An Investigation of Clinician Acceptance of a Guideline Based Patient Registry System for Chronic Disease Management

By

Patricia Marie Fortin

MLS University of Toronto, 1981

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Abstract

Supervisor: Dr. Francis Lau
Co-Supervisor: Dr. Malcolm Maclure

Context: In 2002 federal funds, known as the Primary Care Health Transition Fund (PCHTF) were transferred to the provinces to experiment with different models of health services delivery in primary care. The Northern Health Authority used the fund to implement a Chronic Disease Management Community Collaborative using the Institute for Healthcare Improvement Breakthrough Series and the British Columbia (B.C.) Expanded Chronic Care Model. Included in the Chronic Care Model is an information systems component that enables a population-based approach using guidelines and data to plan, organize, monitor and deliver care for patients with chronic illnesses. In British Columbia a secure web based system, known as the Chronic Disease Management (CDM) Toolkit was developed by the Ministry of Health and made accessible to all physicians in the province to facilitate CDM by collaboratives and individual general practitioners (GPs). Technology acceptance is a mature concept in the information systems literature, and models of technology acceptance are important in health care with the increasing deployment of information systems to support clinical and management work processes. Understanding what variables influence clinicians to use appropriate technology could promote the diffusion of technology in health care. The Unified Theory of Acceptance and Use of Technology (UTAUT) is a recent (2003) model that consolidates eight models of technology acceptance that are prominent in the information systems literature

Objective: To determine what variables, according to the UTAUT, are influencing clinician acceptance of the CDM Toolkit in the Northern Health Authority, and to determine other issues and processes affecting CDM Toolkit acceptance.

Setting and Methods: Seven communities and approximately 60 clinicians were involved in the NHA Collaborative at the time of this research. The researcher provided training and support in the use of the CDM Toolkit. An action research methodology was used, including planning, intervention, observation and reflection. Field observations

were gathered during learning sessions and training interventions. After the training interventions, participants were invited to complete the UTAUT self-administered on-line questionnaire. Seventeen participants responded and of these, 11 completed telephone interviews.

Data Analysis: Associations between intention to use the Toolkit and potential determinants of acceptance were examined in the UTAUT questionnaires using SPSS. Interviews were coded and analyzed qualitatively using QRS NVIVO. Field observations were interpreted using a problem solving paradigm. The 3 methods were combined to specify propositions and lessons learned.

Results: The UTAUT analysis revealed that social influence, usefulness, and facilitating conditions are important variables for the acceptance of new technology. With some adaptations to fit the health care context, the UTAUT was found to be an effective tool to measure CDM Toolkit acceptance in the Northern Health Authority. The field observations highlighted salient issues not captured by the UTAUT, including security certificate implementation, access and confidentiality, physician participation, data entry, flow sheets, infrastructure and training.

Conclusion: Constructs from the UTAUT including social influence, performance expectancy, effort expectancy, self-efficacy and facilitating conditions were useful for understanding CDM Toolkit acceptance. Other variables such as physician participation, incentives, clinical knowledge, and process issues related to implementation were important for CDM Toolkit acceptance. Propositions regarding CDM Toolkit acceptance are generated from this research.

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Dedication

In loving memory of my Mother

IRENE BERGESON FORTIN

July 1920 – June 2005

Chapter 1: The Context

1.1 British Columbia Context: Primary Health Care Renewal

In the period 2002 to 2006, the federal government transferred 74 million dollars to the province of British Columbia (B.C.) to assist with primary health care renewal. Known as the Primary Care Health Transition Fund (PCHTF), the fund was largely divided in proportion to population among the 6 B.C. Health Authorities. Several health authorities, including the Northern Health Authority (NHA) in B.C. implemented chronic disease management (CDM) initiatives aimed at improving care of patients with diabetes, congestive heart failure and/or depression. A Ministry of Health (MOH) analysis had demonstrated the high prevalence of diabetes combined with variable and poorly coordinated care within the primary care system. The problem was highlighted in a report from the Diabetes Working Group:

> In British Columbia, diabetes is diagnosed in approximately 19,000 British Columbians every year. The incidence of diabetes in British Columbia continued to increase over the past decade, due to the increase in obesity and inactivity as well as the aging population. Diabetes was diagnosed in 175,000 British Columbians in 2000/01. (MOH, 2002) By 2010, the prevalence is expected to grow to 325,000 (7.1%) an increase of 90%. (Diabetes in British Columbia Synthesis Report, 2000) It is estimated that the prevalence today is closer to 4.9% of the BC population. (Diabetes Working Group, 2002, p.3)

The report goes on to estimate the cost of diabetes care in British Columbia:

> The cost of diabetes care in BC is staggering. For 2000/01, an estimated $761,400,000 was expended on hospital, physician, renal and pharmaceutical care and services. This is 16.6% of the overall health budget for only 4.9% of the population. (MOH, 2002)
> If the health care system does not manage the disease of diabetes appropriately and does not address their issues, then the frightening potential is for these figures, with their associated costs, to at least double by the year 2010. (Diabetes Working Group, 2002, p.3)

With its share of funding, the Northern Health Authority (NHA) funded a community collaborative focusing initially on the management of diabetes.

1.2 The IHI Quality Improvement Model

The Institute for Healthcare Improvement (IHI) developed the Breakthrough series to help realize improvements in quality while reducing costs. As stated in their Breakthrough Series Paper:

> The driving vision behind the Breakthrough Series is this: sound science exists on the basis of which the costs and outcomes of current health care practices can be greatly improved, but much of this science lies fallow and unused in daily work. There is a gap between what we know and what we do. (Institute for Healthcare Improvement, 2003, p. 1)

The Breakthrough Series advocates for a structure in which organizations can learn from each other and from recognized experts in specific areas of care needing improvement. The Breakthrough Series model is a short-term learning system that brings together teams from hospitals or clinics to seek improvement in a focused topic area. A key to the model is the combination of subject matter experts in specific clinical areas, with application experts who could select, test, and implement changes on the front lines of care.

The model requires an organizational commitment of 6-15 months, and alternates between learning sessions, where teams come together to learn about the chosen topic and plan changes, followed by action periods in which the participants test the changes in their particular organizations.

There have been over 50 quality improvement projects implemented in the U.S. and the model is being continuously refined (Institute for Healthcare Improvement, 2003, p. 1). The model has proven to be successful and has had an impact well beyond improvements in health care and it has received both patient and clinician acceptance and endorsement.

1.3 The Expanded Chronic Care Model

The burden of chronic diseases in British Columbia (B.C.) is high and accounts for almost half of the burden of disease in B.C. (B.C. Ministry of Health Planning, p. 8). To improve management of chronic diseases, the Improving Chronic Care Illness (ICIC) model was developed by a Robert Wood Johnson Foundation National Program (Improving Chronic Illness Care, 2005). The model is composed of six essential elements that have been identified to improve chronic care in the community: The Community, The Health System, Self-Management Support, Delivery System Design, Decision Support, and Clinical Information Systems. When imported to BC, the ICIC model was adapted to include a health promotion and disease prevention component as essential elements, and re-named the B.C. Expanded Chronic Care Model (Appendix A, Barr, 2003).

1.4 The Northern Health Authority Community Collaborative

The NHA's Community Collaborative (hereafter referred to as the Collaborative) adopted both the Expanded Chronic Care Model and the IHI Breakthrough Series Model with the aim of improving chronic disease management in diabetes and congestive heart failure, and depression co-occurring with these two diseases. At the time of this research however, the focus in the NHA was only on diabetes management.

The Collaborative is designed to help a wide range of clinicians in interdisciplinary community teams, to provide guideline-based CDM and prevention and to provide the opportunity for clinicians to collaborate on system redesign of their local primary health care sector. Participants in the Collaborative include physicians, nurses, dietitians, medical office assistants (MOAs), diabetes educators, mental health clinicians, and others.

Participants are located in physicians' offices, hospitals, health clinics, and native health centres in seven communities: Kitimat, Central Interior Native Health Society (Prince George), Quesnel, Southside, MacKenzie, Masset and Chetwynd. Each community had approximately 4-10 clinicians participating, with a total of approximately 60 people participating at the start of the Collaborative.

Although recruitment into the Collaborative began in January/February 2004, the Collaborative was formally launched at the end of April 2004 with "Learning Session 0". In the learning sessions, participants were introduced to the IHI QI model, as well as the B.C. Expanded Chronic Care Model and the CDM Toolkit. . Because of the seven communities are separated by hundreds of miles, learning session 0 was done in four locations.

1.5 The CDM Toolkit

An essential component of both the ICIC and the Expanded Chronic Care Model is an information system to assist with identification and follow-up of chronic disease patients. The intent is to collect data at the patient and population level to monitor progress in relation to performance targets. The Improving Chronic Illness Care website provides the following

purpose and rationale for an information system to assist with patient and population management of chronic diseases (Improving Chronic Illness Care, 2005)

- Provide timely reminders for providers and patients
- Identify relevant subpopulations for proactive care
- Facilitate individual patient care planning
- Share information with patients and providers to coordinate care
- Monitor performance of practice team and care system

To answer the need for an information system, the Ministry of Health expanded a prototype that was originally developed in the Vancouver Island Health Authority (VIHA) to support VIHA's CDM Collaborative. Known as the CDM Toolkit, this information system is a guideline-based patient registry that supports patient, population and practice tracking of diabetes, congestive heart failure, depression, and kidney disease. The system is available on the Internet and accessible to any physicians throughout B.C. who register. A full description of the CDM Toolkit can be reviewed in Appendix F.

1.6 Research Objective

Research on acceptance and use of technology is a mature field in the Information Systems (IS) literature, and a variety of psychological, cognitive, and other models have been developed to assist in determining what influences successful use of an information system. Throughout the current research project, I use Venkatesh et al.'s definition of Acceptance ***of technology*** which defines acceptance as embracing both a person's intention to use or actual usage of technology (Venkatesh, 2003, p. 427).

A variety of surveys, scales and questionnaires, often based on the models of user acceptance, has been developed to try to measure technology acceptance. One recent questionnaire that makes an attempt to integrate a number of theories and models of user acceptance is the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, 2003).

The UTAUT is a general tool based on eight prominent models in the user acceptance literature. Developers of the UTAUT have tested this model in six organizations and have found that it explains about 70% of the variance in technology acceptance.

In health care there is increasing impetus to implement information systems to support clinical and administrative needs, to reduce medical errors (Institute of Medicine, 2000) and to implement an electronic medical record (EMR). As a result, technology acceptance as it applies to health care may become increasingly important as implementers try to influence clinicians to use health care information systems.

The purpose of this research, therefore, is to understand what variables are influencing the acceptance of the CDM Toolkit in the NHA. In order to do this, I used an action research methodology that combined field observations gathered from experience with training clinicians to use the Toolkit, administration of the UTAUT, and interviews based on the UTAUT, in iterative cycles of planning, intervention, observation and reflection.

Chapter 2: The Measurement of Technology Acceptance in Health Care

2.1 Introduction

Technology acceptance is a core concept information systems (IS) literature. A search on the keywords "technology acceptance" yielded 20997 records in Compendex and Inspec.

Several social and psychological models of technology acceptance have emerged to predict and explain technology acceptance. Primary among these models is Rogers' Innovation Diffusion Theory (IDT) (Rogers, 1995), where acceptance at any given time resembles a normal distribution, and rates of acceptance are indicated by the steepness of the curve. Further, Rogers suggests that innovation is accepted based on beliefs related to relative advantage, compatibility, complexity, trialability and observability. Complementary to Rogers' theory are Davis' constructs of perceived usefulness and ease of use (Davis, 1989), derived from Fishbein & Ajzen's Theory of Reasoned Action (TRA) (Fishbein, Ajzen, 1975). These constructs have been found to be fundamental to technology acceptance across settings and time. The TRA is a theory of human behavior, the central constructs of which are: a) attitude toward behaviour, that is, the positive or negative affect that an individual has toward a behaviour, and b) subjective norm, the perception that people who are important think that a behaviour should or should not be performed. Some have used both models in system assessment. For instance constructs from IDT and TRA have been combined in Moore and Benbasat's instrument (Moore, Benbasat, 1991). TRA was extended to the Theory of Planned Behaviour (TPB) (Venkatesh, 2003) by adding the construct of perceived behavioural control, which is the perceived ease or difficulty of performing a behaviour.

A variety of scales and methods have been developed to measure technology acceptance. Davis et al's (Davis, 1989) Technology Acceptance Model (TAM) and its theoretical extension TAM2 (Venkatesh, 2000) are two of the most widely used models in the IS literature(Davis, Bagozzi, 1989). TAM has as its core constructs: a) perceived usefulness, the degree to which a system will enhance job performance, and b) perceived ease of us, the degree to which using a system is free of effort. TAM2 incorporates two additional constructs to include: c) cognitive factors that influence perceived usefulness, and d)

social influence processes that may affect acceptance. Once again, TAM and its extension TAM2 are based on TRA, and also TPB.

Other models that have gained some prominence in the user acceptance literature include Moore and Benbasat's Perceived Characteristics of Innovation (PCI) (Moore, Benbasat, 1991) scales which also combine Rogers' innovation theories and Davis' TAM. Other scales that have been used to assess acceptance specifically in the health care field include instruments developed by Teach and Shortliffe (Teach, Shortliffe, 1981), and its extension, Instrument to Measure Physicians' Use of, Knowledge about, and Attitudes toward Computers, developed by Cork, et al.(Cork, 1998). Dixon's Information Technology Adoption Model (ITAM) (Dixon, 1999) extends the TAM model and is a compilation of several theories of acceptance. The ITAM is focused on physician acceptance of technology in primary care and is intended to predict acceptance in the individual user, as well as refine evaluation and implementation strategies. Most of the models that have received rigorous testing have been found to explain up to 44% of variance in user intentions to adopt technology.

The Unified Theory of Acceptance and Use of Technology (UTAUT) proposed in 2003 by Venkatesh, Davis, et al. has been tested in six organizations and found to explain about 70% of the variance in user intentions to use information systems (Venkatesh, 2003),. The UTAUT attempts to integrate eight user acceptance models: TRA, TPB, TAM, TAM2, IDT, a motivational model, incorporating general motivational theory, Model of PC Utilization (MPCU), which incorporates job-fit, affect towards use, social factors and facilitating conditions, and finally, social cognitive theory which includes the core constructs of performance expectations, personal consequences of behaviour, self-efficacy, affect and anxiety. All of these models have intention to use or actual usage as the dependent variable

In the UTAUT model, four constructs have been derived from the various models, and determined to play a direct role in technology acceptance:

1. **Performance expectancy**: defined as the degree to which an individual believes that using the system will help to attain gain in job performance (Venkatesh et al p. 447).
2. **Effort expectancy:** defined as the degree of ease associated with the use of a system (Venkatesh et al p. 450).
3. **Social influence**: the degree to which one perceives that important others believe one should use the system (Venkatesh et al p.451).
4. **Facilitating conditions:** degree to which on believes that an organizational and technical infrastructure exists to support the system (Venkatesh et al p. 453).

As well, four key moderators of acceptance and usage are identified that influence the four constructs: age, gender, voluntarism, and experience. In addition, but not shown in this model, three other constructs: computer anxiety, computer self-efficacy and attitude towards computers were studied in the UTAUT. In a test of their model Venkatesh et al found these latter constructs to be fully moderated by performance and effort expectancy and thus not salient when performance and effort expectancy are included in the model.

