissemination strategies (tools/resources) (24). However, in the PEN survey, these themes were barriers since respondents may not have been satisfied with the amount of content to search and the amount of tools/resources to disseminate. Dietitians of Canada has already responded to these barriers; therefore, PEN may currently be more useful to dietitians as a KTT tool than at the time of the survey.

#### **5.2.4 Cost of subscription**

Out of 333 respondents, 68 (20%) were PEN non-subscribers. Survey respondents who indicated they did not subscribe to PEN were asked to indicate the reason for not subscribing to PEN. The survey question was multiple choice, check all that apply. Ninety-four reasons for not subscribing to PEN were selected by the non-subscriber respondents. All responses were summarized in **Figure 12**. The greatest reason for not subscribing to PEN was respondents thought the cost of PEN was too high for its value to their practice (41%). Combined, 63% of non-subscribers were waiting for their employer to subscribe to PEN or thought the cost of PEN was too high for its value to their practice. In response to

Figure 12: Reasons for not subscribing to PEN



this same question, twenty respondents selected “other” and provided comments. Five comments were related to the cost and cost for value, such as “unlikely my employer will cover the cost.”. Three respondents commented they were not working, and three were working casually/part time. The remaining nine comments were assorted topics.

Therefore, the main barrier to subscribing to PEN was related to the cost of the service for its value to practice. Although dietitians value EBP, the survey respondents may not have had a positive perception of the value of PEN for the cost. The initial cost of an innovation may affect its rate of adoption (43). Potential adopters want to know the degree to which a new idea is better than an existing practice and know the expected benefits for the cost (43). As DC continues to communicate the benefits of PEN for the cost, more non-subscribers may understand the expected benefits for the cost of the service. Compared to

a year ago, the percent change for the reasons for not subscribing to PEN was not statistically significant.

### **5.2.5 Demographics — non-subscribers**

Out of the 333 respondents, 68 were PEN non-subscribers. The demographic characteristics of Phase II non-subscribers were summarized in **(Table 5)**. In summary, the majority of PEN non-subscribers were from Ontario and Quebec, were under 45 years of age, had attained a bachelor's degree as their highest level of education, worked full time, worked in a clinical employment setting, worked for more than 10 years and had beginner/intermediate computer skills.

In Phase I, 16% of respondents selected the options “not working,” “not applicable” or “working in ‘other’ employment setting” compared to 29% in Phase II. The difference between these proportions was significant ( $z=2.2$ ,  $p=0.03$ ). In Phase I, 19% of respondents had 2-5 years in practice compared to 9% of respondents in Phase II. The difference between these proportions was significant ( $z=-2.0$ ,  $p=0.04$ ). Therefore, compared to a year ago, a higher proportion of Phase II non-subscribers selected the options “working in ‘other’ employment setting,” “not working in dietetics” or “not applicable,” and a lower proportion of Phase II non-subscribers had 2-5 years in practice. These changes are not really surprising as respondents who are not working in dietetics or are working in “other” employment setting would not likely have a subscription to PEN. Having 2-5 years in practice may be a facilitator to subscribing to PEN.

**Table 5: Demographic characteristics of PEN non-subscribers**

Demographic Characteristics of Individuals who indicated PEN Subscriber = No			
Characteristic	Description	N=68	% of Sample
<b>Region</b>			
	BC	5	7.4%
	AB/Terr	8	11.8%
	SK/MN/NW ON	8	11.8%
	Cen/South ON	21	30.9%
	QC/NE&E ON	15	22.1%
	Atlantic	10	14.7%
	Other	1	1.5%
<b>Ages</b>			
	Under 25 years	1	1.5%
	25-34 years	18	26.5%
	35-44 years	18	26.5%
	45-54 years	15	22.1%
	55 years and over	16	23.5%
<b>Education</b>			
	Bachelor's degree	46	67.6%
	Working on or holding graduate degree	22	32.4%
<b>Work Status</b>			
	Full time	40	58.8%
	Part time	18	26.5%
	Occ/Stu/NW	10	14.7%
<b>Employment</b>			
	Clinical	22	32.4%
	Community	4	5.9%
	Research/Academic/Practicum	5	7.4%
	Private practice	10	14.7%
	Public Health	4	5.9%
	Admin/FS	3	4.4%
	Other	20	29.4%
<b>Yrs in Practice</b>			
	Fewer than 2 years	6	8.8%
	2-5 years	6	8.8%
	Between 5 and 10 years	12	17.6%
	More than 10 years	44	64.7%
<b>Computer Skills</b>			
	Beg/Int	45	66.2%
	Advanced	23	33.8%

**5.2.5.1 Characteristics of PEN non-subscribers compared to subscribers**

There were differences between the proportions of non-subscribers and subscribers in certain demographic categories. The differences were summarized in **Table 6**. Based on the results, being over the age of 55 years may be a barrier to subscribing to PEN. Alternately, being under 25 years of age and having 2-5 years in practice may be a facilitator to subscribing to PEN. Working in the Public Health employment setting may also be a facilitator to subscribing to PEN.

**Table 6: Demographic characteristics of PEN non-subscribers compared to PEN subscribers**

<b>Demographic Category</b>	<b>Non-subscriber</b>	<b>Subscriber</b>	<b>Significance of Difference Between Proportions</b>
Under 25 years of age	2%	6%	(z=-2.3, p=0.02)
Over 55 years of age	24%	12%	(z=2.1, p=0.04)
Public Health employment setting	6%	17%	(z=-2.9, p=0.004)
2-5 years in practice	9%	18%	(z=-2.1, p=0.04)

In summary, barriers and facilitators that enabled dietitians to use PEN or prevented dietitians from using PEN to change the way they practiced were summarized in **Table 7**. The review of barriers and facilitators is presented in the Pathman-Rogers model to display which category of attributes facilitated or prevented practice/behaviour change. The researcher suggests that relative advantage and complexity are the attributes that most

greatly influence the adoption of PEN; therefore, they are discussed in further detail in this section. Relative advantage is the strongest predictor of an innovation's rate of adoption (43). Innovations with low complexity are easy to use and have a faster rate of adoption. Practice-based Evidence in Nutrition users saw the relative advantages of using PEN compared to other sources of practice information. Respondents perceived the value of PEN through the quality of content and impact on practice that it provided. However, there is a risk that users may not completely adopt PEN because of the potential barriers of accessing PEN, gaps in content, low use of tools/resources and lack of time to spend using PEN at work. In regards to complexity, respondents perceived PEN as somewhat complex as it relates to mechanics of the PEN service and user satisfaction with search options and printing functions. All PEN features pertaining to complexity (ease of access and user satisfaction with search options and printing functions) should be improved in order to ensure users adopt PEN.

Demographic characteristics of PEN users that were barriers to PEN use are summarized in **Table 8**.



**Table 7: Barriers and facilitators of using PEN to change behaviour/ practice**

PEN Attributes	Stages of Behaviour Change			
	Awareness	Agreement	Adoption	Adherence
<b>Relative Advantage</b> <ul style="list-style-type: none"> <li>cost</li> <li>ease of access to PEN site</li> <li>use of search options</li> <li>use of PEN tools/resources</li> <li>participation in developing PEN content</li> <li>quality of PEN content</li> <li>PEN's importance to practice</li> <li>social status (credibility, PEN authors)</li> <li>PEN orientation</li> </ul>	PEN orientation	<ul style="list-style-type: none"> <li>Use of tools/resources</li> <li>Participation in developing PEN content</li> <li>Quality of PEN content</li> <li>PEN's importance to practice</li> <li>Credibility</li> </ul>	<ul style="list-style-type: none"> <li>Ease of access</li> <li>Use of tools/resources</li> <li>Participation in developing PEN content</li> <li>Gaps in content</li> <li>Cost</li> <li>Quality of PEN content</li> <li>PEN's importance to practice</li> <li>Credibility</li> <li>Time to use PEN</li> </ul>	<ul style="list-style-type: none"> <li>Lack of time to use PEN</li> <li>Time to use PEN</li> </ul>
<b>Compatibility</b> <ul style="list-style-type: none"> <li>users' knowledge and utilization of tools</li> <li>up-to-date information with sufficient detail to guide practice</li> <li>perceived credibility of the PEN service</li> <li>perceived usefulness to practice</li> </ul>	n/m	n/m	<ul style="list-style-type: none"> <li>Use of tools</li> <li>Gaps in content</li> <li>Up to date</li> <li>Sufficient detail to guide practice</li> </ul>	<ul style="list-style-type: none"> <li>Lack of time to use PEN</li> <li>Time to use PEN</li> <li>Perceived credibility of the PEN service</li> <li>Perceived usefulness to practice</li> </ul>
<b>Complexity</b> <ul style="list-style-type: none"> <li>ease of access to PEN site</li> <li>user satisfaction with search options</li> <li>user satisfaction with printing functions</li> </ul>	n/m	<ul style="list-style-type: none"> <li>Ease of access</li> <li>User satisfaction with search options and printing functions</li> </ul>	<ul style="list-style-type: none"> <li>Ease of access</li> <li>User satisfaction with search options and printing functions</li> </ul>	n/m
<b>Trialability</b> <ul style="list-style-type: none"> <li>PEN orientation</li> </ul>	PEN orientation	n/m	n/m	n/m
<b>Observability</b> <ul style="list-style-type: none"> <li>communication of user satisfaction</li> </ul>	↑	n/m	n/m	n/m

n/m = not measured

Barrier to behaviour/practice change

Facilitator to behaviour/practice change

**Table 8: Demographic characteristics as barriers and facilitators to PEN use**

<b>Demographic Characteristic</b>	<b>Description</b>	<b>Barrier</b>	<b>Facilitator</b>
<b>Age</b>	Over 45 years	Frequent PEN use Using one search option Time to use PEN	
	Under 25 to 35 years		Frequent PEN use Time to use PEN PEN orientation
<b>Years in Practice</b>	< 2 years in practice		Frequent PEN use Use of PEN to prepare presentations, policy development
<b>Highest Level of Education</b>	Working on or holding a graduate degree	Reasons for use Agreement that PEN information was up to date Confidence in the quality of PEN content	Authoring PEN content Reviewing PEN content
<b>Computer skills</b>	Beginner/Intermediate	Time to use PEN	

### **5.3 Limitations**

The low response rate of 9.5% in the second survey may be an indication of possible bias in the results. Bias would arise if the distributions of the expressed opinions of those who chose to respond are different from the distributions of the opinions of those who did not respond. However, the sample was a volunteer sample, which may be a criticism of the study, but was unavoidable by the design of the study. The significance of the statistical tests was not affected by a low response rate.

Most studies using surveys examine only a few barriers and use closed questions (30). Subsequently, this approach may lead to results biased by the researcher’s selection of identified barriers (30). Therefore, there may be a slight bias of the identified barriers in this research as survey questions were designed to investigate specific barriers based on

research literature. However, this current study used open-ended questions in the barrier questions, which provided rich detail and allowed the researcher to identify barriers that were not in the survey questions.

## **6.0 CONCLUSIONS AND RECOMMENDATIONS**

This research was informed by Rogers' Diffusion of Innovations Theory and Pathman's Awareness-to-Adherence Model. The purpose of this research was to determine the effectiveness of PEN as a KTT tool for incorporating new knowledge into dietetic practice and identify barriers and facilitators that prevented dietitians from using or enabled dietitians to use PEN to change the way they practiced. Cross-sectional data were compared to baseline data to determine whether there was a change in the effectiveness of PEN and in the barriers and facilitators. Significant changes from baseline to Phase II indicated trends. The analysis informed recommendations to guide future improvements to the service. This research was the first to use comparative data to measure dietetic practice change and knowledge transfer as a result of using an online decision support tool for nutrition professionals.