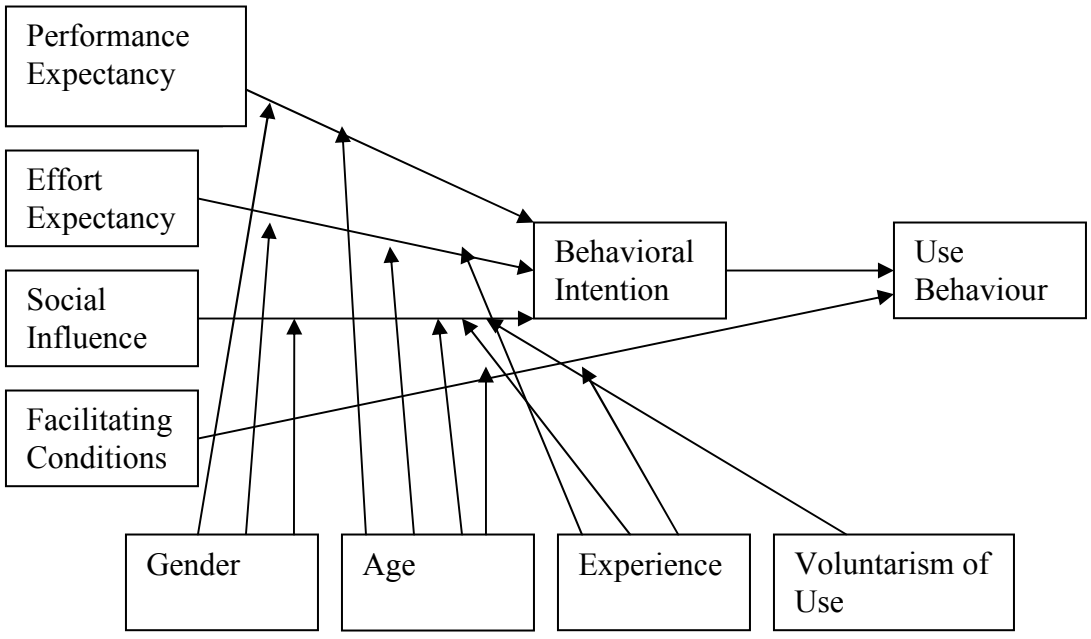


Figure 1: Venkatesh, et al Research Model (Venkatesh, 2003, p. 447)

2.2 Methods

To determine predictors or inhibitors of users' intention to use or actual usage of IS in health care, I reviewed health literature to find technology acceptance models that have been used to measure user acceptance of IS in health care. Searches were conducted using OVID databases and included EBM Reviews (Cochrane Database of Systematic Reviews, ACP Journal Club, Cochrane Central Register of Controlled Trials, and the Database of Abstracts of Reviews of Effects, 4th quarter 2004), Medline (1996 – Present (Jan 2005), and PsychINFO (1986 – Present (Jan 2005). Although the technology acceptance literature has a long history, this search sought to identify current uses of models, and thus concentrated on articles assessing technology acceptance from the mid-nineties to the present. It was assumed that the current literature is likely to incorporate seminal and older models of technology acceptance that have been discussed in the literature.

Descriptors and terms include: technology adoption (text word), technology acceptance (text word), technology transfer, models, data collection, health care surveys, questionnaires, psychometrics, attitude to computers, and information systems combined with the truncated terms: intent, adopt, accept. Over 200 citations were retrieved and these were narrowed to a set of 45 citations that could be relevant to this review.

Articles that focused on validating an instrument, and not acceptance of a specific system were excluded. Articles that discussed acceptance of or intent to use computers in general, and did not refer to specific types of systems were excluded. Articles that discussed theories of, or technology acceptance in general with no reference to a specific system, tools or methodology were excluded, as well as articles that focused on technology diffusion. Articles that discussed technology acceptance in an experimental situation, for patients or students, or focused on instructional technology were excluded. Finally, articles that focused on satisfaction with a system were also excluded. After reviewing the 45 articles a final set of 13 articles were determined to meet the inclusion criteria and focused on technology acceptance of an information system in health care.

2.3 Results

Table 1 provides a summary of the results of the articles selected for inclusion. These 13 articles investigate the acceptance of a variety of systems in health care with a focus primarily on physicians and nurses. One of the articles (Jayasuriya, 1998) focuses on technology acceptance in health administrators, and another (Hughes, 1999) focuses on use of an evidence system in physicians, nurses, and other allied health workers in a multidisciplinary system.

The articles examined acceptance of a variety of systems used in health care including: an EMR (Gadd, Penrod, 2001), a PAC (Boxwala, 1997), Telemedicine(Gagnon, 2003), nursing documentation system(Ammenwerth, 2003), point of care guideline system (Gadd, 1998), ICU bedside monitoring (Dillon, 1998), office automation technologies(Jayasuriya, 1998), e-mail(Hughes, 1999) anaesthesia information management (Quinzio, 2003), clinical data repository (Schubart, 2000), internet information (Chismar, 2002), and clinical evidence information systems(Gosling, 2003). All of the articles focus on use of a system from the perspective of user acceptance, intention to use, ease of use, usefulness, or attitude related to use

The TAM or TAM2 was used in three of the articles(Chismar, 2002, Dillon, 1998, Jayasuriya, 1998). In five of the articles, questionnaires were constructed by the authors to assess user acceptance.(Boxwala, 1997, Gagnon, 2003, Johnston, 2002, Quinzio, 2003, Schubart, 2000). One author (Hughes, 1999) used focus group methodology. The rest of articles used a variety of questionnaires, ranging from older questionnaires from the computer science literature such as the Nickell Computer Attitude Questionnaire to questionnaires such as the Team Climate for Innovation. (Ammenwerth, 2003, Gadd, 1998, Gadd, Penrod, 2001, Gosling, 2003). The search yielded no examples of the UTAUT having been used to measure acceptance of IS in health care.

TABLE 1: LITERATURE REVIEW: SUMMARY OF RESULTS

Article	Scale	Constructs	System	Population	Results
Ammenworth, JAMIA 2003	Nickell Computer Attitude Scale Lowry Nurse Attitude Scale Chin User Acceptance	User Acceptance of computers for nursing process	Nursing Documentation System	Complete data from 31 nurses	No effect or negative effect on nursing process.
Boxwala, Proceedings, AMIA Fall Symposium, 1997	Online questionnaire Survey at end of study, log files (no validated survey use)	Acceptability of accuracy of image analysis tools; time to use; ease of use	Image analysis work station	9 Radiation Oncologists	System rated as acceptable for ease of use and accuracy
Chismar, Proceedings, AMIA 2002	Extended Technology Acceptance Model (TAM2)	Perceived usefulness, perceived ease of use, Intention to use	Health Information on the Internet	89 Hawaiian Pediatricians	Perceived usefulness is a significant and strong influence on intent to use. Perceived ease of use had no influence on intent to use.
Dillon, Computers in Nursing, 1998	20 Items from Davis' TAM, as well as 45 other items to determine attitude to computers.	Ease of use, Usefulness, Attitude	Bedside computer implemented 2 years in 14 bed coronary unit and 19 bed ICU	64 Nurses	Scores on perceived ease of use and usefulness provide evidence of a high overall acceptance. Attitude survey identified need for better training methodologies.
Gadd Proceedings AMIA Annual Symposium, 1998	Doll- Measurement of end user computing satisfaction	Ease of use, Usability	Siegfried – point of care guideline system	6 physicians	Recommendations regarding design features. Also advantages of formative evaluation during system prototyping
Gadd & Penrod Proceedings AMIA Annual Symposium, 2001	Cork Scale, developed from Teach & Shortliffe		Epic Care (EMR)	6 outpatient practices in large academic health centre – 75 physicians pre-implementation, 95 post.	Impact on time required to enter orders and document encounters Optimism decreased
Gagnon, International Journal of Medical Informatics, 2003	Questionnaire developed from the Theory of Interpersonal	Intention to use	Telemedicine	519 returned questionnaires by physicians	Social and personal normative factors are best predictors. Medicine promoting telemedicine can be taylored

	Behaviour				to characteristics of physicians.
Gosling, JAMIA,2003	TCI – Team Climate for Innovation	Clinical team functioning and diffusion of innovation	Online evidence system, CIAP-Clinical Information Access Program	180 Clinicians	TCI scores increase with frequency of IT use. Significant Association between team functioning and effectiveness of online evidence system in terms of improved patient care following system use.
Hughes, Computers in Nursing, 1999	Focus Group Methodology	Barriers and Facilitators to use of e-mail	E-Mail	17 nurses from 3 different departments	System characteristics, passwords, training and administrative support can be either facilitators or barriers to use.
Jayasuriya, IJMI, 1998	Technology Acceptance Model (TAM)	Acceptance	Office automation technologies in community health services	113 surveys, 40 health administrators completed survey	Significant variables: computer skills, perceived usefulness and deign explained 55% of variation in use. Perceived Usefulness is most significant factor
Johnston, IJMI, 2001	Constructed own survey	Physician Attitudes associated with adoption	Any clinical practice computerization	897 physicians	Fear of interference with physician/patient encounters, Costs, time, hardware implementation and staff training are disincentives
Quinzio, European Journal of Anesthesiology	Constructed Questionnaire	User Characteristics Attitude Problems with hardware, software	Anaesthesia Information Management System	44 Physicians, 24 Anesthetic nurses	Perceived quality of training strongly influenced user acceptance. Training strategy must take into account users' needs.
Schubart, IJMI, 2000	Developed Questionnaire based on Roger's Diffusion of Innovation Theory	Proficiency with computers, social networks, and system attributes of system are predictors of initial usage	CDR (Clinical Data Repository	36 questionnaires 12 Interviews	-compatibility with skills and work style strongly associated with usage. Organizational culture and need for data also predictors of usage.

2.4 Discussion

The 13 articles showed that a variety of tools have been used to measure technology acceptance in health care. In addition, these tools are often combined with other methods such as interviews and observations to determine clinician acceptance of IS.

In most of this research, validated scales were adapted to their local situation, or else, a multi-method approach including interviews, focus groups, and/or videotaping was used. However many of the constructs used to explain variance in acceptance were similar to the ones used in the UTAUT. Indeed, perceived usefulness seemed to be the most salient of these constructs, and in one article (Chismar, 2002) it was the dominant construct and explained 54% of variance in intention to use, whereas ease of use had no impact. Other constructs that influenced use included computer experience in general (Ammenwerth, 2003), which had an effect on nursing use of a bedside documentation system. In the UTAUT experience is a moderating variable and has an effect on ease of use, as well as social influence and facilitating conditions. In one study (Gagnon, 2003) social norm was a major predictor of use, and intention to use was highly dependent on the clinical context. In the UTAUT, social norm is similar to social influence and is hypothesized to have the greatest effect when system use is mandatory and in the early stages of acceptance. In another study (Schubart, 2000) compatibility with skills and work style was a predictor. The compatibility construct, derived from Rogers' theory of diffusion of innovation, is related to perceived usefulness in the UTAUT.

In most of the studies surveys were either constructed and tested or developed from validated instruments. The remarkable consistency in the constructs in all of these articles, particularly usefulness, ease of use, and social norm suggests that all studies are at least using or adopting theories from the psychological and IS literature. The only exception to this are the studies using focus group methodology (Hughes, 1999), and one based on a previous questionnaire (Quinzio, 2003), and there is no indication that the previous questionnaire was validated or based on the literature.

The number of different tools used, begs the question as to why is there such variability in measurement of user acceptance in health care? One can speculate that the complexity of the health care environment, as well as the wide variety of clinical and administrative systems implemented, which have included systems such as EMR, telemedicine, anesthesia, e-mail, nursing documentation, image analysis, data warehouse systems, lead investigators to tailor questionnaires to the peculiarities of the system or environment being investigated. Furthermore, there is a history of lower acceptance of technology in health care, with a perception that physicians are more resistant to adopting innovative technologies for a number of reasons including time, costs, and interference with physician-patient interactions (Guerriere, 2001). Perhaps there is a sense that general surveys such as the TAM or UTAUT could not adequately capture the unique experiences of physicians and other health clinicians. This possibility will be examined later in the current research project.

Much of the research on technology acceptance in health care uses multiple methods to assess intention to use or usage, including interviews, sampling at different time lines during the acceptance process, videotaping, and/or the administration of multiple surveys variously measuring usefulness, attitude, ease of use, and other identified constructs. Indeed the great variety of information systems, and the uniqueness and variety of working environments in health care may demand that multiple methods are used and that no single scale or construct is able to capture the richness and complexity of technology implementation in health care In addition, field assessment of technology acceptance is difficult to do in health care, and generally yields small sample sizes, thus the use of multiple methods may provide more insight into variables influencing clinician acceptance of IS.

2.5 Conclusion

This review examines tools and models to measure user acceptance of information systems in health care. This reviewer acknowledges that the user acceptance of technology research is complex and evolving as more sensitive models and instruments emerge form the research. However, to date there are no models and tools that are consistently used or adopted across

clinical professions and health care settings to measure user acceptance of technology in health care. The TAM or its extension TAM2 are two of the most widely validated models, but they are used inconsistently for assessing user acceptance in health care. The UTAUT amalgamates TAM2 and other theories that have been used to determine user acceptance, however, the UTAUT is still quite new and no studies to date have been completed evaluating the use of the UTAUT in health care settings. There appears to be a tendency in health care to construct surveys to assess individual systems however these are primarily based on known theories, of which Rogers' diffusion of innovation is prominent, as well as tested constructs in the IS acceptance literature such as usefulness, ease of use and social influence.

Finally, it appears that there are two promising models, the UTAUT, and perhaps Dixon's ITAM, that may hold promise as standard measurement tools to determine user acceptance in health care. However, both tools have had either no, or limited application in health care settings. As well, and in line with the multiple methods used in most articles, both of these tools are likely to be more useful when done in combination with other methods, particularly interviews. Investigations comparing the validity of these two models in the health care setting could be important in refining and identifying the most appropriate variables or combination of variables from these models that best predict user intention and usage across time and settings.

Chapter 3: Aims and Methodology

3.1 Aims

The aim of this research was to understand variables that were influencing clinician acceptance of an electronic guideline based patient registry system for chronic disease management, known as the CDM Toolkit. A secondary aim was to assess the applicability of the Unified Theory of Acceptance and Use of Technology (UTAUT) survey for evaluating a health information system.

The specific aims of this research were to determine:

1. What UTAUT variables are influencing clinician acceptance of the CDM Toolkit in the Northern Health Authority (NHA) Community Collaborative?
2. What additional issues or process factors are influencing clinician acceptance of the CDM Toolkit?

3.2 Methodology

In March of 2004, I was invited to assist the Northern Health Authority with implementation of the CDM Toolkit as part of the Collaborative to improve CDM in the North. This invitation gave me an opportunity to develop a Master's thesis based on the experience of assisting with implementation of the Toolkit in seven small communities in northern British Columbia. Further, it allowed me to investigate the usefulness of the UTAUT to measure user acceptance of the CDM Toolkit.

Since I was going to be a member of an expert group to assist with overall implementation of the Collaborative, an action research methodology seemed to be appropriate to use as part of an evaluation to understand problems, issues, and successes in system implementation. Action research is described as linking "theory with practice through an iterative process of problem diagnosis, action intervention and reflective learning" (Lau, Hayward, 2000, p. 364). An action research model (Checkland, 1998, Kemmis, 1982, Lau, 1999, Lau, 1997) was chosen primarily because I would be working directly with participants in helping them to use the Toolkit and integrate it into their workplace. As such, I was expecting to engage participants, primarily as informants, to assist in the evaluation of Toolkit acceptance. Furthermore, natural cycles of planning, intervention and reflection are innate to the Collaborative environment and this fit well with action research cycles of planning, intervention,

observation and reflection. The training intervention was done between Learning Session "0" and Learning Session "1". Learning Session "0" provided the opportunity to assess the training needs of participants, and to plan for the training intervention. Learning Session "1" provided an opportunity to reflect back on effectiveness of the training and how users were faring with the Toolkit. Finally, administering the UTAUT as a self-administered on-line questionnaire and the structured interviews using the UTAUT, after Toolkit users had opportunity to gain more experience with the system, provided additional data for reflective learning.

In the end, both qualitative data from field observations, learning sessions, and the structured UTAUT interviews, and quantitative data from responses to the UTAUT survey were used to understand what variables are influencing clinician acceptance of the CDM Toolkit.

3.2.1 Ethics Approval

An "Application for Ethical Review of Human Research" was submitted to the University of Victoria Office of the Vice-President, Research, Human Research Ethics Committee in March of 2004 prior to starting work with the NHA collaborative. Further, a letter was sent to the University by the NHA indicating their acceptance and approval of the University's ethical review as submitted, which allowed me to conduct my research activities with the Northern Health Authority. Participants who completed the survey and interviews were requested to complete the consent form (Appendix B) which was available online with the survey. A form was faxed to participants who could not access the online form.

3.3 Role of Participants

Participants' roles and responsibilities related to the CDM Toolkit included:

1. Attend the Collaborative learning sessions.
2. Learn how to use the CDM Toolkit.
3. Confirm the accuracy of the list of patients with diabetes and congestive heart failure that is used to populate the CDM Toolkit.
4. Input baseline data from the patient records.
5. Update data in the CDM Toolkit as new data is collected from patient encounters.
6. Run reports as required.

The CDM Toolkit began with a probabilistic register. When physicians registered to use the CDM Toolkit, they found in their user space a list of their patients from a logarithm that uses ICD coding from MSP and hospital databases, and/or medications from PharmaCare data to list patients who have a moderate to high probability of having diabetes or CHF.

The physician or MOA or nurse would go through the register and cross-check it with patients' charts to remove patients who do not have diabetes or CHF, and to add patients who do. Baseline data from the chart on the most recent measurements of blood pressure, blood tests and urinalyses were then input. It is at this point that guideline based management of the patient's chronic disease could begin. In the Collaborative, doctors were requested to share their patients so that other participants could access the information and participate in the care delivery of these patients. As such, participants working in the health centres or clinics could also enter data on the patients being monitored in the Collaborative, and indicate what processes (such as foot exam, self-management education, etc.) they have implemented in the management of diabetic patients.

I asked participants to provide feedback to me on their experience with the Toolkit, and any associated problems and learning issues. In addition, I asked participants to complete the UTAUT survey online (Appendix B), and to participate in structured interviews based on the UTAUT.

3.4 Intervention

Planning for training began with Learning Session "0" where the participants were introduced to the expert group, the Collaborative and expanded chronic care models, and finally to the CDM Toolkit.

At this time a general assessment of needs for training was done by the trainers. This was then followed by the training intervention throughout June and July for those participants who had little or no prior experience with the CDM Toolkit, or needed additional training on the system to expand their skills.

In the Training sessions, trainers showed participants how to register for the Toolkit as well as how to install security certificates. They were then given an overview of the system, which was done primarily in an educational environment, and asked to perform some data entry, report generation, and printing functions using the system.

During training sessions I documented observations about the training and any participant feedback or reactions about the CDM Toolkit. I engaged in self-reflection on the process of training and implementation in between training sessions in the different communities in order to improve the training methods, based on feedback from participants, and also based on an assessment of participants' computer skills. Indeed, exit points for reflection occurred between training sessions in the different communities, and between learning sessions.

Finally, in learning session "1" towards the end of July, I engaged participants, through informal discussions, for additional feedback and reflection on their experiences with the Toolkit, as well as secured participation for the last phase of the study, the UTAUT survey and interviews. Also, this was my final exit point from the Collaborative.

In the last phase of UTAUT administration, I sent out a request, at two different time periods on the Collaborative listserv to complete the UTAUT online survey, and also to request volunteers for interviews. An online survey was chosen over a mailed or faxed survey due to the logistics of trying to get it to the right people and completed in a timely manner. For instance, some hospitals, clinics, and offices may have one or more faxes, and one or more addresses so there was no guarantee that it would get distributed to the right people, or even just distributed. Also, there were participants on the listserv that I may not have encountered in the learning sessions or the training intervention, and who may respond to the survey. Finally, some of the participants were contacted directly by me via e-mail to request interviews. In the end, 17 people completed the survey, and of these, 11 people participated in the interview.

3.5 Timing

The Collaborative began in April of 2004 with Learning Session "0". The Collaborative is scheduled to end in March of 2006. Training interventions occurred throughout June and July, with telephone support provided in August. The following timetable summarizes the research schedule.

TABLE 2: GANTT CHART

TASK	START	FINISH	ACTION RESEARCH CYCLE	APRIL 04	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	JAN 05
Learning Session "0"	April 20,2004	May 27, 2004	Planning Observation										
Toolkit Training and support	June 9, 2004	July 20, 2004	Intervention Observation Reflection										
Learning Session "1"	July 21, 2004	July 29, 2004	Reflection with Participants Observation										
Toolkit Support	Aug 1, 2004	Aug 31, 2004	Intervention Reflection Planning										
Administer Survey and Interviews	Sept 1, 2004	Dec 30, 2004	Participant Reflection										
Complete Data Gathering	Jan 1, 2005	Jan 30, 2005	Participant and Researcher Reflection										

3.6 Data Collection

3.6.1 Field Observations:

The researcher was a member of a team of three assisting with system training and support for the users of the CDM Toolkit.

I declared to participants the intent of the study at the outset, and elicited their cooperation, as informants, to provide ongoing feedback on the system implementation process including training and the process of integration of the Toolkit into participants' workflow. Field observations were documented throughout the training sessions, learning sessions, and after exit points.

3.6.2 Interviews:

Individuals were contacted by e-mail to request interviews. Interviews were conducted via telephone, and all interviews were recorded, and later transcribed. Interviews were structured to the UTAUT survey, and participants were asked to comment freely or as requested on their responses to the items in

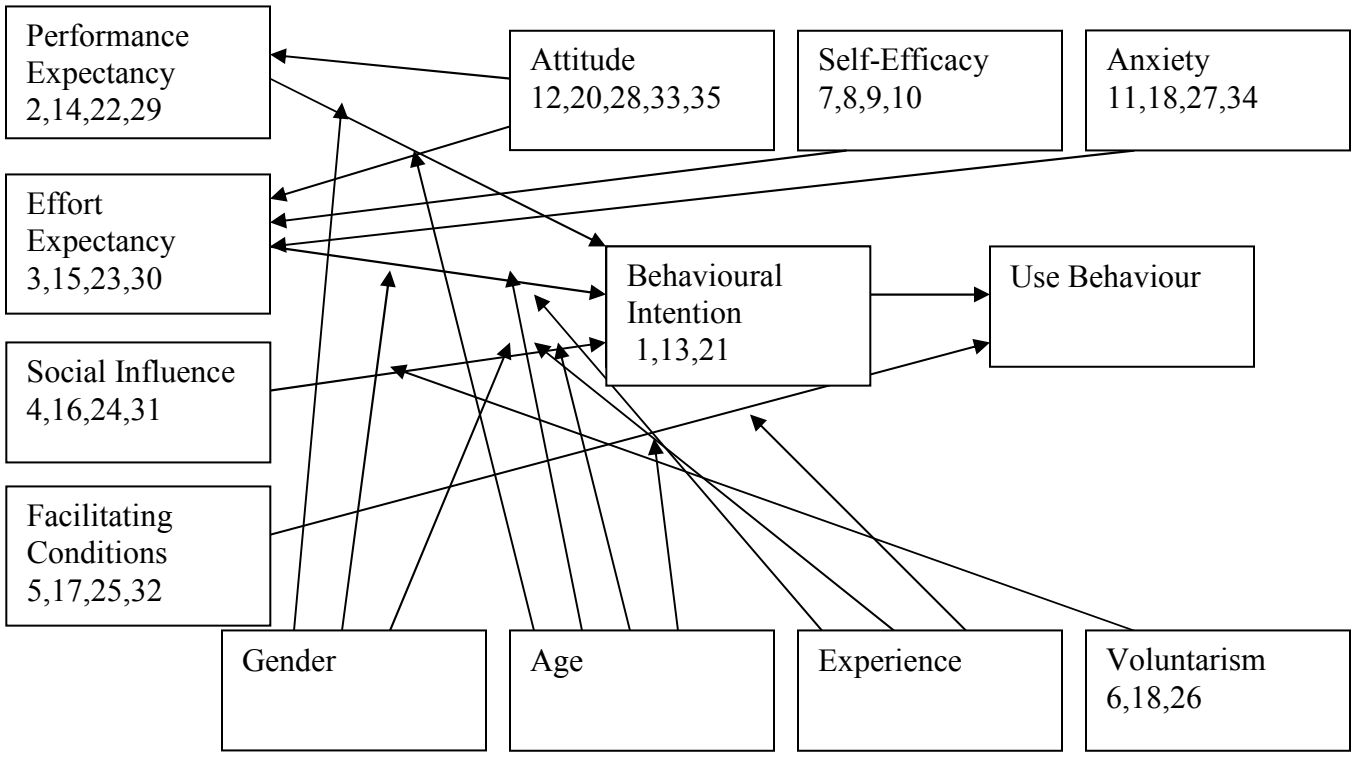
the UTAUT. Completion of the UTAUT survey with interviewees was intended to enrich the results of the survey by providing insight into how statements in the UTAUT were being interpreted. Furthermore, the interviews based on the UTAUT would provide insight into the reasoning behind participants' ratings of the statements in the UTAUT. Interviews were conducted throughout October to December, with one interview in early January.

3.6.3 UTAUT Survey (Appendices C and D):

The UTAUT was developed as a web-based survey, and a request for volunteers to complete the survey was sent out on the Collaborative listserv. The request was sent out twice, once towards the end of October, and another in December prior to the Xmas holidays.

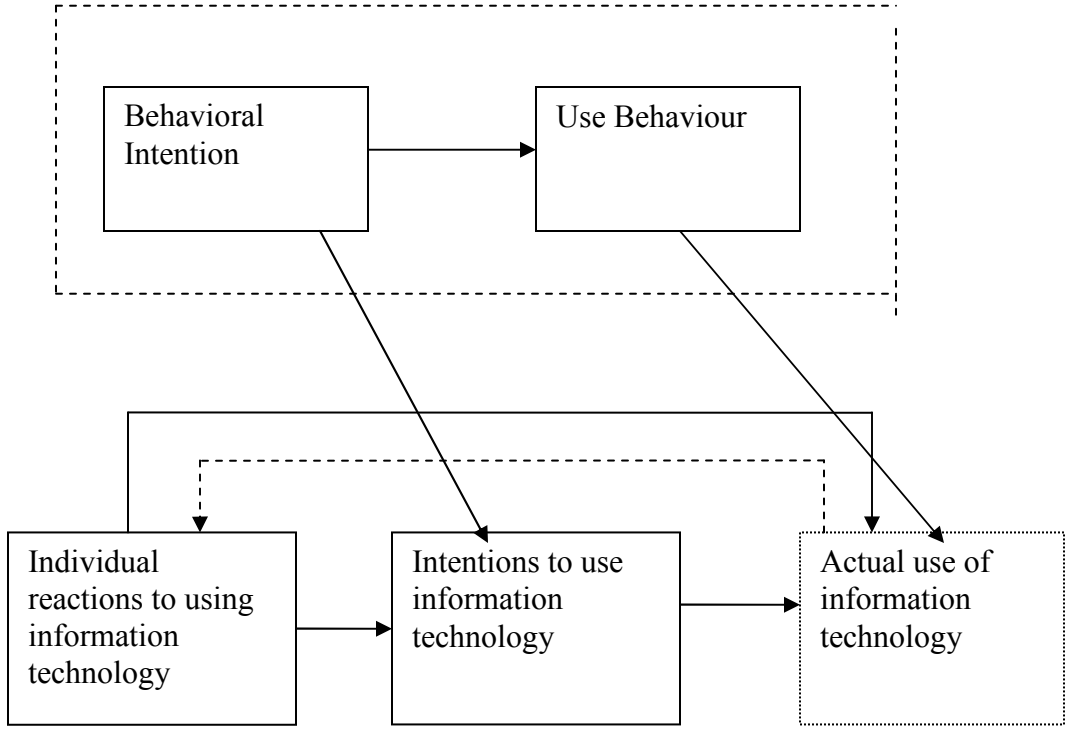
In the UTAUT's initial derivation, the authors also tested three prominent constructs, computer anxiety, computer self-efficacy and attitude towards computers, in addition to the four direct determinants. This was done to test the hypotheses that these variables are being moderated by the other four constructs in the model and as a result they are indirect determinants of intention to use. More specifically and as illustrated in Figure 2, Venkatesh, et al. postulated that self-efficacy and anxiety are fully moderated by effort expectancy when it is included in the model. As well, attitude is said to be significant only when the effort and performance expectancy constructs are not included in the model. As a result, Venkatesh et al. hypothesized that these constructs would have no significant influence on behavioral intention. Nevertheless, the initial version of the UTAUT was used in this research in order to fully test the UTAUT model. The intent was to either confirm Venkatesh, et al. hypotheses regarding the indirect determinants, or determine if these variables were operating differently in the NHA environment.

FIGURE 2: RESEARCH MODEL USED IN THESIS (Adapted from Venkatesh et al. 2003, See Appendix C: UTAUT Survey for corresponding items and numbers)



Furthermore, the role of behavioural intention as a predictor of behaviour, and in this case usage, is well established in both IS and related literature. Figure 3 illustrates the relationship between behavioural intention and use behaviour in the research model as it maps to the basic concept underlying the user acceptance model. In the user acceptance model, the role of intention is a critical predictor of behaviour, which in this case is the actual use of technology.

FIGURE 3: EXCERPT FROM RESEARCH MODEL MAPPED TO BASIC CONCEPT UNDERLYING USER ACCEPTANCE MODEL



(Basic Concept Underlying User Acceptance Models, Venkatesh et al. p. 427)

3.7 Data Analysis

3.7.1 General Approach:

Interviews and field observations were analysed using a content analysis methodology (Krippendorf, 2004). The UTAUT provided a natural structure for the coding and thus construct items in the UTAUT were used to organize the content. Each item in the UTAUT was assigned a number (Var 1, Var 2, etc.), and passages corresponding to the items in the UTAUT were coded according to the corresponding item number. Additional subject oriented coding was developed to capture comments and issues that went beyond items in the UTAUT. These were initially assigned subject codes as they occurred and similar categories were later collapsed into a single representative category. Examples of subject coding used include: data entry, certificates, physician participation.