### ***6.1 Demographics***

The survey yielded a comprehensive picture of the demographic characteristics of PEN users and non-users. Practice-based Evidence in Nutrition users and non-users had similar demographic characteristics, which were that they resided in Ontario and Quebec regions, were under 45 years of age, attained a bachelor's degree as their highest level of education, worked full time, worked in a clinical employment setting, worked for more than 10 years and had beginner/intermediate computer skills. However, subscribers differed significantly from non-subscribers in that more subscribers were under 25 years of age, had 2-5 years in practice and worked in a Public Health employment setting. Evaluation of

the relationship between demographic characteristics and responses to survey questions found that age, years in practice, highest level of education attained and computer skills influenced PEN use. Demographic characteristics associated with greater PEN use were being under 35 years of age, having less than 2 years in practice and working on or holding a graduate degree. Demographics that were associated with decreased use of PEN were being over 45 years of age and having beginner/intermediate computer skills. Promotion of PEN should be tailored for a target audience of older dietitians with intermediate computer skills. Users who were working on or holding a graduate degree had lower levels of agreement that PEN information was up to date and lower confidence in the quality of PEN content. Users with a higher level of education could be asked to develop PEN content and help to keep PEN up-to-date. For non-subscribers of PEN, the cost of PEN for its perceived value to practice was a barrier to subscribing to PEN.

## ***6.2 PEN Evaluation Framework Logic Model for Data Analysis***

As shown in **Appendix B** and **Appendix C**, the PEN Evaluation Framework Logic Model (abbreviated) displays how survey questions linked to Rogers' Diffusion of Innovations and Pathman's Model of Awareness-to-Adherence measure the outcomes and corresponding indicators of the logic model. Data analysis interpreted through the logic model assesses the success of the outcomes. The logic model increases the understanding of which indicators need to be improved to increase the level of success of the outcomes.

Interpreting data through the logic model allows for a targeted approach to increase the effectiveness of PEN. Strength of the PEN logic model was that it framed the comparison of cross-sectional data to baseline data to provide insight into trends in KTT and practice

change pertaining to PEN use. The comparison gave insight into whether improvements to the service improved the measure of the indicator or outcome. This information contributed to the recommendations to DC for improvements to the PEN service. A logic model framework is suitable for repeated measures evaluations. This research used the PEN logic model framework to identify who uses PEN, gaps in content, functionality of technology, value of PEN to users and trends in knowledge transfer and dietetic practice change as it relates to PEN.

Based on the logic model outcomes, PEN effectively transferred knowledge by meeting subscribers' information needs, somewhat effectively transferred knowledge by being a source of valid and applicable evidence-based dietetic information, effectively changed dietetic practice by practitioners' basing aspects of their practice on the evidence from PEN, and slightly/somewhat effectively used technology to support optimal use of PEN. Therefore, PEN users perceived that PEN was an effective knowledge translation and transfer tool that provided support to nutrition professionals to stay up to date with research literature, enabled them to apply evidence-based decision making to practice and positioned them as evidence-based practitioners. The effectiveness of PEN was diminished in certain areas because of three logic model indicators that were not met, which were ease of access, responsiveness and interactivity, and availability and use of practical tools/resources for clients. Indicators were not fully met due to printing difficulties, broken links and search options that were only somewhat effective (ease of access); low practitioner engagement in shaping PEN content (responsiveness and interactivity); and tools/resources being shared infrequently and having limits to their use (use of practical

tools/resources for clients). Compared to the Phase I PEN evaluation of the previous year, PEN was equally as effective as a KTT tool for incorporating new knowledge into dietetic practice.

There were positive and significant trends in knowledge transfer and practice change as it relates to PEN compared to Phase I. The trend in knowledge transfer was that a higher proportion of dietitians asked practice questions that helped shape content. Trends in practice change were that PEN was used more frequently and a higher proportion of dietitians had sufficient time at work to spend using PEN. The only significant negative trend was that there were more broken links and printing difficulties reported; yet the lack of change is worth mentioning. Changes made by DC to the searchability of PEN did not improve users' perceptions of the effectiveness of PEN search strategies and tools. A large increase in PEN content and tools/resources did not increase the sharing of tools/resources or change the perception of PEN's impact on practice. The lack of change in perceptions and sharing of PEN tools points to the need for greater promotion of PEN's content and PEN's function in daily practice.

The data indicates that practitioners of EBP who apply evidence that has been through a KTT process perceive that the applied evidence improves client health outcomes. There were strong relationships between dietitians' agreement that PEN led to positive health benefits for clients and their agreement that the knowledge pathways provide sufficient detail to guide practice, they had confidence in the quality of information PEN provides, the information in PEN was up to date and they had sufficient time at work to spend using PEN.

The perception that PEN improved client health outcomes was also influenced by frequent use of PEN. Further research could measure PEN's impact on client health outcomes and provide strong evidence that PEN improves health outcomes.

Testing of the strength of relationships between various logic model measures found significant relationships. Positive perceptions of PEN's quality of content led to respondents' perceptions that PEN influenced the way they worked and enabled them to take an evidence-based approach to their work. There was a relationship between frequency of sharing tools and confidence in the quality of information in PEN and receipt of a satisfactory answer to practice questions. Having sufficient time at work to spend using PEN influenced perceptions that PEN positively influenced the way respondents work and PEN was a valuable tool for practice.

The logic model could more efficiently answer research questions and guide improvements related to PEN outcomes if there was a standard of achievement associated with each indicator. The results from Phase I and Phase II PEN evaluations can be used to set a benchmark as a standard of achievement for future PEN evaluations. Measurement of the PEN logic model outcomes compared to the benchmark can prioritize improvements to the service based on the gap between actual and targeted level of achievement.

### ***6.3 Pathman-Rogers Model for data analysis***

This research indicates that the Pathman-Rogers model has value to frame and inform the design of evaluations of online KTT tools intended to change behaviour/practice to identify barriers and facilitators. The model may be able to direct quality improvement to specific



attributes, features or content to lead to a faster rate of adoption and achievement of intended outcomes. Framing an evaluation, the model can potentially predict the impact of improvements to the service.

The Pathman-Rogers model suggests PEN attributes and user characteristics can influence dietetic practice change through users' awareness of PEN and its function in daily practice, agreement that PEN is a credible source of evidence-based information, adoption of PEN in practice to build knowledge and adherence to PEN use as the best process for practice guidance. Data analysis using this model identifies barriers and facilitators to dietetic practice/behaviour change. The results have expanded one's understanding of barriers and facilitators to knowledge translation and transfer and dietetic practice change as it relates to PEN by evaluating users' perceptions of PEN features. The evaluation of PEN viewed through the lens of the Pathman-Rogers model informed recommendations to guide DC's improvements of PEN based on PEN attributes.

The barriers to PEN use were technology difficulties (broken links, printing, searchability) and users' satisfaction with them, lack of participation in developing PEN content, gaps in content, use of tools/resources in knowledge pathways and users' perception of lack of tools/resources, and the amount of time available to use PEN at work. To prevent PEN users from stalling at one or more of the steps to behaviour/practice change Dietitians of Canada should address the barriers to PEN use to overcome or diminish their impact on incorporating new knowledge into practice and practice change. Respondents also perceived facilitators that enabled them to use PEN to change the way they practiced.

Compared to baseline, the only change in barriers that prevented dietitians from using PEN to change the way they practice was that printing difficulties and broken links increased significantly.

The facilitators to PEN use were having sufficient time to use PEN, PEN's quality of content, sufficient detail in PEN to guide practice, taking the PEN orientation, and the perceived importance and positive benefits to practice, clients and the dietetic profession. The features of PEN that facilitate use should be enhanced and promoted to reinforce the practice/behaviour change. Facilitators that enabled dietitians to use PEN to change the way they practiced did not change significantly compared to a year ago.

#### **6.4 Recommendations**

After evaluation of a KTT tool, recommended interventions should be tailored to address barriers and increase the value of the tool to the users. Recommendations may be the same as interventions that were used during the implementation of the tool or new ones may be needed (10). Original interventions may be effective, but require promotion or advertising. The following recommendations focus on improving the operation and value of PEN to the PEN user by recommending remedial action to solve the problem, direction on how to improve future outcomes and research to fill in the gaps in understanding.

##### **6.4.1 Technology**

The following recommendations are made to improve the logic model outcome "technology supports optimal use of PEN" and as a result improve functionality for KTT, improve users' perceptions of the relative advantages of PEN over other sources of practice information in

terms of user satisfaction with the mechanics of the PEN site and improve users' perceptions of the complexity of PEN. Recommendations address ease-of-access issues, including broken links and printing difficulties, and low participation by PEN users to shape PEN content (responsiveness and interactivity). The recommendations also address the respondents' comments to the question regarding how to make PEN a better knowledge translation and transfer tool.

#### ***6.4.1.1 Broken links and printing difficulties***

The objective of these recommendations is to increase the ease of printing and the competency of linkages. Broken links should be repaired and any documents that do not print correctly should be reformatted to print properly. Moving forward, to reduce the number of broken links and printing difficulties, DC should continue with their quality assurance procedures and regularly audit the entire site to find broken links and printing issues. Audit and promotion of PEN could be done concurrently. One day a year, invite all PEN users to peruse the website to find a broken link or a document that will not print. Users who find issues could receive an incentive (cookbook, movie coupons).

#### ***6.4.1.2 Effectiveness of PEN searches***

The objective of these recommendations is to increase the effectiveness of PEN search strategies and tools and thereby increase ease of access to PEN's evidence-based information and address users' lack of sufficient time available at work to spend using PEN. PEN should contain searchable, sortable databases that can sort by date for users who want to review new content including tools and resources, evidence (research articles), authors

and reviewers, and knowledge pathways. Searchable databases could also address respondents' comments regarding PEN search strategies and tools that indicated PEN content contained gaps in content. For example, currently, users cannot search the colorectal cancer knowledge pathway with a key word. To reduce the time required to access PEN information, a user who is consulting with a client or colleague in her office should be able to go to the colorectal cancer knowledge pathway and search the key word "vitamin D" to see if there is practice guidance, evidence or lack of evidence on whether it is sufficient to recommend vitamin D supplements for prevention or treatment of colorectal cancer.

#### ***6.4.1.3 Responsive and interactive***

The objective of these recommendations is to increase users' participation in developing PEN content. A remedial, long-term strategy to increase the participation of dietitians in shaping PEN content could be to have a mentor program. Although users indicated they had sufficient guidance in their roles as author and reviewer, a mentor program may make authors and reviewers feel more comfortable in their roles, and therefore, more dietetic practitioners may become engaged in developing PEN content. To supplement the DC PEN Writer's Guide and the evidence-based decision-making tutorial, each region of DC could have a mentor that authors and reviewers could contact for assistance and advice. Mentors could advise how to apply what the authors and reviewers learned from the guide and tutorial and how to provide answers to practice questions that address the context in which the decision is being made.

Other ways to engage and motivate more dietetic practitioners in developing PEN content could be to 1) increase awareness of the benefits of practitioner engagement in shaping PEN content by diffusing research on the subject (for instance, disseminate the advantages of users' ability to shape content in an online decision support system, such as timely updating of existing information and addition of new topics), 2) promote the learning and capacity building opportunities for authors and reviewers that are offered through the evidence-based decision-making course and mentors, 3) measure and post the lag time between when practice questions were asked and answers were provided to quantify how the lack of participation leads to long wait times for answers in order to address the indicator "timely updating of existing information and addition of new topics," and 4) advertise a week-long promotion and incentive program that encourages PEN users to submit practice questions and calls for users willing to answer the practice questions. More practitioner engagement could increase adoption of PEN in daily practice and change practitioner behaviour.

Further research may be required to understand why users do not participate in shaping PEN content. At the annual DC conference there could be a PEN café or teashop booth. Focus groups could be held at the café and teas and beverages could be offered to the participants. Focus group questions could investigate why dietitians do or do not participate in shaping PEN content and the barriers and facilitators to participation. A well-publicized focus group with incentives for dietitians could draw a sufficient number of participants for two to three focus groups a day at the DC conference.

## **6.4.2 PEN Content**

The following recommendations are made to maintain and improve the logic model outcome “PEN is a source of valid and applicable evidence-based dietetic information” and as a result increase the availability and use of practical tools/resources for clients; improve users’ perceptions of the relative advantages of PEN over other sources of practice information in terms of users’ knowledge and utilization of tools/resources, quality of content, credibility and PEN’s importance to practice; and improve users’ perceptions of the compatibility of PEN with their existing values, past experiences and needs.

Recommendations address availability and use of tools/resources for the client, quality of content and having sufficient time to use PEN at work. The recommendations also address the respondents’ comments regarding what limits the use of the tools/resources and how to make PEN a better knowledge translation and transfer tool.