3.7.2 Field Observations:

Field observations were documented in a notebook during learning sessions and training sessions. Observations were interpreted within a problem solving paradigm with a focus on issues identification and lessons learned. Information gleaned from the interviews was also included in the field observations analysis, in particular this information was extracted primarily from 106 text passages that were coded under 18 subject headings

3.7.3 Interviews:

All interviews were done by telephone, later transcribed verbatime, and responses were coded in QRS NVivo according to the variables in the UTAUT. There were 360 text passages associated with the 36 UTAUT variables that were coded. Responses that extended beyond issues addressed in the UTAUT were assigned into subject categories according to the topic of discussion. There were an additional 106 text passages associated with an additional 18 subject categories that were coded Examples of subject categories include: certificates, data entry, time constraints, physician participation, quality improvement, learning sessions.

3.7.4 UTAUT Survey:

The results of the UTAUT surveys were input into SPSS, and all quantitative analysis was done using SPSS. Frequencies, correlations, and regression analyses are used in analyzing the results of the survey. Due to the small number of responses to the survey, the survey and responses given in the interviews were combined to inform the quantitative results of the UTAUT.

Chapter 4: UTAUT Analysis

4.1 Introduction

The UTAUT has not yet been tested in a health care environment and this research provides an opportunity to test the model in a clinical setting with health professionals. The use of the UTAUT in determining participant acceptance of the CDM toolkit in the Northern Health Authority was analyzed using both qualitative data from interviews, and quantitative data from the survey.

I begin by discussing the direct determinants of behavioral intention, performance and effort expectancy, social influence and facilitating conditions; followed by those constructs classified as non-direct determinants, anxiety, self-efficacy and attitude. I have numbered the participants who gave interviews from 1-11 and prefixed each quote with the participant number: P1, P2, P3, etc. All quotes are indented, single-spaced and use a smaller font.

Although Venkatesh et al. emphasize that key relationships in the model are moderated by gender, age, voluntarism, and experience, this analysis can only suggest what influence these moderating variables are having due to the final sample size of 17 subjects and the majority being primarily female (15 out of 17). Finally, since the system was actively used only since June 2004, most of the participants were in the early acceptance stage of technology implementation at the time of data collection.

4.2 Participants

Participants in this research are from the seven communities participating in the Collaborative. At the time of exiting from the Collaborative in August 2004, there were approximately 60 participants in the Collaborative. Of these, 19 responded to the questionnaire, (2 were lost) and of the 17 remaining participants, 11 agreed to be interviewed. The breakdown of occupations and frequencies of participants are shown in the Occupation table 3. Local occupational titles have been collapsed into broad categories.

TABLE 3: OCCUPATION

OCCUPATION	*NUMBER (#)*	*PERCENT (%)*
Dietitian	1	6
Family Physician	2	12
Licensed Practical Nurse	1	6
Manager	1	6
Medical Office Assistants (MOA)/ Clinic Supervisor	3	18
Nurse	5	29
Primary Health Care Coordinators (3 Nurses, 1 Dietitian)	4	23
Total	**17**	**100.0**

The majority of the participants who responded to the request for participation are female 15/17, and the majority are in the 35-44 age range (8/17), followed by the 45-54 (6/17) as the next most common age range. One participant was in the younger age range, with 2 participants in the high end of the age range, 55-64.

TABLE 4: AGE DISTRIBUTION

AGE	*NUMBER(#)*	*PERCENT(%)*
25-34	1	6
35-44	8	47
45-54	6	35
55-64	2	12
Total	**17**	**100.0**

The experience of the participants with the CDM Toolkit varied, from non-user to frequent user, with the majority 9/17 labeling themselves as regular users. However all users were relatively new to the Toolkit, and were using the Toolkit for no more than 8 months at the time of the interviews, and may be considered to have been in the active acceptance stage.

TABLE 5: EXPERIENCE

On a scale of 1 (never used) to 7 (I am an expert), my level of usage of the toolkit is:

SCALE		*NUMBER (#)*	*PERCENT (%)*
1	Never Used	2	12
2	Seldom Used	1	6
3	Occasional User	2	12
4	User	0	0
5	Regular User	9	53
6	Frequent User	3	18
7	Expert User	0	0
	Total	**17**	**100.0**

Out of the 17 participants who filled out the questionnaire, 11 of the participants agreed to do an interview. In the interview, the UTAUT was completed with each of the participants, and participants were asked to comment and to provide reasons for their responses voluntarily, as requested, or when appropriate.

4.3 Voluntarism

In the UTAUT voluntarism is a moderating variable similar to age and gender. Specifically, voluntarism may have an effect on the Social Influence construct, and Venkatesh et al. hypothesize that the issue of voluntarism is likely to increase the effect of social influence when system use is mandatory.

TABLE 6: VOLUNTARISM

Variables and Frequencies

The following table summarizes the responses for the items used to capture voluntarism:

Legend: 1= Strongly Disagree, 2=Disagree, 3=Somewhat Disagree, 4=Neutral, 5=Somewhat Agree, 6=Agree, 7=Strongly Agree							
Variables	***1***	***2***	***3***	***4***	***5***	***6***	***7***
	#	*#*	*#*	*#*	*#*	*#*	*#*
	%	*%*	*%*	*%*	*%*	*%*	*%*
Although it might be helpful, using the Toolkit is certainly not compulsory in my job	3	1	0	1	3	4	5
	18	6	0	6	18	23	29
My boss does not require me to use the Toolkit	8	2	0	1	1	1	4
	47	12	0	6	6	6	23
My superiors expect me to use the Toolkit	4	2	5	1	1	0	4
	23	12	29	6	6	0	23

The issue of voluntary use vs. mandatory use was somewhat complicated in the Collaborative. To begin, participation in the Collaborative was voluntary; however use of the Toolkit was mandatory for some of the participants. Indeed, clinical coordinators, and physicians, or often, their MOAs, were required to use the Toolkit in order to participate in the Collaborative. Others however, who have patients that are part of the Collaborative may or may not choose to use the Toolkit. For instance, a home care nurse may want to enter data on any of her patients that may be participating in the Collaborative, can do so if she chooses, and it is encouraged, but not required. This likely accounts for the wide variation in responses from strongly disagree to strongly agree.

In short, it appears that the issue of voluntary vs. mandatory is somewhat confused with regards to acceptance of the CDM Tool in the NHA. Any discussion of voluntarism, must account for the fact that the Toolkit is both mandatory and voluntary depending on your role in the Collaborative.

4.4 Behavioural Intention

The theoretical models upon which the UTAUT is based have used intention to use or usage as the key dependent variables (see Figure 3, p. 23), which are captured in the behavioural intention construct. The correlation of variables used in the UTAUT with behavioural intention is discussed in this analysis.

Items within behavioural intention are highly correlated and have similar response statistics across items, and indicate that a majority 12/17, strongly agree with the statements and thus were intending, predicting and/or planning to use the Toolkit within 12 months of completing the survey. Once again, it is well established in the IS literature that intention is a strong predictor of behaviour, in this case usage. Moreover, when participants were asked to rate their experience with using the Toolkit, the majority of the participants (12/17) labeled themselves as regular or frequent users of the Toolkit, thus providing evidence for the role of intention as a predictor of use behaviour. (see Table 5, Experience).

TABLE 7: BEHAVIOURAL INTENTION

Legend: 1= Strongly Disagree, 2=Disagree, 3=Somewhat Disagree, 4=Neutral, 5=Somewhat Agree, 6=Agree, 7=Strongly Agree							
Variables	***1***	***2***	***3***	***4***	***5***	***6***	***7***
	#	*#*	*#*	*#*	*#*	*#*	*#*
	%	*%*	*%*	*%*	*%*	*%*	*%*
I intend to use the Toolkit in the next 12 months	1	0	0	0	2	2	12
	6	0	0	0	12	12	71
I predict I will use the Toolkit in the next 12 months	1	0	0	1	2	1	12
	6	0	0	6	12	6	71
I plan to use the toolkit in the next 12 months	1	0	0	0	3	1	12
	6	0	0	0	18	6	71

Appendix E provides a table of frequencies and correlations with behavioral intention for all variables in the UTAUT, where 1 indicates a perfect positive correlation and -1 indicates a perfect negative correlation.

4.5 Direct Determinants Analysis

4.5.1 Performance Expectancy

Venkatesh et al. define performance expectancy as the "degree to which an individual believes that using the system will help him or her to attain gains in job performance." They suggest that the construct is valid across all stages of acceptance and in both mandatory and voluntary settings. They also suggest that the construct is moderated by age and gender and has a greater effect for males and particularly younger males.

Two items in this construct stand out as high and low extremes:

1. I find CDM Toolkit useful in my job.

2. If I use the CDM Toolkit I will increase my chances of getting a raise.

With regards to the first of these items, frequencies for this variable are overwhelmingly favourable, with almost 77% of subjects ranging in their responses from somewhat agree, agree, and strongly agree. This item also exhibits the highest correlation (.800) with the dependent variable, behavioural intention. Indeed, even those who have not yet implemented the Toolkit anticipate finding it useful in their jobs:

> **P1:** I would have to say 5, because I'm not sure yet….. because we haven't used it yet. I'm anticipating it would be a six or seven, but I can't say for sure."

Regular users highlighted several positive aspects of usefulness which include the Toolkit as a communication tool, its importance for reporting, task accomplishment, patient tracking, and for individual and population data.

> **P3:** But it is helpful because I find that, because the physicians are using it, the patients are much better informed. They are much more informed, and they become much more proactive about their disease. So the result is more informed patient, which results in my job being much easier.

> **P6:**…so both in terms of the individual patient encounter, for organizing the information when I see people, and also for the population health data, as far as planning some of the things we do, either in the office or with the diabetic nurse, about how to intervene and get things like flu vaccinations rates up. I find it useful on both fronts.

> **P5:** I kind of have to look at it from a couple of perspectives. Obviously, the toolkit is the key to our collaborative project. So, yes, it's very useful, because I'm able to pull the parameters that I need. I'm able to use it to do that statistic-keeping sort of work for me. So I agree in that sense.

> It has your baselines of what you need. It shows graphs for your whole practice or for individual people you can track all the things. We are particularly doing the diabetes one right now. You can actually track what you're doing into what the set standards are either by your group, your practice, or by your individual clients.

Not all responses to this variable were entirely positive. One participant indicated that they did not find the Toolkit useful in improving patient care for diabetics, as they felt they were practicing guideline based care without the Toolkit. Another participant was neutral in their response as they found the data difficult to read and interpret. In this case, 5 physicians had their data on the Toolkit, with varying degrees of data entry and compliance.

> **P3:** What I'm finding is that the data is difficult to read, difficult to interpret. I think part of that is our situation here. In the diabetes collaborative we have five physicians who make up one team. But then our team data is not very good, because it's very skewed depending on where each doctor is with data entry and how pleased they are with the toolkit. So then we have to go to individual doctors' data. And it's difficult to motivate the physicians based on their data, because they still don't really see the impact that the toolkit could have in their office. So far it hasn't been as useful as I was anticipating.

The item on chances of getting a raise, on the other hand, received a majority, 12/17 strongly disagree response. This item is likely not applicable to the local context in British Columbia, and perhaps not to other Canadian health care jurisdictions as well.

In a discipline where most occupations or professions have relatively well defined salary ranges, and combined with the high rate of unionized positions in the health care field, the acceptance of new technologies is unlikely to affect salary rates.

> **P1:** Oh, number 1. [Laughs.] It's just been part of my mandate; I don't think they're going to pay me for it. I know this is being taped, but the day that the provincial government starts handing out bonuses, I'll be fairly impressed. I've been working for these guys on and off for a long time, and I'm pretty sure that Santa Claus doesn't live here.
>
> **P8:** Okay, that's great. "If I use the CDM toolkit I will increase my chances of getting a raise." [Laughter.] You wish. There isn't a number for "laugh outrageously."

Conversely, if more financial incentives were available to encourage clinician acceptance of technology in health care, a similar item could prove to be a strong indicator of intent or usage.

The responses to the variables related to task accomplishment and productivity are generally more positive than negative. However, data entry requirements, motivating people to get on board, and general computer glitches are influencing the responses.

> **P11:** No using toolkit doesn't make me accomplish things more quickly it's in addition to things I'm doing, one more file I have to put away.
>
> **P3:** I would have to say "somewhat disagree," because the only time that it requires me to complete a task quicker is if I'm doing a recall report and I want to target a specific group. Otherwise it takes me longer to do the work, because it's added workload.
>
> **P5:** I put "somewhat disagree," and I kind of have to qualify that, as well, because obviously if I was trying to do stat-keeping by hand or using another program and entering everything from scratch.... I like the fact that it's all there and it's connected, and you can just do a run chart. So that's certainly quicker. But to actually do the data entry and all of that was laborious.
>
> **P3:** It's not made into a workload issue because the physicians in the office that I'm working with aren't completely sold on the benefits of it. So I'm not overly productive in getting them to move forward quickly. But there are the benefits to it, and it warrants continual.... Sorry; I guess it's hard to really explain that. I'm not as productive as I want to be…..There's a lot that you can benefit from, but you're still promoting the daily or the weekly input of the data, or the use of the recall sheets, to be productive. If you can't get them to do that, then they're not being productive, and I'm not either.

Positive responses generally focused on the ability to share patients, eliminating duplicate work, better patient care planning, and increased patient involvement in care.

> **P9:** But I think the biggest thing is going to be the availability, the opportunity to share with the other two care providers that are key to our collaborative, so that we are not duplicating work and so on. I'm really feeling quite positive about the work reduction side of it.
>
> **P2:** Oh, definitely! Definitely, because once you've got your patients in there, you can really plan from there exactly how to meet the measures that you want met.

Overall the construct of Performance Expectancy in this context has a low correlation with behavioral intention with the variable regarding salary increase likely exerting the strongest effect. Moreover, and as is frequently the case in health care, usage of technology is often not in the context of redeployment of activities or a change in jobs, but an add-on to the job that the person is already doing. Therefore, although the Toolkit may be useful, it certainly won't increase salary, and it is likely to increase the number of tasks to be done and lower productivity, at least in the early stages of system implementation.

Venkatesh et al hypothesize that this construct is modified by gender and age and is more salient for younger males. Participants are predominantly female and in a middle age range and the lower correlation with behavioural intention may be influenced by gender and age in this sample. As well, this research is measuring behavioral intention primarily in the early stages of acceptance, and correlation with behavioural intention may be higher in later stages of acceptance. Indeed, there is

likelihood that tasks will be performed faster and productivity gains made once the technology is fully integrated into workflow.

4.5.2 Effort Expectancy

Venkatesh, et al. define the Effort Expectancy construct as the "degree of ease associated with the use of the system". The responses to the four variables in the Effort Expectancy construct are generally distributed over the high end of the scale from neutral (4) to strongly agree (7). It appears that even those with little or no experience with the system seem to think that the Toolkit is relatively uncomplicated and easy to understand.