### ***6.4.2.1 Tools/resources***

The objective of the recommendations on tools/resources is to increase the use and sharing of PEN tools/resources by facilitating access and availability. Client/consumer tools and resources need to be shared more frequently to increase knowledge transfer. User responses indicated that the materials that they are looking for are not included in PEN and that they would like to have more client/consumer handouts, nutritional screening and assessment tools, and menu plans. The latter tools should be developed and added to the PEN site. A sub-committee of PEN could be formed with a mandate to develop and modify client handouts based on the PEN evaluation. The committee could develop

new and modify current handouts that contain more space to write in, have more pictures and can be printed in a larger font for older clients. Handouts should also be developed for clients/consumers that are tailored to various cultural groups and other language-speaking groups that are prevalent in Canada. The launch of the tools should be announced and use of the tools promoted to increase users' awareness of the tools in PEN. The promotions should state that the tools were developed in response to the PEN evaluation survey. As mentioned in section 6.4.1, the tools/resources database should be searchable and sortable to reduce the time required to sort through search results from the entire PEN database. Further research is recommended to identify what tools and features of the tools/resources would be of most value to PEN users. Qualitative research could explore dietitians' needs and preferences in relation to nutrition education materials (44).

#### ***6.4.2.2 Up-to-date content***

The objective of these recommendations is to keep PEN content up to date. In research literature, older or out-of-date information was a barrier to using the evidence. In the PEN evaluation, there was a relationship between agreement that PEN was up to date and agreement that PEN led to positive health benefits for clients. Keep PEN content as up to date as possible in order to maintain dietitians' confidence in the quality of content. Dietitians of Canada could draw on the pool of mentors to develop content immediately following the release of high-quality research that is significant to dietetic practice to transfer knowledge into practice as quickly as possible. Dietitians of Canada should continue to monitor the effectiveness of the updating system that determines when a knowledge pathway needs to be updated. A biannual review could be done by a review

group made up of specialists in various areas of practice. If a knowledge pathway has been reviewed but there is no new evidence to add to the pathway, a footnote could be added that indicates that a thorough review of the evidence has been completed. The footnote information should include the date of the review and the name of the reviewer. The footnote information could also be in a link from the posted review date.

### **6.4.2.3 Time**

The objective of these recommendations is to mitigate the barrier of insufficient time available to use PEN and facilitate practice change through quick access to PEN content. Practice-based Evidence in Nutrition's EBP features were designed to keep frontline dietetic practitioners up to date with current evidence; however, many users still indicated they did not have sufficient time to use PEN at work, hence they do not frequently access PEN content. Recommendations made in sections 6.4.1 and 6.4.2 regarding technology, especially search strategies and tools, considered the time required to access evidence-based information in PEN. Having sufficient time to spend using PEN at work was significantly influenced by computer skills. To increase users' computer skills as they relate to PEN, the PEN orientation should be strongly promoted to current subscribers to increase their familiarity with PEN, understanding of the benefits of PEN's EBP features and comfort in navigating the site. The orientation offers trialability and increases awareness of PEN, which can lead to adoption of PEN. To encourage engagement in the PEN orientation, new and current subscribers could be offered a discount or a percentage refund on their subscription cost when they complete the entire PEN orientation. PEN could continue to collaborate with universities to promote PEN and the PEN orientation to



students. Users under the age of 25 were the smallest demographic age group. The collaboration could include a PEN representative speaking to second-year nutrition students about the benefits of PEN and the PEN orientation, and the relationship between the PEN orientation and agreement that PEN enabled dietitians to take an evidence-based approach to their work.

#### ***6.4.2.4 Communication/promotion of PEN***

The objective of these recommendations is to communicate to current and future dietetic practitioners regarding users' perceptions of PEN attributes, which could positively influence their perceptions of PEN's relative advantage incompatibility. This, in turn, could lead to adoption and adherence of PEN use. Communication may influence and/or strengthen perceptions regarding quality of PEN content, and PEN's importance and usefulness to practice. Clear, concise communication about the results of this evaluation could continue to be presented at the annual DC conference and other international research forums. The presentation should be made available on the DC website. This information may also address the concerns of non-subscribers regarding cost and value to their practice.

The ultimate goal of PEN is to improve the health outcomes of the population. Further research is required to evaluate the impact of PEN on client health outcomes. Determining the impact of PEN on health outcomes would require a research question specific to client health outcomes. Outcomes and effectiveness research could evaluate the effectiveness of nutritional interventions and programs that were in PEN's practice guidance. The type of

outcomes assessed could include clinical, patient and cost. Overall evaluation requires tracking of outcomes, including clients' evaluations of their experience (4). Tracking would require dietitians to have infrastructure to support the tracking of outcomes. Results of the research could be communicated and promoted globally by DC at international dietetic meetings and conferences.

## 7.0 POSTSCRIPT

This section is dedicated to acknowledging what has been done to the PEN service since the collection of data in 2008. The PEN process is an evolving process. Phase II data was collected in December of 2008. From 2008 to 2011 Dietitians of Canada made many changes and improvements to the PEN service. For instance, DC has implemented quality improvement initiatives to improve the technological features of PEN, vastly expanded PEN content in the knowledge pathways and are running a mentorship program for PEN writers. Some of the changes made were recommended previously in the recommendations section. Below is a list of some of the changes made to the PEN service:

- ⊕ When practice questions are asked that no evidence can be found for it is stated and given a grade of D. Now this information can be found in the practice question beside the key practice point. Previously, it was only available in the evidence summary.
- ⊕ In June, 2011 there were 1613 consumer tools and 1787 professional tools that have been reviewed against the evidence.
- ⊕ The PEN orientation is offered by telephone, webinar, online modules, in-person demonstration. There is now a free 15-day trial of the PEN service.
- ⊕ A new automated broken link checker has been installed and is run weekly. Broken links are repaired immediately.
- ⊕ Reported incidents of failure to print have been reduced to almost nil. Printing was addressed at the entire site as it was recoded and moved to a new platform.

- ⊕ At the annual DC conferences, PEN users are interviewed to understand why they do not participate in shaping PEN content.
- ⊕ DC mandated a group of PEN staff to develop and modify client handouts based on the feedback from the PEN Evaluation.
- ⊕ Focus group research by DC has collected information regarding what new tools and what features of tools would be valuable to users.

## REFERENCES

1. Gray GE, Grey LK. Evidence-based medicine: Applications in dietetic practice. *J Am Diet Assoc* 2002;102:1263-1272.
2. Byham-Gray LD, Gilbride JA, Dixon B, State FK. Evidence-based practice: what are dietitians' perceptions, attitudes, and knowledge. *J Am Diet Assoc* 2005;105:1574-1581.
3. Choi B. Understanding the basic principles of knowledge translation. *Journal of Epistemology and Community Health* 2005;59(2):93.
4. Salmond SW. Advancing evidence-based practice: a primer. *Orthop Nurs* 2007;26(2):114-123
5. Chunharas S. An interactive integrative approach to translating knowledge and building a "learning organization" in health services management. *Bull World Health Organ* 2006;84:652-657.
6. Pappano D, Conners G, McIntosh S, Humiston S, Roma D. Sources of knowledge transfer among primary care pediatric health care providers. *Clin Pediatr* [cited 2008 July 22]. doi:10.1177/0009922808320600.
7. Thomas DE, Kukuruzovic R, Martino B, Chauhan SS, Elliott EJ. Knowledge and use of evidence-based nutrition: a survey of paediatric dietitians. *J Hum Nutr Dietet* 2003;16:315-322.
8. Dietitians of Canada. Evaluation of Practice-based Evidence in Nutrition. Canadian Council of Learning 2006 July.
9. Atkinson SA. A nutrition odyssey: knowledge discovery, translation, and outreach. *Can J Diet Prac Res*. 2006;67:150-156.
10. Graham ID, Logan J, Harrison MB, Straus SE, Tetroe J, Caswell W, et al. Lost in knowledge translation: time from a map? *J Con Ed Health Prof* 2006;26(1):13-24.
11. Westbrook JI, Coiera EW, Gosling AS. Do online information retrieval systems help experienced clinicians answer clinical questions? *J Am Med Inform Assoc* 2005;12:315-321.
12. Sim I, Gorman P, Greenes RA, Haynes RB, Kaplan B, Lehmann H, et al. Clinical decision support systems for the practice of evidence-based medicine. *J Am Med Inform Assoc* 2001;8:527-534.
13. Davenport TH, Prusak L. Working knowledge: how organizations manage what they know. Harvard Business School Press; 2000. p. 5.

14. Landry R, Amara N, Pablos-Mendes A, Shademani R, Gold I. The knowledge-value chain: a conceptual framework for knowledge translation in health. *Bull World Health Organ* 2006;84:597-602.
15. Tetroe JM, Graham ID, Foy R, Robinson N, Eccles MP, Wensing , Durieux P, et al. Health research funding agencies' support and promotion of knowledge translation: an international study. *Milbank Q* 2008;86(1):125-155.
16. Home page of PEN accessed at <http://www.dieteticsatwork.com.www.msvu.ca:2048/PEN/home.asp> on July 18, 2010
17. Home page of the Health Council of Canada accessed at [http://healthcouncilcanada.ca/en/index.php?option=com\\_content&task=view&id=129&Itemid=111](http://healthcouncilcanada.ca/en/index.php?option=com_content&task=view&id=129&Itemid=111) on October 5, 2010.
18. Canadian Institutes for Health Research. Knowledge translation strategy 2004-2009. 2005 [cited 2008 June 20]. Available from <http://www.cihr-irsc.gc.ca/e/26574.html>
19. Hemming J. 2008. Development of Evaluation Tools for Dietitians of Canada's Practice-based Evidence in Nutrition (PEN) Service. Mount Saint Vincent University.
20. Dietitians of Canada. DC Priorities [cited 2009 Nov 07]. Available from [http://www.dietitians.ca/members\\_only/dcpriorities.asp](http://www.dietitians.ca/members_only/dcpriorities.asp)
21. Myers EF, Pritchett E, Johnson EQ. Evidence-based practice guides vs. protocols: what's the difference? *J Am Diet Assoc* 2001;101(9):1085-1090.
22. Brassey J, Elwyn G, Price C, Kinnersley P. Just in time information for clinicians: a questionnaire evaluation of the ATTRACT project. *BMJ* 2001;322:529-530.
23. Freeman AC, Sweeney K. Why general practitioners do not implement evidence: qualitative study. *BMJ* 2001;323:1-5.
24. Armstrong R, Walters E, Crockett B, Keleher H. The nature of evidence resources and knowledge translation for health promotion practitioners. *Health Promotion International* 2007;22(3):254-260.
25. Glasgow RE, Lichtenstein E, Marcus, AC. Why don't we see more translation of health promotion research to practice? Rethinking the efficacy-to-effectiveness transition. *Am J Public Health* 2003;93(8):1261-1267.

26. McGlynn EA, Asch SM, Adams J, Keesey J, et al. The quality of health care delivered to adults in the United States. *New England Journal of Medicine* 2003;348(26):2635-2645.
27. Lavis JN, Lomas J, Hamid M, Sewankambo NK. Assessing country-level efforts to link research to action. *Bull World Health Organ* 2006;84:620-628.
28. Liang L. The gap between evidence and practice. *Health Affairs* 2007;26(2):w119-w121.
29. Kendall H, Chockalingam A, Best A, Walsh G. Technology-enabled knowledge translation: building a framework for collaboration [editorial]. *CMAJ* 2003;168(6):710-711.
30. Farrell A. An evaluation of the five most used evidence based bedside information tools in the Canadian Health Libraries. *Evidence Based Library and Information Practice* 2008;3(2):3-17.
31. Alper BS, White DS, Ge B. Physicians answer more clinical questions and change clinical decision more often with synthesized evidence: a randomized trial in primary care. *Ann Fam Med* 2005:507-513.
32. Magrabi F, Westbrook JI, Kidd MR, Day RO, Coiera E. Long-term patterns of online evidence retrieval use in general practice: a 12-month study. *J Med Internet Res* 2008;10(1):e6 [cited 2008 July 28]. Available from: <http://www.jmir.org/2008/html/1/e6/>
33. Lynda Corby. Join your colleagues in making PEN your nutrition knowledge destination. *Members in Action* 2008 August [cited 2008 Aug 25]. Available from: [http://www.dietitians.ca/members\\_only/membersinaction\\_archive.asp?fn=DCYOU&id=12160&nav=section&lang=English](http://www.dietitians.ca/members_only/membersinaction_archive.asp?fn=DCYOU&id=12160&nav=section&lang=English)
34. Dietitians of Canada. PEN - Practice-based Evidence in Nutrition. [cited 2008 Sep 10] Available from <http://www.dieteticsatwork.com.www.msvu.ca:2048/pen/home.asp>
35. Dietitians of Canada. About PEN - Practice-based Evidence in Nutrition Features. [cited 2008 Sep 03]. Available from <http://www.dieteticsatwork.com.www.msvu.ca:2048/Pen/features.asp>
36. Williams A, Holder B, Krebs P, Muhajarine N, Waygood K, Randall J, et al. Knowledge translation strategies in a community - university partnership: examining local quality of life. *Soc Indic Res* 2008;85:111-125.
37. Weiss R, Charney E, Baumgardner RA, German PS, Mellits D, Skinner EA, Williamson JW. Changing patient management: what influences the practicing paediatrician? *Pediatrics* 1990;85(5):791-795.