> **P7:** Yes. I've had the demonstration a couple of times, and I think it looks very straightforward and very user-friendly; however, I haven't gotten right into the nitty-gritty of it myself.

A few did mention some initial problems in using the system. One infrequent user mentioned the need to refer to the user manual when trying to access reports. Another mentioned that it was clear and understandable due to increasing use.

> **P8:** Because I use it infrequently, I had to refer back to a written guideline of how to print the run charts

Some problems were identified, but these related more to interpreting the content and values embedded in the flow sheet rather then navigating the Toolkit.

> **P10:** For instance, on the diabetes toolkit, there was a foot exam and then a foot assessment. We weren't sure what was the difference between them. So we would be marking that we'd done a foot assessment but not a foot exam, and our stats were saying that every single person in the office had never a foot exam, but they had.

> **P10:** And then the micro-albumin. You're not able to reflect whether it's a positive or a negative result, because you have to input a unit, and that doesn't come up as helpful in the statistics. But they've rectified those as of the last week.

Positive comments highlighted the system built-in prompts and defaults to assist with error prevention, and referred to the ease of navigation.

> **P10:** I feel, when you're actually using it, there are enough checks on it that if you enter something incorrectly or in the wrong manner, it will tell you. There are enough ways to tell, when you're actually on the toolkit, how to do something. If you do have a problem, the Help desk is a phone-call away.

> **P4:** It's mind[less]! You know what? Anybody who has ever been on a computer can figure their way around this.

> **P5:** It's easy to use online. The program itself lets you know what's expected, what it is that it's requesting or if you've missed some information. We do have the toolkit user guides, so those are quite handy to have, and they do walk you through it quite easily. I'm not finding it confusing**.**

Nevertheless, items in this construct seem to be affected by users' computer experience in general. Participants who strongly agreed with the ease of acquiring the skills to use the system seemed to have prior experience using other systems.

> **P3:** Yeah, I think it's easy.
>
> **P4:** I'm a sly otter.... I just go!...It's just...fill-in-the-blanks.
>
> **P2:** Well, I've done data entry for at least 80 patients now, and I've done it all myself.
>
> **P5:** I'm comfortable with computers and the lingo and that kind of thing.
>
> **P4** Yes, and I've used databases before in other places, so the idea of the little box entries doesn't bother me. I understand how they work.

Another inexperienced user, who is not involved in data entry, but is required to retrieve aggregated reports from the system made an interesting comment about creating different views based on Collaborative roles, in order to simplify access.

> **P8:** Well, if there was a button that was for primary health care coordinators or chronic disease managers, and it didn't get into all of the other.... [If it] by-passed a lot of the options and it was simpler for us to only use it occasionally, that would be helpful.

In general, those who were quite new to computers tended to struggle more than those with prior computer experience.

> **P2:** I would say it's more neutral, but that's more because I didn't have a lot of computer skills when I first started to learn it. I would say, by using it, sheer practice improved my computer skills. The actual learning how to use the toolkit is not a difficult process. It's very user-friendly.
>
> **P11:** It wasn't easy, as completely computer illiterate, was a whole learning process, that took about a year. Brand new LPN, still learning job, and two new systems.

The inter-item correlations for this construct are quite high, indicating that all the variables have high validity as an expression of effort expectancy. When the variables are correlated with the dependent variable of behavioral intention, it exhibits a slightly higher correlation than Performance Expectancy.

According to Venkatesh, et al., effort expectancy is mediated by self-efficacy and anxiety and it is also moderated by experience. Users who were less experienced in using the Toolkit, as well as

users who where less experienced with computers in general tended to rate the variables in this construct slightly lower.

4.5.3 Social Influence

This construct is defined as the: "degree to which an individual perceives that important others believe he or she should use the new system". Venkatesh et al. suggest that this construct is not significant in a voluntary setting and becomes significant in the mandatory setting, and in the early stages of acceptance

In this sample, the Social Influence construct correlates the highest with behavioral intention. Two items on "people who are important to me", and "people who influence my behaviour" have the highest correlations within this construct.

In the context of the Collaborative, most participants interpreted "people" to be a director, supervisor or colleague. One person remarked on the unusual phrasing and interpreted the comment as referring to her superiors:

> **P8:** It's an odd way of saying people that give me direction.... I mean, all I can say, really, is that I'm supposed to print the run charts to see what's going on.

In general responses varied, some did not perceive the Toolkit as a required however others who were more directly involved in the Collaborative had no doubt that use of the Toolkit was required.

> **P5:** I strongly agree. I was looking at it from the sense of the person that's directing me in my job is the person who is managing this project and has said, "In order to be a part of the collaborative, we're using the CDM toolkit." So they have said, "You need to use the toolkit in order to be a part of the project."

Nevertheless, it appears that participants had difficulty interpreting this statement in the context of their working relationships. Without offering any interpretations, this statement was variously interpreted as family, superiors, or colleagues.

> **P8:** Well, "people who are important to me" would be my family, and I'm not sure they care. [Laughter.] Carrying that a little further, they'd want to know that doctors are following guidelines and that they are making sure to do appropriate recalls, so I'd leave it at six.

One regular user of the Toolkit answered more literally and gave a strong negative response suggesting that the question is not relevant:

> **P4:** People who are important to me don't work here, so I don't know what you can do with that. …. Well, my janitor is really important in my work…..
> It totally has no bearing. I'd say strongly disagree 1.

Another participant who rated the statement as neutral, but expressed similar concerns regarding the wording of this statement:

> **P5:** I put "neutral" on that one, mostly because.... I had answered it in the beginning, like, yeah, the people who had influenced me said, "You need to use the toolkit." But I kind of had a hard time with who's important to me and why are they to me; I don't know.

> **P5:** Yeah. I guess some of my coworkers from the nursing point of view are important to me, but they're saying, "Well, let's just wait and see." They're a little skeptical about [it], you know. Is this going to take off, or is it just going to a project that's not going to go anywhere of the lack of buy-in, or whatever? So I just put "neutral" for now....

With regards to the 2 items in the construct addressing senior management support, most participants responded positively. They appreciated the meetings and demonstrations organized by the senior management, as well as the availability of IT support for the Toolkit.

> **P9:** Providing a number of training opportunities and the support and the follow-up. I'd probably give that a seven, actually.

> **P5:** It's just that everybody's going through a learning curve. Everybody's learning to use it. So the ones who have been most helpful in getting on the toolkit are [IT support] and those type of positions….

> **P1:** My organization, which is Northern Health, whom I work for, has been very supportive in allowing me to go to the two learning sessions, as well as my one-on-one session with [IT support]. As I said earlier, they have been really supportive in pushing the various pieces that needed to be pushed in order to get the high-speed Internet and whatever that I needed.

One participant interpreted this statement in the context of management being responsive to suggestions about changes required in the Toolkit to make it more relevant:

> **P6:** Again, with some of the initial issues around the use of the system, certainly the listserv and other formats have been helpful in trying to problem-solve. They've been fairly responsive to some of the feedback from the collaborative about what we might like to see on there.

> **P6:** To start with, when we did the run charts with the A1c's, rather than getting a percentage of people under 7, it was just generating your average value. That wasn't really in the aims and measures anyway, because you're looking to get a percentage. That was added with the next revision of the toolkit. So I think they've been fairly good at responding to people's suggestions and comments.

There were few negative responses to this item and interestingly these referred to the difficulty that one group had in involving physicians, which has been an ongoing challenge in the Collaborative.

> **P5:** …..The organization in terms of the NHA has certainly hired people to do the teaching and all that sort of stuff. But in a way, I felt that, because of our physician issue, if the organization was supportive of using this toolkit, more pre-education should have gone out to the physicians. Right now, as it sits, the toolkit is sort of a physician's preventive tool that can then be shared out to the larger collaborative group. They still own those patients. They are the ones that have the certificate and need to delegate. In that sense, I didn't feel that it was supporting the use of the toolkit.

Venkatesh et al. suggest that this construct is significant in a mandatory setting, but not in a voluntary setting, and only in the early stages of acceptance. In the context of the Collaborative, although participation in the Collaborative is voluntary, use of the Toolkit by many who choose to participate is mandatory, likely accounting for the higher correlation of this construct with behavioral intention in this "mandatory" use setting.

Nevertheless, this construct may have correlated even more highly with behavioural intention if some of the items were reworded. For instance, instead of people, the items may be more salient if professional colleagues, administrator, or other colleagues had been used. Moreover, in light of the strong professional identifications in health care, there is a possibility that the social influence construct is significant across all stages of acceptance.

4.5.4 Facilitating Conditions

Defined as the "degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system", Venkatesh et al. hypothesize that facilitating conditions is a direct effect on usage as users find "multiple avenues for help and support throughout the organization." Facilitating conditions is thus moderated by effort and performance expectancy, and will not have an influence on behavioural intention.

Two variables within this construct received relatively high positive responses: I have the knowledge necessary and I have the resources necessary to use the Toolkit. With regards to the first item, participants tended to comment on having the clinical knowledge to use the Toolkit. One participant remarked that her clinical background was useful in understanding what was collected and also what was needed on the Toolkit.

> **P5:** From the other perspective, too, it was that I am a service provider. I have the clinical knowledge so that...from a lot of the things they were asking for on the toolkit, I understood what they were asking or what they were needing. I think having that clinical knowledge was quite helpful....

Another participant remarked on the importance of knowing what the normal clinical values are so that the physician could be flagged if values where unusual.

> **P4:** Okay, if you're the person putting the information in, you should know what the normal values are, so that if one comes up as way out of line...
>
> **P4:** ...you can flag it and say to the doc, "Have a boo at this." Because if a lab result comes in and you put it in and the doc doesn't check.... As long as you know the baseline values, and you know what an A1c should be...
>
> **P4:** Let's say someone's A1c was 7.2 and you went, "That's kind of high," and you point it out to the doctor. "Oh, that's good for that patient!" It's just a heads-up for them.

Participants considered "resources" as having the necessary hardware and technical support to use the Toolkit. One group rated this variable highly even though it took them several months to get the high speed internet connection that they needed to use the Toolkit. Another person who also rated the variable highly is using Windows 98 which resulted in slower access and seemed to cause a variety of glitches in accessing the Toolkit. The concern centered on only one computer being set up to access the Toolkit, and when it was occupied, no work could be done on the Toolkit. An interesting comment was made around the location of the computer being in the general office, versus the patient examination room where values could be input directly and records could be viewed in the presence of the patient.

> **P6:** Technically, it's not that difficult to use. Most people would probably find that anyone who has a passing familiarity with computers could use it. My only thing is, I have a computer terminal at my desk, but that's not where I'm seeing the patients. Ideally, it would be nice to be in an office where I actually had a terminal there and could look at it with the patient there and then enter the data there. It's more a question of the resources to support it. But overall, yes....

Finally, in one of the groups participating, the physician was trialing a small number of patients, and one person expressed frustration that all patients seen in the process of home care were not on the Toolkit, due to the restrictions set by the Doctor.

> **P7:** The reason I say that is that not all of my diabetics in the home nursing care program are part of the collaborative….As far as computer and time and all of that, I have that at my disposal. I just don't have all of my clients referred by the physician. He's reserved that way. He's just trialing this. But I think that's a bit of a hindrance.

With regards to the item on compatibility, a couple of interviewees mentioned the lack of compatibility with other province-wide systems, such as the Public Health Information System (IPHIS), as well as Pathnet, the laboratory system. Others mentioned the lack of compatibility with

electronic medical record systems that were implemented in the office. One interviewee was doing double entry, once into the diabetic sheet of the Jonoke electronic medical record (EMR) system, and another into the Toolkit. Although the ability to pull information from an EMR application into the Toolkit is possible, the onus is on the EMR vendor to set up the XML protocols to do this. At this point in time, only one vendor (Clinicare) had done this.

A few participants mentioned the lack of compatibility between the Toolkit and their office paper based systems. Often, the data entry person had to consult several charts from hospitals, physicians' offices, and labs to acquire the necessary data to input into the Toolkit.

> **P2:** The only system we use is paper. If you had an electronic medical record and you could just slide all the information in there nice and easy, that would be great if it was compatible. But with the paper trail this bit of information is in the hospital chart, this bit is in the physician's chart, this bit is in the lab it was tough to gather everything.

In the end, the Toolkit was often the only data entry system that participants were using, and thus had no compatibility problems.

The majority of responses were positive with regards to assistance with system difficulties and participants generally knew who and where to call for help. One neutral participant was also participating in the Provincial Collaborative which had an active listserv that discussed and posted solutions to problems, and used this as a source for help. Others were able to use local expertise for some computer troubleshooting problems, and for Toolkit issues. One person commented that one of the main contacts at the Ministry of Health was very busy and difficult to contact. Finally, some participants mentioned that they had the numbers and contacts in their manual, but did not have to use it at this point in time.

Although Venkatesh et al. suggest that facilitating conditions is moderated by performance and effort expectancy, this is not the experience with the participants in this research. In fact, facilitating conditions correlates more highly than effort or performance expectancy on behavioural intention.

It appears that the users of the system in these fairly isolated Northern communities have a built-in adeptness to secure the assistance they need from colleagues and other local experts. Indeed, although help was provided by the NHA in support of the Toolkit, many users were asking for help from a local computer person, or another participant who had already developed some expertise. In

short, it appears that several users had already tapped in to multiple avenues of help including the provincial help desk, the Collaborative help, as well as local computer experts and users.

4.6 Indirect Determinants Analysis

In the UTAUT, self-efficacy and anxiety are "modeled as indirect determinants fully mediated by perceived ease of use"(p.455). Self-efficacy and anxiety are derived from social cognitive theory (SCT) and are defined as: "judgment of one's ability to use a technology to accomplish a particular job or task" and "evoking anxious or emotional reactions when it comes to performing a behavior (e.g., using a computer)". Venkatesh et al. suggest that these two constructs will not have a significant influence on behavioral intention.

4.6.1 Self-Efficacy

The responses to this construct suggested that the regular users of the Toolkit were competent and confident with their use of the system. Others indicated that support was still necessary, but they were also in early acceptance stage of the system. This construct appeared to lose relevance once participants became regular users of the system.

> **P9:** I do think that somebody should be there to help you, especially in the early stages. Once you become familiar with it, then it doesn't really matter that much. But especially in the start-up stages, you need some support.
>
> **P4:** All the pre-education was good enough to get me going.

Most people felt competent enough with the system to proceed on their own, but appreciated having the support to back them up if they did get stuck. Many indicated that the system is self-explanatory, that they don't get stuck and have no need for the help.

> **P3:** I've called the Help Line, but not recently. Now I can kind of muddle through on my own. I don't think the toolkit is difficult to understand; I think it's pretty easy.
>
> **P4:** The way it's set up, you shouldn't get stuck and yes, I can call. It's a neutral.

With regards to having enough time to complete a job, this item also appeared to be more salient in the early stages of acceptance. There were comments around the data entry requiring more time. However, the more experienced participants seemed to think that time was not an important factor in using the Toolkit.

> **P7:** I find that the toolkit is very easy to navigate with. I've tried some things out just to figure out what does this report look like and how does it run, and it's easy.
>
> **P4:** I don't need a lot of time. That's what I like about it. Once you're done, you're out of there. I strongly disagree 1. You walk in there, do it, be gone.

None of the participants used the online help that was available with the Toolkit. Many were not even aware of it, and others based their assessment of the online help on prior experience with online help systems, and they were not keen to try to navigate through it to find a solution for their problems.

> **P2:** Yeah, I have. But sometimes maneuvering through Help, if you're short of time....
> I've used the Help in the past, but generally for the challenges that I have had, I needed more than the Help desk could give me. That was more in start-up.
>
> **P4:** The Help? No, I haven't had to. On any computer program that I've ever used, the Help thing drives me insane. It goes, "Blah, blah!"
> "No, I don't want to know that. Here's the problem. That's all I want. I don't want all the options. I just want to know [this]. You tell me, and that's it."

It appears that the self-efficacy construct in this context and stage of acceptance is not distinct from and fully mediated by effort expectance as Venkatesh et al suggest, but overlapping with the effort expectancy construct. Indeed, when responding to the variables in self-efficacy, the participants frequently referred to the ease of use of the Toolkit, suggesting that these constructs are being interpreted more as system efficacy instead of self-efficacy. The responses further suggest that the stage of acceptance is significant with regards to this construct, and help and support is needed in the early stages of IS acceptance.

4.6.2 Anxiety

Like self-efficacy, Venkatesh et al suggest that Anxiety is an indirect determinant of use that will have no effect when effort expectancy is included in the model. Further, in this research, it appears that anxiety is also moderated by experience with the system and experience with computers in general.

Participants were not apprehensive about using the Toolkit, and most are quite comfortable with it. One participant who responded with a neutral indicated that because of the lapsed time in between

uses, there was a need to become familiar with the system again: “Oh, I feel like I have to relearn this thing again.”

Participants who were familiar with databases tended to accept that the information was recoverable if a mistake was made. Nevertheless, there were comments around having more constraints in the system to prevent loss of information. For instance, one person suggested that if a patient is “removed” from the system because of death, transfer, or other reasons, that there should be a temporary “trash” file, where they could go to recover deleted information if necessary.

All participants were of the opinion that there are enough constraints built into the system to prevent errors and to recover information if a mistake should be made. One person in the very early stage of acceptance captures the general sentiment:

> **P5:** I just feel that others have used it, and they’re not having difficulties with it, and I just don’t see it to be complicated. If I make a mistake, I just feel there’s probably a way of correcting it.
>
> **P2:** So I don’t look at that as a hindrance. Five to seven years ago, I wouldn’t necessarily have wanted to turn on the computer or move to a different program within my computer screen without having my husband or my children beside me. But I’m over that.
>
> **P4:** No, I don’t think the system is set up that way. Hitting the wrong key it’s pretty idiot-proof, because I’ve hit a few wrong keys, and it will either not accept it or.... No ... I think it has enough checks on it that that’s not going to happen.

One occasional user experienced some frustration with trying to look at new features in the system and not being able to find them. Again lack of familiarity and occasional use seemed to be the problem. For the most part however, as users became more experienced with the system they were less intimidated by the Toolkit.

> **P10:** It was intimidating but no longer…. Because of familiarity and using it, and just clicking on things who cares what happens just to see.
>
> **P3:** This is tough, because initially I would have had to say, probably a 7, but now it’s not.
>
> **P8:** No, it’s not been intimidating. The odd time, when you’re pushed for time, you go, “Oh, I don’t have time to figure this out!” But it’s not intimidating.

Finally, this construct has a negative correlation with behavioural intention and does not appear to be a predictor of intention.

4.6.3 Attitude

Attitude is defined as an individuals' overall affective reaction to using a system. Venkatesh et al. indicate that in some of the models, attitude is significant across all time periods as well as being the strongest predictor of behavioral intention, whereas in other models, the construct is not significant. Further, the authors suggest that attitude has a spurious relationship, and is only significant when the key predictors of performance and effort expectancy are not included in the model. As a result, they hypothesize that attitude will not have a significant influence on behavioral intention.

Most participants seemed to think that using the Toolkit is a good idea. Moreover when speaking to the items in this construct, participants often spoke to the clinical utility of the system and the system's contribution to better patient management.

> **P4:** What I really like is that you can track every individual patient. You know whether this patient's holding their own, deteriorating or getting better. You don't have to go digging through their file and reading for 20 minutes. All you have to do is look at a graph, and there it is.
>
> **P1:** Once we get familiar with it and start generating the encounter forms, then that makes it a little easier during the visit itself to keep track of those measures that we're looking at. We still look at the population as a whole.
>
> **P2:** The toolkit really enhances diabetes management of patients. The patients just do so much better because their doctors are doing a much better job of keeping track of their diabetes because of the toolkit. Everybody wins.
>
> **P9:** For me, personally, the main benefit is that it helps in communication so that I know what has actually been done and what needs to be done. The other thing that assists in communication is that, as a result of physicians being more proactive in their diabetes care, the patients are more informed.

Some were slightly less positive in their ratings because they were concerned that the system use was not mandatory, in the sense that participation in the Collaborative was not mandatory. The suggestion was that it complicated matters by having some people using it and others not. This concern was expressed in light of having some difficulty with physician buy-in in that particular community.

> **P1:** It is a bad idea in the sense that it would be a better idea if the people at the ministry had just said, "From now on, diabetes will be managed this way." I think when you run into some people using it and some people not.... If it's not mandatory for physicians to use the system, then it's hard to get the buy-in. So in that sense, I disagree that it's a bad idea, but I put "somewhat disagree."
>
> **P5:** I put "somewhat agree." It probably kind of goes back to the fact that it's a great idea, but you'd need universal acceptance to make it a better idea.

In highlighting the items on the system being interesting and fun, it is notable that participants had difficulty with these descriptions. Participants had difficulty with the adverb "interesting" and seemed to look for other words to describe the Toolkit's effect on work. Some words mentioned include "easier", "more challenging", "time consuming", "a change", "efficient". One person was definitely concerned about the added time and duties that resulted in using the Toolkit. In addition to data entry in the Toolkit the participant was assigned additional responsibilities that came along with practicing guideline-based care.

> **P3:** I think I'll remain doing all the computer part of it, but we're booking group sessions, and I'm booking diabetic days. I've had to learn how to do the foot exams and all the other things that go with it. I'm involved in getting the other clinics on it and what not. So, yeah, it's become quite a job to say I already had one.

Another participant who agreed with the statement saw the Toolkit as not only an opportunity to evaluate performance against other practices, but spoke to the opportunity it gave their particular practice to try to do things differently and improve care.

> **P6:** Yeah, I'd agree with that, because it's interesting to look and do the comparisons about our measures versus other places, and just to look at the areas where we're perhaps not doing as well as we'd like. I think it's an incentive to look at the office and other practices and how we might better meet the needs. It's definitely interesting, because prior to this we hadn't had an easy way to look at things in that population.

Attitude has a low overall correlation with behavioral intention. As Venkatesh et al. suggest, perhaps this construct is a determinant of behavioral intention only when performance and effort expectancy are not included in the model. Also, when speaking to these variable most participants spoke in terms of the Toolkit's usefulness and clinical utility suggesting that perhaps the construct is overlapping with the performance expectancy construct.

4.7 Discussion

It is understood that the small sample size restricts the conclusions that can be made on the usefulness of the UTAUT as a measure of acceptance of the Toolkit. However, the interviews do provide some insight into responses to the variables used in the UTAUT. Moreover, the majority of participants were already using the Toolkit or were intending to use it within the next 12 months.

Overall, the findings from this research suggest:

1. Social influence is behaving as hypothesized by Venkatesh et al., thus having more effect in a "mandatory" environment and in older females
2. Self-efficacy is not behaving as an indirect determinant moderated by effort expectancy, and it correlates higher than effort expectancy.
3. Facilitating Conditions is having an effect on behavioral intention even with effort and performance expectancy in the constructs.
4. Effort Expectancy is moderated by experience as hypothesized.
5. Performance expectancy is not the strongest influence as hypothesized by Venkatesh et al., but may be influenced by gender and age also as hypothesized.
6. Attitude and Anxiety are not having a significant influence on Behavioural Intention as hypothesized by Venkatesh et al.

4.7.1 Social Influence

In this sample, social influence correlates the highest with behavioural intention. Venkatesh et al. hypothesize that social influence is not significant in a voluntary setting, but each item in the construct is significant in a mandatory setting, but only in the early stages of experience and is stronger for women, and particularly older women.

The environment can be considered "mandatory" for the majority of participants to the questionnaire, as well they are almost all women, and the majority (15/17) are in the older age group (35-64), and all are in the early stages of acceptance even though some of the participants are regular users. Thus seemingly supporting the authors' hypotheses concerning this variable.

It must be noted however, that participants also had some difficulty with the items in this construct. As one person commented, "people who influence my behavior" was an odd way of saying "my directors" or "my superiors", not inclining to interpret this as also referring to patients, colleagues or other types of working relationships. Some examples of influential relationships may make this item more explicit and useful. Similarly, the same can be said for "people who are important to me", which may also benefit from being made more explicit. Frequently, people thought of their families, or just co-workers more generally. One person answered it with reference to nursing colleagues. Perhaps if these items were made more specific, variables referring to professional identity and

professional relationships may actually increase the correlation of social influence with behavioural intention and usage.

4.7.2 Self-Efficacy

Self-efficacy is hypothesized to be an indirect determinant of behavioral intention fully mediated by effort expectancy, and to behave similarly as the anxiety construct. Venkatesh et al. thus hypothesize that this construct will not have a significant influence on behavioral intention. In this sample, self-efficacy was second to social influence on behavioral intention, and just slightly higher correlation than facilitating conditions. The items in self-efficacy were answered very positively by more regular users of the system, and less positively by infrequent or non-users. Furthermore, the responses to the variables in this construct seemed to be interpreted more similarly to the responses to the items in effort expectancy. Indeed, positive responses to this variable highlighted the "efficacy" of the Toolkit as being easy to understand and use.

The Toolkit is a "task-oriented system", users are either inputting results data from patient charts, laboratory, blood pressure, glucose or other tests, or they are running reports for updates on status of individual or groups of patients, or running reports in order to perform other task-oriented activities such as recalls for blood pressure checks or foot exams. Users seemed to relate in a more concrete manner to the variables in the self-efficacy construct, as they seem to capture in a more transparent way the task oriented activities associated with the Toolkit.

The unexpectedly high correlation of self-efficacy with behavioral intention in this sample could be spurious in its overlap with effort expectancy, due to the small sample size. However, it could also be a testimony to the inherent simplicity of the Toolkit. It is a fairly intuitive system, simple to navigate, with appropriate constraints and a number of navigational prompts, thus increasing participants' perceived confidence with using the system. In addition, some participants felt that a brief introduction and overview of the system were sufficient to get them started in using the system.

4.7.3 Facilitating Conditions

Venkatesh et al. hypothesize that the facilitating conditions construct does not have an influence on behavioral intention, but does have a direct influence on usage. The effect of the facilitating

conditions construct is hypothesized to increase with experience and to be more salient in older workers.

Venkatesh et al. also state however, that the construct will have no effect on behavioral intention particularly when effort and performance expectancy are in the model. Facilitating conditions is nevertheless correlating higher than both effort and performance expectancy on behavioral intention in this sample. This effect may be the result of 12/17 participants declaring themselves as regular or frequent users of the Toolkit.

Because the system is somewhat intuitive, and generally considered relatively easy to learn, facilitating conditions may be more salient for regular users who already feel that they have not only the computer competencies to use the system but also the clinical knowledge. Having the clinical knowledge and knowing that someone is available for help may be more important to these users, than the fact that the Toolkit is easy to use.

4.7.4 Effort Expectancy

Effort expectancy ranks slightly lower then facilitating conditions on behavioral intention. In testing the various models, Venkatesh et al. found that effort expectancy is significant only during the early stages of acceptance. As well, Venkatesh et al. suggest that the effect is stronger in women, and particularly in older women.

Venkatesh et al.'s hypotheses are somewhat supported by this sample in that effort expectancy was moderated by experience. Effort expectancy in the context of the Collaborative received higher ratings by participants who had prior computer experience, especially with data entry, then those who did not. It appears that this construct may not be as salient as others, or as Venkatesh et al. expect, due to the greater ubiquity and penetration of computers overall. With exposure to systems come familiarity and an increasing confidence with computers.

4.7.5 Performance Expectancy

Performance expectancy has a low correlation with behavioural intention in this sample. However, one item in the construct: I find the CDM Toolkit useful in my job, has the highest correlation of all items in the UTAUT. Indeed, the Toolkit was frequently praised for its clinical utility in many areas.

It is the other items in this construct that are more problematic, and it is argued, particularly in the health field. Some of these have already been mentioned, such as the Toolkit increasing one's chance of getting a raise. This item is likely not applicable to any professional working in the health care field, even physicians, at least in Canadian health jurisdictions. As well, and in terms of task accomplishment and productivity, systems are often introduced, not in the context of a new job, but usually on top of the work that the health professional is already doing, so it generally results, at least in the early stages, in more work, and concomitantly, lowered productivity.

Venkatesh et al. state that "the performance expectancy construct within each individual model is the strongest predictor of intention and remains significant at all points of measurement in both voluntary and mandatory settings." Further, this construct is moderated by gender and age and is considered to be more salient in men and particularly younger men. Indeed, the gender issue may be a factor influencing the lower correlation with behavioural intention since the sample is predominantly women.

Further, it is suggested that at least with regards to the use of the Toolkit, the performance expectancy construct may become more salient in a summative evaluation, when the Toolkit is fully integrated into the workflow, and people are realizing full clinical and process-related benefits of the system.

4.7.6 Attitude and Anxiety

Attitude and anxiety correlate the lowest with behavioural intention Like self-efficacy, these two constructs are also hypothesized to be indirect determinants, and to have no significant influence when performance and effort expectancy are included in the model. Certainly this seems to hold with the anxiety construct, which has an overall negative correlation with behavioural intention. It appears that common anxieties that may have been associated with computer use, no longer apply. Indeed, most people were aware that they are unlikely to lose information and mistakes can be corrected, thus dispelling any intimidation or apprehensiveness about using the system.

Attitude has a very low positive correlation with behavioural intention, again supporting the authors' hypothesis that this is an indirect determinant and has no effect. When participants spoke to items

in this construct, it was primarily with reference to the clinical utility of the Toolkit, thus suggesting a closer relationship of these items with the performance expectancy construct.

4.7.7 Conclusion

In general, constructs identified in the UTAUT, with some modifications, appear to be relevant for predicting behavioural intention with regards to users of the Toolkit

In a re-test of the UTAUT, I would do as the Venkatesh et al suggest and eliminate the anxiety and most of the attitude construct from the scale. I would revise the performance expectancy construct and eliminate the variable on getting a raise, and include the higher loading variable: "Using the system is a good idea" from the attitude construct, as people generally referred to the utility of the Toolkit when commenting on variables in the attitude construct.
I would also be tempted to combine self-efficacy and effort expectancy and use the highest loading items from each of the constructs. Again, the reason being that the responses to these constructs emphasized the ease of use, but the items in self-efficacy seem to capture better the task based activities involved in using the Toolkit.

The high correlation of social influence with behavioural intention highlights the importance of this construct in this health care environment. It is suggested that this construct would be even more salient if variables were made more specific with the identification of important and influential people as colleagues and supervisors.