38. Norman CD, Huerta T. Knowledge transfer & exchange through social networks: building foundations for a community of practice within tobacco control. *Implementation Science* 2006;1:20-31.
39. Cochrane LJ, Olson CA, Murray S, Dupuis M, Tooman T, Hayes S. Gaps between knowing and doing: understanding and assessing the barriers to optimal health care. *J Cont Educ Health Prof* 2007;27(2):94-102.
40. Byham-Gray LD, Gilbride JA, Dixon B, State FK. Predictors for research involvement among registered dietitians. *J AM Diet Assoc* 2006;106:2008-2015.
41. Pathman DE, Konrad TR, Freed GL, Freeman VA, Koch GG. The awareness-to-adherence model of the steps to clinical guideline compliance. *Med Care* 1996;34(9):873-889.
42. Rogers EM. *Diffusion of innovations*. 4th ed. New York: The Free Press; 1995.
43. Rogers E. *Diffusion of innovations*. 5th ed. New York: The Free Press; 2003, p.5,219-266.
44. Monsen ER, Cheney CL. Descriptive Research Designs. In: Monsen ER, ed. *Research: successful approaches*. 2 ed. American Dietetic Association; 2003. p. 1-14, 223.
45. Miller EM, Smith KL. Handling nonresponse issues. *Journal of Extension* 1983:45-50.
46. Moore DS, McCabe D. *Introduction to the Practice of Statistics*. 5th ed. Freeman; 2006.
47. Waller KV, Jordan L, Gierhart J, Brodnik MP, Schiller MR, Flanigan KS, et al. Research skills and the research environment: A needs assessment of allied health faculty. *J Allied Health* 1998;17:101-113.
48. Coleman P, Nicholl J. Influence of evidence-based guidance on health policy and clinical practice in England. *Quality in Health Care* 2001;10:229-237.
49. Rubin HR, Pronovost P, Diette GB. From a process of care to a measure: the development and testing of a quality indicator. *Int J Qual Health Care* 2001;13(6):489-496.
50. Dietitians of Canada. PEN - help section. [cited 2008 Sep 10]. Available from [http://www.dieteticsatwork.com.www.msvu.ca:2048/pen/module\\_library.asp](http://www.dieteticsatwork.com.www.msvu.ca:2048/pen/module_library.asp)



## Appendix A

## PEN Evaluation Questionnaire

### Section 1: PEN Subscriber

1. Do you have access to PEN through an individual subscription or your employer?

Yes – direct to question 2

No

a) Please indicate your reason for not subscribing to PEN (check all that apply).

I do not think PEN will help me in my practice.

I am waiting for PEN content to be expanded.

I think that the cost of PEN is too high for its value to my practice.

I am waiting for my employer to subscribe to PEN.

I am not familiar with PEN.

I am semi/retired and for that reason do not think that I would make good use of PEN.

I do not have access to the Internet at work.

Other (Please specify in the comment box below).

Comment:

b) What sources of practice information do you use? Please check all that apply.

Colleagues

Electronic databases (such as PubMed and National Guideline Clearinghouse)

Electronic Evidence Libraries (such as Health-Evidence.ca, Cochrane Database of Systematic Reviews and The Canadian Best Practices Portal for Health Promotion and Chronic Disease Prevention)

General Internet searches

Online or hard copy journals

Clinical practice manuals

Nutrition-related websites (such as Dietitians of Canada's website)

Print resources (such as textbooks)

Handouts from conferences/information sessions

Other (Please specify in the comment box below).

Comment:

**Those who answer no will then be directed to Section 11 – Demographic information.**

2. What type of PEN access/license do you have?

- Individual
- Group
- Site
- Don't know

3. What type of Internet access do you have?

- High speed
- Dial up
- Don't know

4. Are you a member of Dietitians of Canada?

- Yes – direct to question 5
- No

a) If no, please tell us your profession. Are you a:

- Dietitian
- Nurse
- Pharmacist
- Physician
- Student/Intern
- Other (Please specify in the comment box below).

Comment:

5. How did you find out about PEN? Please check all that apply.

- Dietitians of Canada promotional material
- Friend/colleague
- Key words in search engine (such as Google)
- Link from another website
- Please give the name of the website:
- University/college professor
- Internship preceptor
- Other (Please specify in the comment box below).

Comment:

6. Have you participated in a teleconferenced or in-person PEN orientation offered by Dietitians of Canada?

- Yes
- No

7. How often do you use PEN?

- Daily
- Not daily, but at least once per week
- Not weekly, but at least once per month
- Sometimes, but less often than once per month
- Never

a) Why not?  
Comment:

**Those who answer never will be directed to Section 11 – Demographic information.**

Section 2: Ease of access to PEN

1. When accessing the Internet in your practice:

- I have exclusive use of a computer.
- I share a computer with others at my place of work.
- I need to access the Internet at a location away from my working environment.
- I do not have access to the Internet at work.

2. Once you have entered the PEN website:

a) Is the PEN site designed to make it easy to find what you are looking for?

- Yes
- No

Comment:

b) How often do you encounter a broken link (i.e. a hyperlink [a word or phrase that you can click on to jump to a new document or a new section within the current document] that does not work when you click on it)?

- Always
- Usually
- Sometimes
- Seldom
- Never

Comment:

3. Do you print information from the PEN website?

No – direct to Section 3, question 1

Yes

If yes, please indicate how often you encounter any of the following difficulties (situations unrelated to hardware printer problems):

i) The document will not print at all.

- Always
- Usually
- Sometimes
- Seldom
- Never

Comment:

ii) The document will print, but the text is out of alignment, a portion of the text is cut off and/or graphics are missing from the document.

- Always
- Usually
- Sometimes
- Seldom
- Never

Comment:

### Section 3: PEN Search Strategies and tools

1. PEN provides several options to search for information: key word search, advanced search and topic search by Table of Contents or Practice Category.

Please check the response that best describes your experience in using each of these search options:

a) Key word

How often do you use this search option?

- Often  
 Occasionally  
 Never – direct to the next option

Comment:

Do you find this search option to be effective?

- Yes  
 Sometimes  
 No

Comment:

Are the search results organized in such a way that you are able to find the information you are looking for in a reasonable amount of time?

- Yes  
 No

Comment:

b) Advanced Search

How often do you use this search option?

- Often  
 Occasionally  
 Never – direct to the next option

Comment:

Do you find this search option to be effective?

- Yes
- Sometimes
- No

Comment:

Are the search results organized in such a way that you are able to find the information you are looking for in a reasonable amount of time?

- Yes
- No

Comment:

### c) Table of Contents

How often do you use this search option?

- Often
- Occasionally
- Never – direct to the next option

Comment:

Do you find this search option to be effective?

- Yes
- Sometimes
- No

Comment:

Are the search results organized in such a way that you are able to find the information you are looking for in a reasonable amount of time?

- Yes
- No

Comment:

d) Practice Category (Population Health/Lifecycle, Health Condition/Disease, Food/Nutrients and Professional Practice)

How often do you use this search option?

- Often
- Occasionally
- Never – direct to question 2

Comment:

Do you find this search option to be effective?

- Yes
- Sometimes
- No

Comment:

Are the search results organized in such a way that you are able to find the information you are looking for in a reasonable amount of time?

- Yes
- No

Comment:

2. Are you usually able to find the information you want by using only one search option?

- Yes
- No

Comment:

#### Section 4 – General PEN use

1. What are your reasons for using PEN? Please check all that apply.

- To find answers to practice questions
- To find answers to clients'/colleagues' questions
- To find teaching materials for clients/colleagues



- For professional development (e.g., to learn more about a particular topic, to review the most current evidence-based guidance on topics of interest)
  - For research in preparing presentations, developing new resources and/or defining policy
  - For curriculum content development (i.e., as an instructor for academic courses)
  - For mentoring students
  - Other (Please specify in the comment box below).
- Comment:

2. When faced with a practice decision, how likely are you to use PEN?

- Very likely
- Somewhat likely
- Not very likely

Comment:

3. How often do you need to consult a source other than PEN to answer your practice questions/make a practice decision?

- Always
- Usually
- Sometimes
- Seldom
- Never

Comment:

4. How often do you link through to read the reference abstracts/articles for key practice points when in a knowledge pathway?

- Always
- Usually
- Sometimes
- Seldom
- Never
- I was not aware that I could do this.

Comment:

5. How often do you refer to the evidence grade [A,B,C,D] for key practice points in a knowledge pathway?

- Always
- Usually
- Sometimes
- Seldom
- Never
- I was not aware that I could do this.

Comment:

6. How often do you link through and read the information about knowledge pathway contributors?

- Always
- Usually
- Sometimes
- Seldom
- Never
- I was not aware that I could do this.

Comment:

### Section 5: Participation in developing PEN content

1. Have you submitted any practice questions to PEN?

- Yes
- No
- I was not aware that I could do this.

Comment:

2. Have you been a reviewer for PEN content?

- Yes
  - a) Did you have sufficient guidance in this role?
    - Yes
    - No
- No

Comment:

3. Have you authored any content for PEN?

Yes

a) Did you have sufficient guidance in this role?

Yes

No

No

Comment:

Section 6: Use of PEN tools/resources

1. How often do you share the tools/resources included in PEN with clients/colleagues/other health professionals?

Daily

Not daily, but at least once per week

Not weekly, but at least once per month

Sometimes, but less often than once per month

Never

Comment:

2. Is there anything that limits your use of the PEN tools/resources for your clients?

Yes

a) If yes, what limits your use of the PEN tools/resources for your clients? Please check all that apply.

The materials are often not at an appropriate reading level.

The materials that I am looking for are not included in PEN.

The materials are often too basic and/or not detailed enough.

I do not see clients.

Other (Please specify in the comment box below).

Comment:

No – direct to question 3

3. What kind of tools would you like to see included in PEN that are currently missing? Please check all that apply and write your specific suggestions in the comment box below.

- Client handouts at a lower reading level
  - Client handouts that have been adapted to other languages/cultural groups
  - More detailed/advanced materials
  - More calculators
  - More consumer/client handouts
  - More nutritional assessment and screening tools
  - Menu plans
  - Nutrition care maps/algorithms
  - Other (Please specify in the comment box below).
- Comment:

Comment:

### Section 7: Quality of PEN content

Please indicate the extent of your agreement with each of the following statements:

1. I usually receive a satisfactory answer to the practice questions that I have.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Comment:

2. The knowledge pathways typically provide sufficient detail to guide practice.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Comment:

3. The information is typically up to date.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Comment:

4. Overall, I am confident in the quality of the information PEN provides.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Comment:

### Section 8: Importance of PEN and impact on practice

1. What sources of practice information do you regularly use? Please check all that apply.

- Colleagues
- Electronic databases (such as PubMed and National Guideline Clearinghouse)
- Electronic Evidence Libraries (such as Health-Evidence.ca, Cochrane Database of Systematic Reviews and The Canadian Best Practices Portal for Health Promotion and Chronic Disease Prevention)
- General Internet searches
- Online or hard copy journals
- Clinical practice manuals
- Nutrition-related websites (such as Dietitians of Canada's website)
- PEN
- Print resources (such as textbooks)
- Handouts from conferences/information sessions
- Other (Please specify in the comment box below).

Comment:

Please indicate the extent of your agreement with each of the following statements:

2. PEN is a valuable tool for my practice.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Comment:

3. PEN has positively influenced the way I work.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Comment:

4. PEN enables me to take an evidence-based approach to my practice.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Comment:

5. In my opinion PEN has led to positive health benefits for my clients.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Comment:

6. I usually have sufficient time at my work setting to spend using PEN.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Comment:

7. By promoting evidence-based practice, PEN can enhance dietitians' credibility with other health professionals.

- Strongly agree
- Agree
- Neither agree nor disagree
- Disagree
- Strongly disagree

Comment:

### Section 9: Overall Rating of PEN

1. Have you recommended PEN to colleagues?

- Yes
- No

Comment:

2. Overall, how do you rate the PEN service as a practice guidance tool?

- Excellent
- Very good
- Average
- Fair
- Poor

Comment:

3. Is there anything that would make PEN more useful to you as a knowledge translation tool?

- No
- Yes (Please specify in the comment box below).

Comment:

#### Section 10: Communication about PEN updates

1. What is your preferred method to receive updates about PEN?

- By email updates sent to all PEN subscribers
- By electronic newsletter such as the DC “Members in Action”
- Through the “What’s New” section on the PEN website
- Other (Please specify in the comment box below).

Comment:

2. How often would you prefer to receive updates about PEN?

- Weekly
- Monthly
- Quarterly
- As new information becomes available
- Other (Please specify in the comment box below).

Comment:

#### Section 11: Demographic information

1. Please indicate the DC region in which you are located:

- BC Region
- Alberta/Territories Region
- Saskatchewan/Manitoba/NW Ontario Region
- Central/Southern Ontario Region
- Quebec/North Eastern/Eastern Ontario Region
- Atlantic Region
- Don’t know



2. Age

- Under 25 years
- 25-34 years
- 35-44 years
- 45-54 years
- 55-64 years
- 65 years and over

3. Highest Level of Education Attained

- Some university
- Bachelor's degree
- Working on master's degree
- Master's degree
- Working on doctoral degree
- Doctoral degree
- Other (Please specify in the comment box below).

Comment:

4. Employment

a) Work Status

- Full time
- Part time
- Casual
- On leave
- Unemployed
- Retired
- Student

b) Employment setting. Please choose the most appropriate category.

- Clinical
- Community (i.e., schools, fitness centres, grocery stores)
- Administrative
- Public Health
- Food Service/Hospitality
- Private Practice
- Research/Academic
- Internship Practicum

- Not working in dietetics
- Not applicable
- Other (Please specify in the comment box below).

Comment:

5. Years in Practice

- Fewer than 2 years
- 2-5 years
- Between 5 and 10 years
- More than 10 years

6. How would you rate your computer skills?

- Beginner
- Intermediate
- Advanced

**SUBMIT**

Your survey response has been received. Thank you for sharing your time and insights.

## **Appendix B**

### Links Between Survey Tool Questions and Theoretical Frameworks (51)

<b>Survey Tool Section</b>	<b>Model 1 — Based on Rogers' Diffusion of Innovations Theory</b>	<b>Model 2 — Based on the Pathman Theory of Adult Learning</b>
Section 1: PEN Subscriber	Trialability (Q6)	Awareness (Q5, Q6) Barriers (Q3) Facilitators (Q6)
Section 2: Ease of Access	Relative advantage Complexity	Adoption Barriers (Q1)
Section 3: PEN Search Strategies and Tools	Relative advantage	Adoption
Section 4: General PEN	Relative advantage (Q3) Compatibility	Agreement Adoption (Q5)
Section 5: Participation in Developing PEN Content	Relative advantage	Awareness Agreement Adoption
Section 6: Use of Tools/Resources	Relative advantage Compatibility	Agreement Adoption Barriers (Q2 & Q3)
Section 7: Quality of Content	Relative advantage Compatibility	Agreement Adoption
Section 8: Importance of PEN and Impact on Practice	Relative advantage Compatibility	Agreement Adoption Adherence Barriers (Q6)
Section 9: Overall Rating of PEN	Compatibility	Agreement
Section 10: Communication about PEN	Observability	Awareness
Section 11: Demographic Information	--	Adoption (Q2, Q3 & Q5) Barriers Q6

## Appendix C

## PEN EVALUATION FRAMEWORK LOGIC MODEL Abbreviated

OUTCOMES		INDICATORS	SURVEY QUESTIONS
<b>Knowledge Transfer — Short Term</b>			
Short Term	Subscribers use PEN to meet their information needs	Demographic information on users. Who uses PEN.	Section 1, Q4 Are you a member of DC? a) If no, please tell us your profession.  Section 11, Q 2-6 Demographic information: region, age, education, work status, employment setting, years in practice, computer skills
		Frequency of use (How often do users access PEN?)	Section 1, Q7 How often do you use PEN?
		Reasons for use (clients, professional development, research, curriculum development, students)	Section 4, Q1 What are your reasons for using PEN?
Short Term	PEN is a source of valid and applicable evidence-based dietetic information	Quality of content	i) Section 7, Q1-4 I usually receive a satisfactory answer to the practice question that I have. The knowledge pathways typically provide sufficient detail to guide practice. The information is typically up to date. Overall, I am confident in the quality of the information PEN provides. *Comments for all 4 questions

OUTCOMES		INDICATORS	SURVEY QUESTIONS
Short Term	PEN is a source of valid and applicable evidence-based dietetic information	Availability and use of practical tools/resources for clients	Section 6, Q1-3 How often do you share the tools/resources included in PEN with clients/colleagues/other health professionals? Is there anything that limits your use of the PEN tools/resources for your clients? If yes, what limits your use of the PEN tools/resources for your clients? What kind of tools would you like to see included in PEN that are currently missing? *Comments
<b>Knowledge Transfer — Change in Practice</b> <i>“Intended users implement knowledge”</i>			
Short Term	Individual practitioners base aspects of their practice on the evidence from PEN.	Percentage of practice based on PEN (target is 30% of practice is based on PEN)	Section 4, Q 2-3 When faced with a practice question, how likely are you to use PEN? How often do you need to consult a source other than PEN to answer your practice questions/make a practice decision? ii) Section 8, Q1 What sources of practice information do you regularly use? Please check all that apply.
		Percentage increases over time	The above compared to one year ago.
		Increased pride in the quality of PEN (increased recognition of	Section 8, Q 2-4,7 PEN is a valuable tool for my practice.

OUTCOMES		INDICATORS	SURVEY QUESTIONS
		the benefits/usefulness of PEN, which included positive impact on practice and enhanced credibility of the profession)	<p>PEN has positively influenced the way I work.  PEN enables me to take an evidence-based approach to my practice.  PEN has led to positive health benefits for my clients.  By promoting-evidence-based practice, PEN can enhance dietitians' credibility with other health professionals.</p> <p>Section 9, Q1-3  Have you recommended PEN to colleagues?  Overall, how do you rate the PEN service as a practice guidance tool?  Is there anything that would make PEN more useful to you as a knowledge translation tool?</p>
<b>Technology</b>			
Short Term	Technology supports optimal use of PEN.	Ease of access (speed, navigation, finding needed information, ease of printing, competency of linkages)	<p>Section 2, Q1-3  Do you have exclusive use of a computer?  Is the PEN site designed to make it easy to find what you are looking for?  How often do you encounter a broken hyperlink?  Do you print information from the website?  If yes, how often do you encounter any of the following printing difficulties? a) will not print at all, b) will print, but the text is out of alignment</p>



OUTCOMES		INDICATORS	SURVEY QUESTIONS
			ii) Section 3, Q 1-2 How often do you use this search option (key word, advanced, table of contents, practice category)? Do you find this search option to be effective? Are the search results organized in such a way that you are able to find the information in a reasonable amount of time? Are you usually able to find the information you want by using only one search option?
Short Term	Technology supports optimal use of PEN.	Responsiveness and interactivity (user's ability to shape content and timely updating of existing information and addition of new topics)	Section 5, Q1-3 Have you submitted any practice questions to PEN? Have you been a reviewer for PEN content? Did you have sufficient guidance in this role? Have you authored any content for PEN? Did you have sufficient guidance in this role?  Section 7, Q3 The information is typically up to date. *Comments

**Appendix D—ethics approval**

## Appendix E

## Email invitation to complete PEN Evaluation Questionnaire

Let's hear your voice – help to evaluate Practice-based Evidence in Nutrition [PEN]

Dear Members:

Under the leadership of Lynda Corby and Jayne Thirsk, Dietitians of Canada is conducting a research study in partnership with Dr. Daphne Lordly, an Assistant Professor in the Department of Applied Human Nutrition at Mount Saint Vincent University (MSVU); Dr. Theresa Glanville, Professor, Department of Applied Human Nutrition (MSVU); and Connie Martin, Masters Student at MSVU.

This research team is inviting you to participate in our study, *Evaluation of an on-line evidence-based knowledge translation/transfer service for dietetic practice*. This project is being funded by the Canadian Council on Learning. The purpose of the study is to evaluate Dietitians of Canada's Practice-based Evidence in Nutrition (PEN) to determine its effectiveness as a decision support tool for the dietetic profession. We are inviting both subscribers and non subscribers to participate in this study.

This study involves participation in a short online questionnaire. The questionnaire will take approximately 10-15 minutes to complete for PEN subscribers and about 5 minutes for non subscribers. All responses will be anonymous and kept confidential. It would be appreciated if you can complete the survey within the next 7 days.

A benefit of your participation in this study is the opportunity to play a role in facilitating further development of the PEN service. Your participation is completely voluntary. You may withdraw from completing the questionnaire at any time without penalty.

No personal information is being collected and at no time will the researcher be able to link responses with individual email addresses. After the study is completed, all e-mail addresses will be deleted and the survey will be closed. Your data will be numerically identified and only group results will be presented in future presentations or publications by the researcher. If you wish to receive information on the results of this study, please email [daphne.lordly@msvu.ca](mailto:daphne.lordly@msvu.ca)

If you have any questions about this study, please contact Daphne Lordly at 902-457-6259 or [daphne.lordly@msvu.ca](mailto:daphne.lordly@msvu.ca). This research activity has met the ethical standards of the University Research Ethics Board at Mount Saint Vincent University. If you have any questions or concerns about this study and wish to speak with someone who is not directly involved with this study, you may contact the University Research Ethics Board, by phone at 902-457-6350 or by e-mail at [research@msvu.ca](mailto:research@msvu.ca).

**By clicking on the link below, you are indicating that you fully understand the above information and agree to participate in this study.**

**Click the following link or paste it into the address bar of your internet browser to access the questionnaire. Once you click on the link you will be prompted to enter your DC Member ID# in order to access the survey.**

[http://survey.marketlinksolutions.com/frm\\_survey\\_view/PENSurvey2007/PENSurvey.asp](http://survey.marketlinksolutions.com/frm_survey_view/PENSurvey2007/PENSurvey.asp)

**Thank you in advance for your participation.**

## **Appendix F**

## All comments provided to the PEN Evaluation Questionnaire

### Section 1, Question 1a) Please indicate your reason for not subscribing to PEN. Other.

- I am just getting ready to re-new my membership
- I am planning to in the next budget
- I am not working in direct patient care
- I have had access for one year but I did not make use of it.
- See it as a valuable resource but never got round to sign up
- My practice does not involve counselling
- presently not working in dietetics
- Not currently in practice
- I have worked for a long time in LTC and find lots of the issues I have to deal with are around food preferences, menu, poor appetites. swallowing that you have to work with the client and staff involved rather than research a topic
- have never got around to checking it out
- I work very part time hours in community based program and did not feel that it would be good use for me to subscribe but will look into PEN in the new year
- I work casually, and would like to access PEN, but because of my work status, I am not eligible to have access
- To my knowledge, my current place of work does not subscribe to PEN
- Waiting for employer to pay for PEN. However, have used downloaded information from pen from manager.
- Unlikely my employer will cover the cost
- not enough income coming in yet and do not know how long I will remain a member of Dietitians of Canada
- Not currently practicing; entering medical school in January
- Although I think this is a valuable tool, I cannot afford it.
- I am unsure if the value gained through having access to PEN would be worth the cost
- I currently work in research and have been seeing the same pts for 5 yrs - not a lot of new questions come up from them in which I would need to look something up and the cost is not worth the benefit to me at this time. I plan on subscribing when my current position is over.

### Section 1, Question 1b) What sources of practice information do you use? Other.

- PEN
- Conferences
- handouts from exhibitors, mailings
- hard copies: Nutrition Action & University of California, Berkley Wellness Letter
- Attending conferences that are specific to the area i am working in.
- information sheets provided by various societies, manufacturers, etc.