Finally, it would be highly informative to test the UTAUT in a summative evaluation of the CDM Toolkit, once it is integrated into the workflow, which may increase both the salience of some of the constructs such as performance expectancy, and decrease the importance of others, such as social influence, and thus providing more support for the author's hypotheses regarding the UTAUT.

In conclusion, further testing of the UTAUT is required in order to support or refute some of the conclusions in this analysis. Nevertheless it is suggested that these constructs from the general IS literature, with some modifications, are useful for determining behavioural intention with regards to the CDM Toolkit.

Chapter 5: Field Observations Analysis

5.1 Introduction

Participants were first introduced to the CDM Toolkit in Learning Sessions '0' via a live presentation of the Toolkit educational environment. Field observations were collected and documented throughout the training intervention period which lasted for a period of two months until Learning Session 1 at the end of July. Ongoing support for Toolkit use is still provided to this date in the Collaborative.

Since the intent was to assist participants in the Collaborative to become self-sufficient and independent users of the Toolkit, a "train-the-trainer" approach was taken in most communities. Trainers were informally identified within communities, and included several different occupational roles. In some of the communities the "trainer" or helping role was taken on by the Primary Health Care Coordinator (PHCC) for that community. The PHCC role was created to support the Collaborative and focused on providing leadership and coordination of Collaborative participants in clinics, offices, and hospitals. In other communities, a member of the IS department was assigned the role of assisting and trouble shooting. Yet, in other communities, the trainer was a nurse or office assistant who had gained substantial experience using the Toolkit through their participation in a pilot provincial Collaborative through the British Columbia Medical Association (BCMA).

Finally, although a "train-the-trainer" approach was adopted, the designated Toolkit trainers for the Collaborative's initial implementation period, trained as many people involved in the Collaborative and likely to use the Toolkit during the period of time covered by this report. Approximately 50 people were trained in the use of the Toolkit throughout the month of June, with each training session lasting about an hour. It was expected that as new people came on board over the course of the Collaborative, that the community trainers would take over introducing the Toolkit. As well, it was expected that these trainers would be able to assist with trouble shooting problems as they arose once the designated trainers exited the Collaborative.

A number of issues and lessons learned were identified throughout the training. Many issues were minor procedure issues related to the data in the Toolkit, for instance, weight can be input in pounds

or kilograms but not both. These observations focus on the more critical implementation issues, and are grouped into the following categories:

Certificate Issues
Access/Confidentiality Issues
Physician Participation Issues
Data Entry Issues
Flow sheet Issues
Infrastructure Issues
Educational Environment Issues

Categories represented re-occurring issues that had an impact on Toolkit implementation by either causing confusion or delay in training or uptake of the system. Categories were identified by the researcher's observations or participants' reflections in interviews or from discussions during training and field observations. For instance, access/confidentiality issues were identified primarily by the researcher based on attendance at a meeting where the issue was discussed. Whereas physician participation issues were identified primarily by participants with 21 text passages being assigned to the subject coded "physician particpation" in QRS/NVivo. Finally, although the issues identified are Toolkit related, some of these are complex and impact beyond simple use of the Toolkit. For instance, physician participation issues, as well as some infrastructure issues are influenced by the larger organizational context.

5.2 Certificate Issues

The CDM Toolkit uses a 2-factor security model consisting of a digital certificate and user id and password. In the Toolkit, the patients are "owned" by the physician, and thus the onus is on the physician to apply for the certificate.

Since the Collaborative emphasized multidisciplinary care of the patient, and since many of the participants involved in the Collaborative were not associated with a physician's office, a secondary application process, by organization (i.e. G. R. Baker Memorial Hospital), was set up through NHA IS to allow other clinicians to have access to the Toolkit.

***Problem Identification*:**

1. The 2-tier process for applying for certificates was not made transparent nor was it well-communicated. When requests were sent to the NHA, there was no response and long delays in getting the certificates, and no one person was familiar with the process or who was responsible. It appeared that the certificate application process within the NHA was a "black hole" from which certificates were slowly or never generated.

2. The urgency of getting the certificates was not apparent to IS in the NHA, and the person co-coordinating the process did not see issuing certificates as a job priority. Similarly, the importance of prompt registration to use the Toolkit, due to the time delay in issuing certificates was not emphasized with physicians and other participants.

3. Doctors were often not aware of how to apply directly for the certificate, or were slow in so doing. As well, others involved in the Collaborative, such as the primary care coordinators often took the lead and applied for the certificate on the doctors' behalf.

4. There appeared to be problems with the five to ten day certificate turnaround time with the MOH as well. For instance, one of the coordinators applied for a doctor's certificate on July 7th, and she was still waiting for it to arrive on July 27th.

5. All of the above resulted in extensive delays of ten days and often much longer. This impeded the education process in that certificates weren't available to load, and clinicians did not have access to the "live" toolkit to practice what they learned or to begin doing data entry. This resulted in delays in getting started on the Collaborative when motivation was high after Learning Session '0'.

Lesson Learned: Ensure essential processes for access to secure systems are well-communicated and prioritized.

Although there was a single person in charge of issuing certificates in the NHA, this person was not part of the Collaborative, nor aware of the urgency of certificate processing. A member of the Collaborative expert team, likely someone providing IT support, should be designated to focus on and oversee this crucial initial step. This could have resulted in a more streamlined process, eliminating delays, and advancing the Collaborative. Although the problem was eventually sorted out and one of the IT trainers took more responsibility for certificate implementation, many delays that could have been avoided had already occurred. As well greater assistance to those requiring assistance in getting over this initial hump in accessing the Toolkit need to be provided. It is necessary to ensure the process is clear and transparent; a single person responsible for this could have expedited the process.

5.3 Access/Confidentiality Issues

In the Toolkit, patients are "owned" by the physician, and the physician determines who can get access to his patients. A physician can give access to all, or a group and/or to an individual patient. The person whom access is given to must be registered to use the Toolkit.

Problem Identification:

1. The NHA process of providing certificate access by organization resulted in default access to participants with a user id and password to registered physicians' patients in the particular community.

2. Some physicians were not aware who had access to their patients nor aware of the NHA process for granting access, or the process in general for granting access, or that they could remove access.

3. Access to some physicians' patients were given by others in the Collaborative, who had taken initial responsibility for loading the certificate and thus had access to the physicians' user id and password.

Lesson Learned: Ensure widespread and targeted educational interventions for understanding access and confidentiality processes.

The initial confusion and learning curve required to get started on the Collaborative resulted in incorrect information or lack of communication, which seemed to be the case with regards to certificate, as well as access and confidentiality issues. Indeed an MOA in one physician's office was concerned that the physician may not want to share patient information. Although, ultimately there were no serious problems that resulted from the lack of proper understanding of shared access, this is an area where there could have been some negative consequences, particularly with physicians not knowing who has access to their patients. Targeted and specific educational interventions should have been delivered to physicians and participants to ensure complete understanding of the process for default access, and granting and removing access, and protecting confidentiality of patient data within the Collaborative.

5.4 Physician Participation Issues

Although the Collaborative is multi-disciplinary and is inclusive of all participants involved in managing patients with chronic diseases, physicians are essential participants as owners of the patients, who provide and approve access to their patients in the Toolkit. Often in the northern communities recruitment is difficult, and communities experience periods of physician shortages. Some physicians are working to meet their five-year requirement of working in an under-serviced area and do not plan on staying beyond five years. Other issues included the lack of physician leadership, and the lack of trust with regards to physicians' relationship with the MOH. Indeed one physician saw the Collaborative as a communist plot intended to make them salaried physicians.

Problem Identification:

1. In one community, there were no physicians on board with the Collaborative, thus making it difficult for non-physician participants who were keen, to be involved. The non-physician participants eventually decided to input patients and indicators that they were tracking in their clinic.

> **P1:** They refused to become part of the collaborative themselves, so we were not able to populate our list using their MSP billing numbers. So what we're going to do is, we're going to populate our list

based on the diabetic nurses. So I think we have about… somewhere in the neighbourhood of 45 to populate.

2. In another community, only one of the physicians took leadership in participating in the Collaborative on a trial basis, and the other physicians were advised to restrict their participation based on the outcome of the one physician's experience. This is in part due to the physicians also anticipating shortages and increased workload with one doctor retiring and another leaving the community in the near future. The physician agreed to initial data entry for a few patients as a pilot. This restricted involvement by other participants, since they may not have any relationship with the selected patients. It further restricted productivity gains with the need to continuously address the issue of patient participation in the Collaborative in a non-threatening and discreet manner.

P7: Then, with us encouraging [Dr.XXX], that's when we got the extra patients come on, because at first we started with five, and they were all with [non-physician clinician]. And [physician]said, "Do you want to use it?" And I said, "Yes," so then he gave us more....

P7: And then approaching him today with the new client, I said, "Would it be possible to put this client on the collaborative?" And he said, "Would you like to?" And I said, "Yes," and he said, "Fine; consider it done."

3. In one community, all physicians were participating, except for one, who was convinced that the Toolkit would interfere with physician/patient relations.

4. There was generally a low or no turnout of physicians at learning sessions. One participant suggested that this could be a result of the lack of peer promotion. As well, and although not mentioned, the lack of compensation for the time to attend the Collaborative learning sessions could have influenced physicians attendance.

P8: What I think really would have helped is if the BCMA would have done more with their members of course, I don't know what they did do with them to say, "This is what is going to happen; this is how these people are going to help you," and sort of set the stage for the physicians actually wanting to engage with us because they know this is something they're going to have to do, but wow, they're getting all this help. The engagement of the BCMA was poor.

Researcher: Do you mean just in terms of telling physicians how they should work with this?

P8: Well, you can't tell physicians anything but suggesting to them the merits of this, and having it not just come through you and the Ministry of Health and us, but rather more promotion from the BCMA.

5. There was no physician leader in the Collaborative, although other, excellent resource physicians were available and attended learning sessions. The problem with the lack of physician leadership is expressed in the following quote from a PHCC:

> **P8:** We have to promote to physicians the importance of their attending the diabetes collaborative, and promote to the physicians the importance of them getting their patients registered and the data entered and what the toolkit can do. I'm not sure that we're the best ones to do that, because [we're not] peers. Had it been a peer-evoked program, I think the physicians might have listened far faster. We would have wasted a lot less time and energy. And we, as primary health care coordinators, diabetes collaborative coordinators and the allied health professionals, then could have just focused on learning our part. I think we would have saved an enormous amount of time and money.

Lesson Learned: Physician issues and physician leadership need to be addressed to secure physician participation and engagement.

It is anticipated, though not guaranteed, that a physician leader participating at the program management level and/or more peer promotion from BCMA may have facilitated and secured greater participation of the physicians at the start of the Collaborative. Furthermore, given the sensitivity over the workload issues in the North, as well as the sometimes difficult situation of physician recruitment, a physician familiar with the issues in the North is preferable. Perhaps a learning session by physicians for physicians could have resulted in better initial buy-in to the Collaborative and use of the Toolkit.

> **P5:**…the organization in terms of the NHA has certainly hired people to do the teaching and all that sort of stuff. But in a way, I felt that, because of our physician issue, if the organization was supportive of using this toolkit, more pre-education should have gone out to the physicians. Right now, as it sits, the toolkit is sort of a physician's preventive tool that can then be shared out to the larger collaborative group. They still own those patients. They are the ones that have the certificate and need to delegate. In that sense, I didn't feel that [the Collaborative]was supporting the use of the toolkit.

One non-physician participant remarked that it would be better if the system was declared mandatory, and all physicians had to adopt as part of their billing for treating chronic diseases.

> **P5:** Most of what concerns me is that I think it is a good tool, but what would make it better is if it was universally used.... It would make it easier if it just became part of everyday work, not some special project that some people are doing. That makes it harder to integrate that with other people that aren't using it and aren't part of the collaborative and haven't heard about it. Since it is through the Ministry of Health, if it was just a directed thing.... Maybe eventually that will happen and they'll say, "These toolkits for the various chronic diseases are mandatory." That becomes part of the billing or the coding or whatever. I think the universal use is very important. Right now, that's what I don't like about it. Some of us are not using it and not linking with others. It's a work in progress.

> **P5:** With the whole fee-for-service system, if the physician charges whatever code...because he's had a visit with the diabetic client, if part of that billing was that that form needed to be filled out in order to

> receive his payment for seeing that patient, then I think they would do it. Then it would just be, yeah, of course they'd use the toolkit, because they have to. I know that's not the way to go about it, especially in collaboration and that sort of thing.

Finally, it is suggested that some form of incentive payment for the time to attend the Collaborative learning sessions may have encouraged more physician participation.

5.5 Data Entry Issues

Data entry is undoubtedly one of the more time-consuming aspects of using the Toolkit. Once the registry is populated and the physicians' patients have been confirmed, the next step is to do a retrospective chart review and enter baseline data for each individual patient. This aspect was considered the most onerous part of data entry into the Toolkit, whereas ongoing data entry for patient encounters did not seem to be as time consuming.

Problem Identification

1. One of the physicians commented on the cost of data entry for his patients as he had to pay his MOA overtime in order to get the baseline data into the system. He further remarked that he was not seeing any benefit to the system and hoped that it would be forthcoming.

2. The time-consuming aspect of data entry was reiterated by all participants in most physicians' offices. They either had to do the data entry after hours, hiring summer students, or paying overtime to have the data entry done.

3. Trainers were available to do data entry, but a process to take advantage of this was not in place, and only one community organized to use this additional resource.

Lessons Learned: Provide data entry incentives and make them available immediately.

The NHA eventually provided $5000/physician up to a two physician practice and $3000/physician in a practice with three or more physicians to assist with the cost of data entry. It is suggested that the time and cost involved in data entry should have been addressed at the start of the Collaborative,

and also any available resources (such as trainers doing data entry) should be integrated into the process and their use encouraged.

> **Researcher:** Do you think there could have any other thing done in terms of incentives for the physicians? You identified strong leadership in that area as missing. Is there anything else?
>
> **P8:** You mean, like introduce the $5,000 up front? [Laughter.] That might have helped.
>
> Well, they have all received their money. My understanding is that they're using it to pay the MOA for the extra time that they've worked on it.
>
> **Researcher:** Do you think it's been an additional incentive?
>
> **P8:** Oh, yeah, because our last physician came on board once the money came.

5.6 Flow Sheet Issues

When starting to use the Toolkit, a flow sheet has to be selected. Presently there are 2 flow sheets in the system for diabetes. One was developed by the VIHA Collaborative, and the other by the BCMA Provincial Collaborative.

Problem Identification

1. The BCMA flow sheet that is available online in the Toolkit is different from the paper one that was originally developed by the BCMA. In the printed versions, indicators for five consecutive visits were displayed allowing the physician a quick view of the history of a specific indicator which assisted with problem solving regarding any changes in indicators. In the flow sheet's online version, only current data and historical data from one previous visit were available.

2. Most MOAs and physicians complained about the lack of visitation history on the online form and indicated a clear preference for a format that was similar to the BCMA printed form. They were reluctant to use the online form as a result.