### Section 1, Question 4a) Non DC member: Please tell us your profession.

- National Sales Manager Nutritional

Section 1, Question 5: How did you find out about PEN: Other comments.

- DC Interest Group RDFC
- Dietitian's of Canada Conference (Halifax 2006)
- I am part of the PEN team
- I learned that PEN was a way to do my CCP for the college
- Jayne Thirsk
- Jayne Thirsk - she gave a DC update and included PEN information
- participated in PEN creation
- provincial DC annual conference (session facilitated by Heather Alaverdy)
- Research Fair
- Through presentation from Judy Jenkins (DC Atlantic Canada)
- work discussions
- Wrote pathway for UBC class

Section 1, Questions 7a) Never uses PEN - why not?

- Access is not convenient as it is in another building
- doesn't occur to me to use it
- don't think to or too busy to take the time to search
- I have a new subscription, and have not yet used PEN.
- Lack of time. I had hoped to use it more often however I have not done so.
- Location of PEN is not convenient. (Individual dietitian's office)
- Not seen as most informative source

Section 3, Question 1a) Key word search frequency.

- I don't find this easy to use.....don't get where I want to quickly
- I don't find this produces good results.
- I have had many negative experiences with "search" options on different websites. To me, they are not helpful and do not lead me to the info I am looking for. I usually avoid them.
- I was lost as soon as a question was asked for and I had no idea how to form a good question.
- Like the new results format.
- none
- The searches have improved since recent changes but still don't always find what I am looking for.

Section 3, Question 1a) Key word search effectiveness.

- A much simpler format has to be used to allow a new user to access any info depends on what you are looking for
- hard to know if just spelled incorrectly etc or no info on site on the topic
- I don't always find exactly what I am looking for.
- I find it leads me to irrelevant info often
- I sometimes need to try more than 1 key word to find what I need.
- It improved since the last PEN updates
- It is mostly effective; occasionally I have to try other words.



- many diseases not covered in PEN material
- Much better than it was in terms of organization of search results.
- none
- not a lot of health topics to search for
- Search option is not always what I am looking for
- Sometimes the information is not in the PEN system.
- Sometimes the nutrition condition I'm searching for is not listed/available
- still a lot of topics not available
- There have been a number of times when the topic I'm looking for isn't included on the site yet.
- using keyword doesn't always take me to where I need to be
- Would be nice if it would do related words if the one you enter does not have any results.

Section 3, Question 1a) Key word search organization.

- Again, it's OK, but I think it could be improved to be easier/faster
- As the number of questions increase - there may be too many results to search by this method. At this time the number of results are usually manageable.
- Depends. The search results from just a key word can be too broad
- Especially to find client related teaching info when they are waiting for you
- except sometimes the topic isn't covered yet
- generally, but it is sometimes hard to find exactly what I'm looking for no matter how I search for it.
- Great
- greatly improved over past year,
- I find the clients handout parts quick but at times looking for other information quickly takes a bit of continued linking. There is more "filler" to sift through
- I wouldn't say the results are "disorganized", but I find I have to click through to each link before I find what I need, rather than it being evident from the list of results what I am looking for.
- I'd rather see the background info before specific Q&A
- It is difficult to get the information I require quickly
- need to search through all results
- occasionally, but overall I find the search bar un-useful
- often have to sift through a lot of stuff. Don't have time to keep narrowing search because I often have a patient in front of me.
- PLS HAVE THE INFO ALIGNED WITH THE MOST UPDATED FIRST.
- sometimes
- Sometimes want information more specific
- sometimes, but often not. I am not sure if the PEN is just missing a lot of pertinent data or if I am just not finding the topics on PEN
- sometimes, not easy to navigate, have tried and given up at times
- sometimes old info stays on site which can be confusing
- the whole process is very confusing. Ask someone who has limited skills to access the info and they will have a great struggle
- Usually a variety of topics will pop up and I feel I have to weed through them to find what I want.

- usually need to look at a lot of info. to find what is needed
- yes but, returns are not always relevant and time is wasted looking through irrelevant info

Section 3, Question 1b) Advanced search frequency.

- don't know what this is or how to use it
- I didn't realize it existed until now.
- I find I get the results I want with the key word search.
- I never have had to.
- none
- same as above
- see above
- some topics are not available
- would not begin to know how to use this. Saw the presentation but would not be able to complete this at present level of knowledge

Section 3, Question 1b) Advanced search effectiveness.

- Either narrows search too much or not enough
- If my search topic is so specific that I need to use the advanced feature, I usually cannot find info on that specific topic
- It can be hard to get many results on PEN if you put too many criteria in, so I usually have to use the key word search
- none
- sometimes the information is just not there...then I "send a question" and wait months for an answer...come to think of it...I have never recieved an answer to a question I sent last spring.
- Try finding Breast Cancer and Flaxseed
- Use it rarely.
- usually gets too complicated for what I am looking for. Also time limits my using the info

Section 3, Question 1b) Advanced search organization.

- ADA seems to provide more information
- However, it does not always meet my specific needs (but is a common problem with search tools)
- most times
- never had a problem
- only if information is actually there
- sometimes
- sometimes works but not always
- Unless the nutrition pathway is not developed. Sometimes it is difficult to find specific information.
- Usually I need to spend quiet sometime to find some information
- Well again hit or miss depending on what I'm looking for

Section 3, Question 1c) Table of Contents search frequency.

- I actually find it most effective to search this way by browsing the categories, and clicking to check if my question is answered this way... but it takes longer!
- I am never quite sure where to search - I usually just enter everything at the top (advanced search). Advanced search and key word search could be explained a little better. I had forgotten about using the table of contents as well, so thanks for mentioning it. I now will click on this area too (I don't usually scroll down when I'm searching)
- I find this to be the way that helps keep me oriented within the system
- I was unable to use this in the year I had the PEN access. An online users training is needed since my colleague was able to use site this way
- When I'm not looking for a specific question but looking to see what is available on a topic.

Section 3, Question 1c) Table of Contents search effectiveness.

- don't use it as often
- Easier to look through the table of contents since all the topics are laid out for you.
- Provides opportunity to see what other pathways are available.
- when the keyword search does not work

Section 3, Question 1c) Table of Contents search organization.

- I find i am always going back and forth on the site topic to find what I need
- I find it takes me a long time to find the info I am looking for so hence I tend not to use the tool as often as I perhaps should be
- I now have an ADA membership just for the evidence based component!!!!!!!!!!!!!!!!!!!!
- I would rather have stated sometimes...my brain does not always see the logic in the way this is formatted!
- if I am looking for something very general it works well.
- see above... clicking and browsing takes longer, but usually I end up finding what I'm looking for this way.
- sometimes
- The ADA website seems to provide more specific info eg. tube feeding calculations
- The organization of this format is better than the other methods but still could use some work.
- There needs to be an occasionally option here!

Section 3, Question 1d) Practice category search frequency.

- Again, the ADA site provides more information
- Categories are too broad
- Didn't realize it existed
- Don't think I realized it was an option, would it help if you are searching by key word??
- haven't paid attention to the Practice Category - shall revisit the site

- I also use this when the keyword search does not work
- I use this method the most.
- I use this the most often to try to narrow down to seniors
- Less frequently than other methods
- The different methods of searching need to be highlighted/explained a little better. As I mentioned earlier, I just usually enter everything at the top (under advanced search).
- use this mostly
- Would like more info related to food service issues and management

Section 3, Question 1d) Practice category search effectiveness.

- More info is available now, but for the price we pay, the ADA is more cost effective

Section 3, Question 1d) Practice Category search organization.

- Depends on topic
- Information is very general
- Most of the time
- only use this if I know there is a specific general category I'm looking for
- Sometimes
- sometimes there are no results
- Things I am looking for are not always available in database
- Too many results
- Try finding info on fluid requirements during cancer treatment

Section 3, Question 2: Are you usually able to find the information you want by using only one search option?

- Only sometimes
- Again, my infrequency of use has resulted in infrequently encountered problems
- But I find that a lot of the time, the answer to my search is that no information is available, e.g. MAOI diet.
- But sometimes the information is not in the PEN system
- But takes a lot of clicking to get to what you are looking for
- I may be able to when I complete the intro course. At this point it is still a mystery
- I often find I have to "fiddle around" to find what I'm looking for.
- I usually give up without trying other options - not sure how to use advanced search
- I usually have to do a combination of searches.
- I usually have to search around, partially as I don't use it very often so am out of practise, and partially as i work in LTC and lots of answers aren't there yet
- if I am looking for general information, then YES, but if it is very specific, then I usually need to use >1 search option to find the information I am looking for.
- if the category is covered by PEN, often I find Google much more efficient
- occasional troubles still though
- one search option is all I need especially when PEN doesn't have any information

- PEN is not able to identify some important handouts I use e.g. Toronto Public Health resources
- see above
- sometimes
- Sometimes the info needs to be searched on several options
- sometimes there is nothing conclusive
- somewhat
- The practice guidelines and Related Tools and Resources allow me to access more detailed information.
- This is often because there is more than one simple answer for the question and supporting information still needs to be researched.
- Unless the topic isn't covered on the site.
- Usually
- Usually try a couple just to ensure I have found all the information I am looking for

Section 4, Question 1: What are your reasons for using PEN? Other

- any time there is a question that I am not sure of the answer or want to be sure I am up-to-date on my knowledge
- evidence-based information for decision making
- I love the client handouts.... would love to see more to come.
- If the manual is unavailable there is not much choice in terms of keeping up with the latest resource
- Information for teaching patients
- To complete assignments
- To create CPEN resources (at Dial-A-Dietitian)
- To research best practice for my long term care clients , families and nurses
- To see if I can become faster at using PEN
- to update our internal Diet Manual for public health personnel
- updating current resources
- when writing therapeutic diets ie this should replace our old diet manual

Section 4, Question 2: When faced with a practice decision, how likely are you to use PEN?

- Ability to do this has dramatically increased since PEN was first launched.
- Am just getting to realize the value of PEN and will be using more frequently.
- But would network with public health colleagues working in the area to get additional information and confirm the PEN recommendations as occasionally i have heard colleagues express concern with the accuracy/appropriateness of PEN recommendations.
- depends on familiarity of topic
- have not found very much info when i try, so have to use other sources, too bad-would like to only have to go here
- Have only had access for a few months, so need to remember it is a tool available to me.
- however, I'm getting discouraged b/c I often don't find what I'm looking for
- I am using PEN as an option more recently than I did when I first joined
- I can't access info well enough to be timely
- I trust PEN as an accurate and up to date resource. As I am the sole dietitian in my organization, it is a welcome tool.
- I trust that PEN is the most up to date information.

- I trust the results I find, so I always use it when I have a practice question that I can't answer on my own
- I usually will check there first to see if topic is included, if not, then I will search elsewhere.
- I will always use PEN as my first resource, however 50% of the time I cannot find the answer or related information.
- I will often try this first because I am aware that this will likely hold the best information but I can't always find it.
- I work alone in rural settings or in private practice PEN is always available.
- If it was easier to find things I would use it more often
- In public health we follow Health Canada guidelines PEN does not.
- It is the first source that I turn to for information
- Not enough relevant information on the site
- Often I don't find the answer though...there should be a way of submitting practice questions!
- Too much American content

Section 4. Question 3: How often do you need to consult a source other than PEN to answer practice questions?

- Although the answers to my practice questions may actually be in PEN, the frustrations with the search process is most likely the reason why I end up consulting other sources.
- depends on reason for using PEN. Will also use other resources for professional development.
- Either the pathway is not yet developed or I will look it up elsewhere as additional information
- I don't feel PEN is user friendly. I like materials that are easy to read so that it can also be used to give to clients and to date, I've never been able to use anything from PEN for clients.
- I find PEN great for common questions but it is somewhat lacking in clinical information for disease specific states such as pancreatitis, GI surgery etc.
- I may refer to the ADA Manual of Clinical Dietetics as well.
- I often use Up to Date as I work with a Physician and Nurse Practitioner - very medical based but often more specific
- I tend to use the white clinical manual
- I will sometimes use the patient hand-outs from the BC health files because I find the format better than the PEN hand-outs.
- if I cannot find the information I use the ADA's evidence library
- If the topic I'm looking for isn't in PEN yet.
- If you can find what you are looking for on PEN, the answer is usually thorough with up to date references
- In public health we follow Health Canada guidelines PEN does not.
- It is quick and easy if I want more I will look but not usually
- just to gather additional or supporting info
- Most of the time I find PEN doesn't have exactly what I am looking for so I need to look at other options.
- Not enough clinical topics are covered by PEN
- NRC, OPHA, Health Canada, Eat Right Ontario, ON Min of Health Promotion
- often look at references included in pathways

- PEN doesn't always have the most current information or rather an evidence level that does not meet my needs
- PEN is one of many tools. Should not rely on only one.
- PEN is still limited in the information that is available (especially in the renal area)
- PEN is with providing general info, but usually need to look elsewhere for specifics
- Range of topics on pen not broad enough yet
- Renal failure most notably
- THE INSTITUTE WHICH I WORKED FOR PROVIDE THE INFO
- there are many pathways missing still
- There are times that I cross-reference evidence in PEN with recommendations from Health Canada. When translating evidence to recommendations or positions for the general public, I generally rely heavily on Health Canada.
- usually when that info isn't yet available on PEN
- We shouldn't have to look elsewhere
- when I couldn't find it in the PEN website

Section 4, Question 4: How often do you link through to read the references?

- But - this relates to my previous comments about not having a tree diagram or a map to show you where you are in the system. I don't really like to click on these additional documents because then I get lost.
- depends how much time I have
- Depends what I am researching
- I find that links don't work at times.
- I look but don't spend a lot of time
- PEN is supposed to be a fast resource to reliable information and yes I believe the information is reliable it is not usually fast. Would rather see each area of interest have the key clinical practice guidelines present then go into the practice points.
- the links do change often so sometimes they don't work
- This is very frustrating, because the links are quite often to places where you have to purchase the info, or subscribe (usually \$ required)
- Unfortunately, the links to abstracts/articles don't always work or imply extra costs.

Section 4, Question 5: How often do you refer to the evidence grade?

- As above
- Gives me a little more ammunition to say this is well supported or not well supported
- I find this section VERY confusing. When I am looking for info, I want to know things quick and to the point. Should I recommend a supplement or not. When evidence is graded it can be extremely unclear. What I am hoping in the future is that the layout of evidence graded will be separated: 1 section that is clearly labelled for recommendations and another section for info to not be recommended.
- I would prefer to have a way to email directly which I thought we could when started - now I copy and paste info into an email message
- Makes this superior to traditional diet manuals.
- This is essential to understanding the strength of the evidence.
- This is very helpful.

- Wish PEN and all other health professional information services used the same evidence grading process & criteria

Section 4, Question 6: How often do you link through and read the information about knowledge pathway contributor?

- I check this only if the info leaves me wondering
- I check to see if I know them and if it looks credible
- I didn't know this was available.
- I think the best feature about PEN is the links to the research articles and abstracts, as well as the evidence grade. I find this very very useful
- it's great idea to give credit to contributors
- knowing it was written and reviewed by dietitians is all I need to know
- The ADA still seems to provide superior resources. Our PEN is a great resource, but we still have a way to go for the price that we pay.

Section 5, Question 1: Have you submitted any practice questions to PEN?

- at the very beginning
- can't remember what it was
- I asked 2, I received an answer to one...but the other I've not recieved an answer
- I received a prompt and satisfactory reply.
- I tried to get info on dysphagia positioning for feeding, tilt in space wheelchairs and was unsuccessful
- I've submitted several questions, only about one in three have been answered, likely there's a back log now

Section 5, Question 2: Have you been a reviewer for PEN content?

No comments

Section 5, Question 3: Have you authored PEN content?

No comments

Section 6, Question 1: How often do you share the tools/resources?

- I didn't think we we're allowed to share with others unless they have membership???
- I find it often difficult to find the basic tools. You need to search the topic to find them.
- I use the cholesterol & triglyceride hand outs
- I was unsure that this info could be shared with colleagues.
- I work very part time
- If it can be shared I will
- It helps when you are in a "heated debate" I use it to prove my points!!
- need to use Canadian info first - example: Canadian Cancer Society before American Cancer Society
- share the responses from eat right ON which is based on PEN content or share the specific recommendation found on PEN as part of the group discussion about a particular issue.



Section 6, Question 2a) Limits to the use of PEN tools/resources - yes. What limits your use of the PEN tools/resources for your clients?

- Difficulty in using the site for info need more computer skill and icon use than I have
- do not include pictures, prefer to have links to other printed material with language other than English
- I deal with a lot of First Nations clients who have different food sources and variable levels of literacy in English
- I deal with the geriatric clients and they need something very simple and large print
- I wish the resources were more basic! Less information, more pictures!
- I work in a bilingual facility, there is less available for French resources compared to Eng.
- I work with geriatric population and not as much information there for this group
- In my case language
- Information too general. Not enough room for RD written comments. Some tools more for prevention then for clinical practice.
- It is rare that I need a copy of one of the PEN resources, but when I want one, I find them difficult to locate.
- layout is not always visually appealing
- less material in French
- limited to approved resources by employer
- Many of my clients are looking for material that is "holistic and alternative" in language and content and may not be accepting of what looks like a "conventional" resource.
- Materials are sometimes US based or have a lot of logos/branding from other health regions; I would prefer to use more generic/DC branded/Canadian materials; also some of the handouts are out of date (i.e. not updated to new food guide)
- Must follow Health Canada guidelines.
- no access outside of work
- not enough clinical topics
- Not enough white space, too much print esp. from the D of C resources. Need more culture appropriate materials.
- not translated to French
- Often the client handouts are becoming 3 or 4 pages and if I can find something on 1 or 2 I am more likely to use that if the information is there. I find the PEN handouts waste alot of space and paper
- Required to use specific resources in my health region
- Some of the material has been developed by other sources with reference to their website of other provincial "dial a dietitian" numbers which can be confusing for my clients. Would like materials to have a standard "stamp of approval" with Pen logo for consistency
- sometimes have limited computer assess
- Sometimes no French doc.
- sometimes the info is too detailed for some patients
- sometimes the links to the resources do not work
- They are very clinically focused....I work in public health so I like more general materials. Something more basic about healthy heart that just explains the terms (eg. LDL, HDL, and the dif dietary fats etc) and then makes reference to CFG.

- The hand-outs are too busy because of all the logos on both the top and bottom of the page. I also find the list of "steps you can take" too long. I prefer when the information is broken down more. For example, the hand out on Heart Healthy Eating: Cholesterol has a long list of "steps you can take". I prefer if the steps are broken down into categories such as "Choose low fat dairy", "Eat more whole grains" etc and that each category is followed by some specific tips.
- The materials are SOMETIMES not at an appropriate reading level.
- The resources are not easy to read - example high calorie high protein info
- time to actually sit down and use PEN
- unsure if able to handout resources not approved for use in the health region
- we must use our hospital endorsed pamphlets/resources first but if not available, can give DC PEN resources
- Wonderful handouts, some of the items are at too high of a level for all clients such as the cholesterol one

Section 6, Question 3: What kind of tools would you like to see included in PEN that are currently missing?

- all of the above, especially materials on food service
- In fairness, I use PEN very seldom so it may provide better information then I realize but I have not found it useful on a regular basis. I think it would be valuable for professional development but currently I find it hard to use to meet day-to-day needs.
- Lower literacy tools are often not available. this would be a real service.
- One thing that would be helpful is to know how to reference statements that are made in PEN. The evidence-based statements can be helpful for informing policy development but I don't know how to reference these statements.
- Sometimes I need material on cholesterol for those who can not read or write. Yes these people do exist and they are born in Canada.
- Would like to see PEN continually expanding/ updating.

Section 7, Question 1: I usually receive a satisfactory answer to the practice questions that I have.

- A fair amount of the time my question is not answered at all on PEN
- Content is still limited on PEN but improving all the time
- I received a response, but my question was never addressed.
- If the info is there, it is satisfactory. But often it is not.
- If there is a pathway on the issue
- If there is information on a topic it is satisfactory, but I often find no information on my questions.
- Often can't find a specific answer to my questions
- Sometimes information is not available on the topic I am searching
- sometimes paediatric applications are not included
- Sometimes the answer is satisfactory, sometimes it isn't , especially if there is no answer
- Sometimes the answers seem very technical and I have trouble "understanding" or assimilating the knowledge
- When I go to PEN I can usually get at least part of the answer there. Don't usually rely on it alone.

Section 7, Question 2: The knowledge pathways typically provide sufficient detail to guide practice.

- Although, often I find that there is "not enough evidence to support...." one way or another
- As I don't rely on it totally, I'm not sure what the answer is here.
- Could provide more detail, more thorough assessment of evidence
- Depends which pathway I need to consult. Some are still in development.
- Sometimes there is too much detail; it can be hard to find the answer to the question amid all the explanation!
- The guidelines often need to be 'translated' to consumer friendly terms.
- The pathway is good, if you find it, but a mix of the old nutrition manuals and the knowledge pathways would be nice
- Topic may not be covered

Section 7, Question 3: The information is typically up to date.

- I think so, but do not use it often enough to evaluate this.
- If the info is there
- Sometimes it isn't clear when the information is updated
- This is why information shouldn't be printed off.
- topic may not be covered

Section 7, Question 4: Overall, I am confident in the quality of the information PEN provides.

- Great reliable resource.
- I trust the info but sometimes I feel it is noncommittal - does not take a stand one way or the other. Presents the facts then it is rated perhaps this means more research is needed and could be a source of required research areas.
- just wish there was more things that i could use
- More peer evaluation needed to ensure pathways are not biased in anyway. Should be reviewed as a journal would be reviewed. Comments should be anonymous.
- On the completed pathways
- Some pathways are stronger than others.
- the content is great it is the organization of the information I find frustrating although it has improved with recent changes.
- The quality is there, but again the spectrum of topics is very limited
- would love to see more extensive topics covered, and more clear practical nutrition practice points.

Section 8, Question1: What sources of practice information do you regularly use? Other

- DC handouts
- ADA evidence reference library and clinical manual
- ADA website

- Contact other dietitians
- Eat right Ontario
- Eat Right Ontario, Health Canada, On Min of Health Promotion, CDO, OPDQ
- hospital website health library
- journals/ newsletters that I subscribe to
- Materials/resources from health unit
- media
- Nutrition surveillance data (CCHS, etc.)
- Online courses such as those offered by DC or APSEN
- private dietitian websites e.g. RD411; government websites e.g. Health Canada; public/professional newsletters e.g Berkeley WellnessLetter; quackwatch and snope.com
- Provincial nutrition resources
- Pub Med is available through only two RDs at work so timely reply is not available.

Section 8, Question 2: PEN is a valuable tool for my practice. Comment.

- Client handouts are great
- Hard copy diet manual would be more helpful in my work due to computer accessibility, time constraints, use by food service supervisor as nursing home facility may not have purchased PEN
- I love the idea of PEN, I think if made more simple and user friendly with clear concise practice points it would be very valuable
- I think it has great potential
- Need more topics covered
- Needs some work to make it easier to find the info - then it will be a much more valuable tool.
- with a better variety of choices in place
- Would be more valuable if it addressed more topics related to my work; at the very least it should include all the topics that were in the ADA/DC Manual of Clinical Dietetics

Section 8, Question 3: PEN has positively influenced the way I work. Comments.

- In general, the evidence I have found in PEN has provided newer/stronger evidence for what I am doing.
- Saved a lot of time on researching topics of interest to my clients/ myself. Now that I work with it, I wouldn't want to be without it.

Section 8, Question 4: PEN enables me to take an evidence-based approach to my practice. Comments.

- especially for dietitians in remote areas, where continuing education is not always specific to dietetics
- I have always used evidence based practice
- It adds to that ability but is not the sole enabling factor. It has a lot of potential to become a much bigger factor.

- just that sometimes the topic I am searching for isn't available/completed yet
- My practice has always been evidence-based, I hope!
- Not all clients are persuaded by evidence-based information
- There is not enough PEN topics related to evidence-based public health practice.

Section 8, Question 5: In my opinion PEN has led to positive health benefits for my clients.

Comments.

- Again I compare to the Diet Manual to PEN - not every topic is available on PEN yet I need up-to-date information.
- although I don't work directly with clients
- Because I don't use it enough
- Enables them and me to be more informed
- I don't see clients
- I would have to do a study to give you an evidence based answer
- I'm able to get up to date, current material to discuss with them/ link in with handout material for them etc.
- It could have health benefits, if I was able to find answers to my questions.
- This cannot be answered by use of PEN alone. Health benefits in my setting of counselling have to do with willingness to change on the clients behalf, regardless of what the "evidence" is.
- When I have found the material I am looking for, PEN has been great.

Section 8, Question 6: I usually have sufficient time at my work setting to spend using PEN.

Comments

- Depends on a day.
- Does anyone, with current workload demands?
- I like PEN because it doesn't take long to access useful information.
- I make time for what I need to do but I don't browse other things
- I often write down things I want to look up more and do this at home when I have more time.
- I use my home computer and bring things to the office.
- if PEN could be more user friendly and the information found more readily
- it depends upon how long it takes me to actually find the info I am looking for
- Much of my research time is at home due to time constraints
- Other sources mentioned above are much faster to access and use
- PEN is wonderful, so I make the time and it saves time in the long run.
- Usually I'm too busy with my workload and the material I needed is urgently needed and I would not have time to use PEN. Is there a more friendly way to cut down the time to find the material? e.g. faster log in method?

Section 8, Question 7: By promoting evidence-based practice, PEN can enhance dietitians' credibility. Comments.

- and makes RD messages more consistent!

- Ensure quality of evidence is high to achieve this goal.
- I see patients in a doctor's office and I show the doc the PEN website. He was so impressed and wished he had something like it from his organization!
- if organized differently yes, I agree
- In my experience, especially with nurses, many health professionals don't care about the evidence and tend to go with "this is what I heard on TV" or "this is the way we always do it"
- PEN COULD enhance RD's credibility if more info was available

Section 9, Question 1: Have you recommended PEN to colleagues? Comments.

- All my colleagues have access already
- Always!
- because of search difficulties - not because of any lack of confidence in the material contained.
- Currently all my colleagues get PEN
- Encourage all students to have it and they must participate in the orientation
- I am the only RD working in nursing home
- I don't work with other dietitians
- I'm only RD
- Many times
- My colleagues often discuss it and some are more positive than me; my overall experience with PEN has been frustration
- Only because there hasn't been an opportunity.
- They all have access.

Section 9, Question 2: Overall, how do you rate the PEN service as a practice guidance tool? Comments.

- Are there ways to further incorporate and apply information from the evidence based/informed course offered by DC? For eg. I'm guessing all questions are formulated using the pico method. What is the weight of the evidence - are there ways to evaluate Good when topics covered
- I am hopeful that it will be great as the "search engines" are improved
- I anticipate that it will only get better as it grows and more information is available.
- I feel that I haven't really used PEN enough but hope to use it more to see what is available.
- I look forward to it's continued expansion.
- I think the search process has to be simplified with less steps to accessing the info
- If I need answers to something I go there to check first and then other places if I need to.
- In our department we strongly recommend it
- My answer is average because I have limited time to use it
- To me it is not enough as there are lots of topics not there as yet. I have always worked based on the best references and evidence I can find.

Section 9, Question 3: Is there anything that would make PEN more useful to you as a knowledge translation tool? Comments.

- making the site more easy to navigate; providing more consumer resources

- Free access to PEN for all dietetic interns and for one year after graduation. 2) Is PEN subscription tax-deductible for agency or individuals? 3) Will the Allied Health Professional Fund in Ontario reimburse individual subscriptions? 4) Would DC sell
- 1) More health topics. 2) Include information from Manual of Clinical Dietetics (esp. energy requirements, protein requirements...etc) 3) Evidence on the latest "super magic food" that people are using
- a wider breadth of information and information displayed in a way that allows quick review (rather than paragraph form)
- again - great to have it online if it meets needs, especially in the are of guidelines and handouts
- Again more health promotion and public health resources.
- An evidence based review of more alternative viewpoints such as "acid-alkaline diets" and detailed nutrition information handouts on specific foods of consumer interest, such as acai berries
- As an intern, I would like to have access to PEN from my home computer, not just the computers at the hospital.
- as comment above
- as previously indicated, more nutrition care maps
- As time goes on and more issues are added, that will be helpful. A "current issues" section for hot topics would be great. Perhaps you have this already - I haven't been there in awhile as I find it hard to get to PEN!
- better key word searches
- Better table of Contents example: CANCER - Breast cancer - topics
- continual increase in number of pathways.
- Continue to become more comprehensive as a database. Fix technical problems (e.g. unable to access Diverticular Disease tool)
- continue to build it and grow in content
- CONTINUED ADDITION OF TOPICS/PATHWAYS
- Continued improvements to how the website functions.
- Easier log in the system, e.g. one touch method?
- Easier to navigate
- e-mails of PEN updates sent through DC
- Ensure Health Canada guidelines are included. Ensure PEN pathways are thoroughly peer reviewed - anonymous procedure.
- Expand topics
- expand topics, provide more health promotion strategies evidence, more community-base focus
- expanded issues/questions
- Expanded topics and tools - just keep adding to it
- faster responses to practice questions asked!
- Have COMPLETE material for all diseases and conditions ex. GERD - recommendations to clients is not listed.
- Have it more affordable for individual purchase
- Having access to client hand-outs on specific topics
- Having more time to access it.

- I think PEN is a wonderful too. It would be nice, however, if there were more consumer/patient handouts and meal plans. I'm sure these resources will increase in the future though.
- I would like to receive updates thru email when the PEN website is updated (RSS feed)
- I would really appreciate the reinstatement of the conference call use of the program. I was unable to access much help by e-mail and the time of calling to talk to staff is when I am out working. I have to do the course at home since I work part-time
- include even more topics
- include more topics/disease specific handouts
- Including more detail and more clinical based questions.
- Including more pathways
- Instead of having to jump all over the place to find practice guidelines, it would be nice to have a section that has the clinical practice guidelines for any particular clinical area of practice-ie cancers, diabetes, arthritis, eating disorders, etc.
- Just expanding number of pathways, topic areas which I know is ongoing
- just having the time to become more familiar with it
- Just keep up the excellent work and grow the content and pathways
- just taking the time to develop more pathways, there is so much more to learn!
- Just to continue adding as much information as possible on as many nutrition-related topics as possible.
- Keep adding to the content. Improve layout / search functions
- keep expanding and addressing questions - often the question I have is not there and I need the answer tomorrow -so can't wait until it is addressed
- keep-on updating. I just can't imagine the number of RD hours in this great resource. RD from France are trying to set themselves the same way. DC has very forward thinking.
- larger, more detailed database of topics - I use ADA's on-line Nutrition Care Manual a lot because I can find what I am looking for in detail and quickly.
- linked with Toronto Public Health nutrition resources, and more workshop modules
- lower reading level resources and more on new food products coming out
- Make it more accessible (less expensive) to dietitians across Canada
- making PEN easier to use with fewer layers, increasing the content and developing more client handouts would make PEN more useful.
- menus, lower literacy teaching tools, other languages, nutritional assessment forms
- more client information handouts (more detailed, including menus)
- more clinically relevant topics. The majority of RD's work in clinical settings, yet this is not represented in the PEN pathways. there is a disproportionate amount of content on prevention/community
- More evidence based guidelines
- More frequent updating of practice questions as new research becomes available ie., probiotics
- more handouts, more disease states
- more health topics, easier search tools and better website layout...too confusing
- More information available to give to my clients and scientific info that would be condensed and easy to find.
- more information for the geriatric population and assessment tools
- More information on food composition
- More information on different health issues.



- more knowledge pathways, e.g. ileostomy, enteral feeding, specific cancers, amputations, wound care
- More knowledge pathways, so all areas of dietetic practice are represented.
- More LTC focus
- more nutrition support and acute care illness information/pathways
- more pathways. It's meant to replace the manual of clinical dietetics but PEN is not yet complete enough to accomplish that.
- More pathways...GI, surgical areas etc.
- more pathways/additional topics covered
- more paediatric topics
- More practice questions and client handouts
- more practice questions/answers
- More public health related information and pathways
- More relevance to public health.
- more topics
- More topics - I will make more of an effort to submit practice questions when suitable if I don't find the information included.
- more topics and links that actually take you to useful information
- more user friendly & practical
- more user friendly!!!!!!! handouts quickly available
- much more info on a broader range of topics
- my comments are already expressed throughout this survey
- need more clinical information on more topics
- Need more practice questions
- not sure
- often, I cannot find the information I am looking for and have to look elsewhere
- Once the renal section is up and running:)
- receive an alert by e mail when updates are done in the PEN pathways
- refer to previous comments on searchability
- See previous answers and comments. Also, when pathways are updated, having the topics and specific question and areas displayed larger on the front of the website.
- See previous comments
- Sets of basic graphics as educational tool (cholesterol pathways, Glucose/insulin cellular mechanisms, sodium/fat impact on arteries ...)
- Simply, to have more knowledge pathways and more practice questions answered. The information I currently seek and find in PEN is very useful and practical.
- since the new website it is somewhat more difficult to find the list of handouts available: pen handout collection.
- Some items listed previously, like menu plans
- Sometimes the information seems geared to more of an individual/clinical setting. It would be nice to also include some comment on areas where community dietitians are providing population health recommendations.
- Still find there are some practice questions I cannot find answers to.
- There are still many areas of practice not covered in PEN
- Time will expand the scope of information which will make it even more helpful
- To have a very obvious quick link to access the client handouts. I usually have to poke around to find them

- to have all the information from the Manual of Clinical Dietetics updated and available through PEN
- To have more detailed information / algorithms on background information, and more handouts for clients.
- translate the evidence into practical applications i.e. lists, handouts, tools etc
- Update and keep adding and updating. At present it is time consuming and has gaps, plus seems " higgly piggly "
- Why doesn't Dietitians of Canada include access to PEN as part of our yearly membership dues? If a great majority of dietitians come to rely on it, it would be beneficial to do so and would prevent members having to register to PEN separately
- wider range of topics including links to full research articles (i.e. not just the abstract)
- Would be nice if this program was covered by the Allied Health Professional Development Fund, since it does contribute to professional learning and activities. I would then be more inclined to renew membership annually.
- Yes, please just keep it simple, information simple, conclusions simple and how to use it simple. I like the additional pathways for when we want to dig deeper into the issue. However, most of the time in our "real" life and busy work we just need quick

Section 10, Question 1: What is your preferred method to receive updates about PEN? Comments.

- not sure. I guess an email PEN update b/c then I know that it is about PEN only. My DC mail gets a bit confusing as I get so much and I don't know what to keep/read/trash.
- regular mail, I am more likely to pay attention to than emails

Section 10, Question 2: How often would you prefer to receive updates about PEN? Comments

- as new info becomes available...but not more than once a week.
- I get enough emails and I use PEN enough to see what is new in the What's New Box.
- I would prefer that update are made available through the "What' New" section of the PEN website when I log into PEN.
- no preference, but I don't really want to be bombard with electronic emails/notices etc.
- When I visit the site. I don't need to know everything about dietetics all the time.

Section 11, Question 1: Please indicate the DC Region in which you are located: Comment

- currently working out of the country
- N/A
- ON

Section 11, Question 3: Highest Level of Education Attained: Comments

- Certificate in Gerontology
- Dietetic Internship
- Postgraduate diploma in community nutrition
- Working on dietetic internship

Section 11, Question 4 b) Employment Setting: Comment

- 1 have 2 part-time jobs - clinical and academic working with students
- 40% clinical dietetics and 60% Director of Food Services
- Business
- Business and Industry/Food company
- Call centre
- Call Centre: Dial-A-Dietitian
- Cancer centre - outreach Prevention program
- clinical educator
- Collaborative Health Clinic
- Community Health Centre
- Community, including outpatient counselling
- Consultant
- Family Health Team
- FHT
- First Nation community
- First Nations Health Centre
- Food industry
- food service/ and clinical
- Government
- Government/policy
- health charity
- Healthcare Industry
- industry
- Inpatient (Clinical) and Outpatient nutrition services
- LTC corporate role
- Natural Foods Grocery Chain
- nutrition communications
- Organizational management
- Pharmaceutical Company
- Pharmaceutical Industry
- Population Health
- Primary care (a combo of clinical and community)
- primary health
- RD for the First Nation Community
- Research -- some related to food & nutrition
- Research in academic and internship practicum 50-50