3. This was communicated several times to various people involved with the Toolkit and the Collaborative, but response was slow and feedback inadequate. The following excerpts from two different communities illustrate the problem:

Community 1:

P10: It seems to take a long time to make the changes. My one example is.... I'm trying to remember the month. I think it was in the spring of 2004 when the community collaborative started. So that was in May or April, where [name]requested that the toolkit be able to have more of a flow sheet look, so our physicians could print off one to save paper, have the baseline data there, and they could continue to use the sheet for five or six visits. Well, that still hasn't happened, and it's to a point now that my program is developing that. I hear, "It's coming; it's coming; it's coming," but the physicians don't want to be printing off a flow sheet every single time the patient comes in, because they don't want to waste the paper you know, all that kind of stuff.

ResearcherI know, because we requested that quite a while ago. I sent that to [MOH], because they liked the BCMA sheet because it had five visits.

P10: Right. And the problem was that that came out first, and all of our physicians were using the sheet prior to the collaborative starting. So then when the toolkit came on board, the MOA was trying to use a flow sheet that didn't match with the toolkit. And that has been a huge, huge problem with us. That's why we were.... "Why can't we have these two sheets now?" So that's when they started to take it forward. But in fact right now my secretary is at the computer place in town trying to get it cut-and-pasted and just adds columns so that everyone is using the same form that reflects the same toolkit.

Researcher: You're making your own flow sheet.

P10: We're probably paying for the cost of what the ministry is doing. It just takes too long.

I don't know. I think, from my understanding, that they really do want a flow sheet printed off prior to every visit. And it just isn't conducive to that. So our docs are trying to be a little bit more responsible with the amount of paper and that kind of stuff. Not every visit will be a flow-sheet visit. That's probably been one of the biggest stumbling blocks for us. We're trying to orientate everybody to the toolkit, and then we're actually using a flow sheet that doesn't jive.

Community 2:

P6: I think there were some bugs initially with it in terms of data entry, and I recall some problems with getting some of the run charts going. My only remaining problem with it I haven't checked it out extensively is about being able to do an actual flow sheet. I think now you can do it on an Excel spread sheet, but I haven't really checked it out. You're just getting an encounter generated, as opposed to a flow sheet, and I think that's something that would be useful to have a flow sheet so you can compare past values. I've noticed that they've been pretty responsive as far as the problems that have been identified, in trying to meet the need.

P6: f you're trying to make it user-friendly and not make it extra work, both in places where you have a computerized record and just paper charts, if you have to look at both at the toolkit and then go back and look at something else to see what the previous lab result was, it's not as useful.

Lesson Learned: A communication process is needed with appropriate and timely feedback to action re-occurring items that need attention, particularly those items that facilitate use and promote acceptance.

The Toolkit developers are highly responsive to problems, and the problem was eventually corrected with the online flow sheet having records for 3 visits. However it would have been more

efficient and effective if a process was in place and the trainers and users could have formally communicated the problem, and received appropriate feedback regarding issue and timelines to communicate back to clinicians. Since the interviews were done after the introduction of the 3-visit flow sheet, it appears that this is still somewhat of an issue.

5.7 Infrastructure Issues

Some of the NHA's services are centralized in Prince George such as IS, and the NHA serves a large geographical region consisting primarily of smaller, more remote communities. Although there are issues around connectivity, these were actively being addressed at the central level. However, local issues around access and hardware surfaced, that sometimes were dependent on the broader organizational framework.

Problem Identification

1. In one community, the computers were old and lacked the necessary processing power to access the Toolkit efficiently. These problems were identified at the time, however, when returning to the community over 6 weeks later, participants were still without adequate computers to access the Toolkit.

2. As a result of the lack of hardware support, participants were concerned about the priority given to the Collaborative and how decisions were being made and who was making decisions around who gets what.

3. One community was delayed in getting high speed access to the internet, and waited several months for this to occur, once again delaying participation in the Collaborative.

> **P1:** Well, for me the resources boil down to the technology, so it has been a really long process here at the [Name] Centre. We just got our high-peed Internet on September 9 or 10 or something. We'd been waiting since April. The reason the [community name] project has been so delayed is that we had no technology here to support the use of the toolkit. I had the paper toolkit at my disposal, but the other resource that hadn't been available until the end of September was the physician agreement. So now I have physician agreement, I have the technology, and I have the two diabetic nurses on board, so I see this as going forward now. Most of the…at least the foreseeable glitches, I think, have been ironed out.

4. In one physicians' office the assistant who was doing all the data entry was using Windows 98 and encountering numerous problems in accessing and using the Toolkit. As a result, the assistant was trying to time data entry on down times (i.e. early morning), when her computer worked more efficiently with the Toolkit site. In addition, there were problems with getting access to the computer to do the work.

   P3: That's tough. I have [the toolkit] on only one computer. So if it's not my day to work on this computer, I don't have access to it. It's not necessarily a 7, because if we had more resources here, it would be much better.

   Researcher: Are you still doing it on Windows 98, as well?

   P3: Yes.

   Researcher: Has that been still causing problems?

   P3: At times. It prints very slow and what not. Yeah, it's not the greatest.

   Researcher: Do you think there's any chance of you upgrading in the near future?

   P3: I've asked, but I haven't heard anything about a date yet.

Lesson Learned: Ensure a communication process is in place to identify address hardware and other technological issues in a prompt and efficient way. If possible, include a budget to address critical hardware issues.

Once again, neglecting to address critical hardware issues resulted in delays in some participants using the Toolkit. As well, it put into question the credibility of the Collaborative as an important initiative within the NHA. Furthermore, there was palpable frustration with the participants not knowing why, who, or how decisions about hardware needs are being made. A more transparent process for addressing hardware issues may have expedited acquisition of the necessary hardware, and reduced frustration.

Also, perhaps additional incentives, in the form of payments for investment in new computers to be used specifically for the Collaborative as part of the Collaborative budget costs could have alleviated some of these problems. Further, incentives of this nature provided to physician's offices, may have secured faster buy-in with the physicians, and at the very least made data entry faster for some of the MOAs.

5.8 Education/Training Issues

Since the Toolkit contains patient specific, confidential data, developers of the Toolkit have replicated the system into an educational environment to be used for training and demonstration purposes. This enabled a fairly comprehensive training protocol where trainers can have the trainee sit down and add patients, edit baseline data, print functions and generate reports. Nevertheless, where possible trainers would train people in their working environment with the patients in their own registry. Finally, trainers were requested to train all participants in the Collaborative and working in hospitals, clinics, and physicians' offices.

Problem Identification

1. The variety of work environments resulted in a need to accommodate working schedules. For instance, in some physicians' offices training had to be done early in the morning prior to the office opening, or over lunch hours or after 5:00 when the office was closed, as there would be either no time for training otherwise, or no computer available to do the training on.

2. Problems occurred in the educational environment, and functions were often not available. For instance, in one week most of the report functions were not available, which is one of the more interesting, useful, and attractive features of the Toolkit.

3. Not being able to access functions was a problem in the Education Environment because the certificate process was so slow, trainers were unable to get into working environments to do training.

4. Although the "train-the-trainer" approach was needed for ongoing recruitment in the Collaborative, it was important to realize that the trained trainers were also busy clinicians with other responsibilities and this approach, depending on work and time constraints, was not always adequate to meet the needs of the Collaborative.

Lessons Learned: Be adaptable by providing training that accommodates clinician work schedules, and provide some risk management.

The need to accommodate participants' schedules and resource availability was not taken into account initially. On a couple of occasions training was done at 8:00 a.m. with nothing scheduled again until later in the day or the next morning. Better planning and integration of schedules may help to ensure better use of training time and resources. During this "down" time, trainers could have been assisting with baseline data entry, but the need and a process had not yet been addressed.

Also some basic risk management such as testing the training environment in advance of most training interventions could have resulted in better planning. For instance, trainers could have tried to secure access to a working environment or downloaded examples of some functions that are critical for clinicians to be familiar with.

Finally, having onsite trainers is an excellent idea, but additional backup may be necessary to support clinicians when they don't have the time to do the training.

> **P2:** [Name] has been willing to let me go full-time, but we don't have the nurses here, so I'm still having to work on the floor half-time. I've been putting a lot more hours in than just part-time, but I don't know where we're going to get. Now it means I've got to get that office redesigned and turn it over to them, and that means educating nurse staff, too.

5.9 Conclusion

These field observations have highlighted the most salient implementation issues regarding the CDM Toolkit in the NHA. Other issues identified related primarily to content issues and formats around entering data into the Toolkit. Many of these problems have been corrected with ongoing iterations of the Toolkit. The ones highlighted here however have had some major implications including stalling the progress of the Collaborative, and in some cases inhibiting getting started due to lack of hardware, certificate problems, or physician issues and lack of incentives.

Chapter 6: Synthesis and Conclusion

6.1 Introduction

This research sought to provide an understanding of variables influencing acceptance of the CDM Toolkit in the Collaborative. An action research methodology was used in an iterative process of planning, intervention, observation, and reflection. Observations gathered from field notes are used to describe issues that arose throughout implementation. The UTAUT was administered to provide some quantification of variables influencing acceptance, and interviews were to inform and interpret the UTAUT. It was not possible to do multiple regression because of the small sample size, as well bivariate correlations could be spurious or due to confounding. Nevertheless, and although the sample size is too small to generalize about the variables influencing acceptance, the results of this research provide an opportunity to suggest propositions based on what dimensions appeared to be the most salient, that is the most prominent and relevant to Toolkit accepance, variously identified by the researcher or the participants. This final chapter therefore, assimilates results from the UTAUT, interviews, and observations with a focus on the more salient and robust variables.

6.2 Models of Technology Acceptance

The general IS literature provides a mature field of inquiry into technology acceptance based on a variety of social, psychological and cognitive models. Prominent among these are Rogers diffusion of innovation, Fishbein and Ajzen's Theory of reasoned action, and cognitive social theory. As well, validated instruments have been developed based on these theoretical models. The maturity of this general IS literature on acceptance provides a foundational evidence base for focusing health technology acceptance research using these models.

Proposition 1: The UTAUT, a model derived from the general IS literature on technology acceptance, provided a sound evidence base from which to further explore acceptance of the CDM Toolkit in the Collaborative.

Indeed, the recent literature on technology acceptance in health care seems to be relying more on general models and constructs of acceptance as a basis for their research. However, questions within the constructs need to be refined and focused on items that are salient to the health care environment.

Proposition 2: Although the models are useful for providing an evidence-base from which to explore technology acceptance, the models need to be tailored to the language and work environments in health care.

6.3 Social Influence

Social influence was not included in the original TAM, it was added to TAM2, and finally became a direct determinant in the UTAUT. In this research, Social Influence correlates the highest with behavioural intention and its importance is further suggested in comments on physician participation issues in chapter four.

Venkatesh et al suggest that social influence is significant only in the early stages of acceptance and in mandatory settings. I suggest that social influence behaved differently in the NHA setting. Health care is composed of distinct professions, physicians, nurses, dietitians, and others. Professional identification is important in health and as a result, experiences of colleagues, both within professional roles and in relation to other professions, may influence behaviours of colleagues. I propose that social influence is likely one of the most salient variables influencing Toolkit acceptance. Even in the field observations, non-physician colleagues suggested that peer support for the physicians may have influenced more involvement by the physicians at the start of the Collaborative. Further, social influence may be salient through all stages of adoption, acceptance and ongoing use.

Proposition 3: Social influence was a key construct determining acceptance of the CDM Toolkit, and may play a role in all stages of IS implementation from pre-adoption, adoption, intention and use.

Proposition 4: Social influence in the form of clinical leadership, particularly for physicians either through their colleagues in the NHA or from the BCMA is an important variable and may have expedited physician participation in the Collaborative and uptake of the CDM Toolkit.

Research is needed to determine how this influence happens and to what extent it explains variance in intention and usage. This is not only important for physician acceptance of IS, but also to promote acceptance of IS in other disciplines.

Items in the UTAUT social influence construct can be refined to more clearly identify what aspects of social influence are having an effect. For instance, instead of "people who are important to me think I should use a system" and "people who influence my behaviour think I should use a system", should be reconstructed to determine who are the important and influential people. Items could read: "My professional colleagues think I should use the system", "Colleagues in other professions think I should use the system", "Administrators who influence my behaviour…"

Proposition 5: The language used to measure the social influence construct should be made more specific to the environment being investigated. With regards to the NHA some reference to professional colleagues, such as other nurses, physicians, diabetic educators, or reference to managers could have identified more specifically the social influences that are operating in this environment.

6.4 Facilitating Conditions

In this research, facilitating conditions correlates third highest with behavioral intention. The focus of this discussion is on the one item on "having the knowledge necessary" to use the system. My initial interpretation of this item referred to the computer knowledge, however, in the interviews, some clinicians clearly interpreted this item as having the clinical knowledge to use the system.

Proposition 6: Clinical knowledge emerged as an important variable in acceptance of the CDM Toolkit. Consideration should be given to specifying clinical knowledge as an item in the facilitating conditions construct specifically to measure acceptance of a clinical information system such as the CDM Toolkit.

Indeed, the item may help to identify those whose clinical knowledge is lacking or in need of upgrading, and thus identify any remedial education needed to promote acceptance of a clinical information system.

6.5 Performance Expectancy

Venkatesh et al. hypothesize that this construct is one of the main constructs in user acceptance and that it is salient across all stages of the acceptance process. For various reasons, already mentioned and related to the nature of the health care environment with its discrete professional categories and standard salary scales, the construct did not behave as the authors' hypothesized. Further, system implementation is often done in addition to other regular work activities, and it takes time to fully integrate a system into workflow. Nevertheless clinical utility is a key variable as suggested by "I find the Toolkit useful" having the highest correlation with behavioural intention. As well, interviewees often spoke to the utility of the Toolkit for communication with colleagues and patients, for improving patient care, and for implementing guideline based practice.

Proposition 7: Performance expectancy construct may be more salient in later stages of CDM Toolkit implementation once it is more fully integrated into the workflow and productivity and task accomplishment gains are more evident.

Moreover, the item on getting a raise should be eliminated, especially in Canadian and other similar jurisdictions, and perhaps replaced by an item that further captures clinical utility or measures the effect of other incentives such as new hardware, or time reserved for learning and integrating a system into workflow, or payment to attend learning sessions.

Proposition 8: The item on getting a raise in the performance expectancy construct has no validity in the context of CDM Toolkit implementation in the NHA.

Finally, items from the Attitude construct, which were answered with a similar interpretation as the items in performance expectancy may be more salient for expressing performance expectancy in this context. In particular, the item: "Using the system is a good idea" could be substituted for the item on getting a raise.

Proposition 9: The higher loading item from the Attitude construct on "Using the system is a good idea" may be useful for assessing performance expectancy with regards to the CDM Toolkit.

6.6 Effort Expectancy

Effort expectancy, as Venkatesh et al. suggest, appears to be mediated by users' experience with computers in general, as experienced users gave higher ratings to the items in this construct. Also, the constructs in self-efficacy, which should have no influence when effort expectancy is in the model, did seem to have an influence in this study, however, this effect could be spurious due to the small sample size. Nevertheless, it was suggested that the users related to the "task oriented" focus of the items in the self-efficacy construct, and further interpreted these items in terms of system efficacy vs. self-efficacy.

Proposition 10: Some items in the self-efficacy constructs were more salient in expressing effort expectancy with regards to the CDM Toolkit due to their focus on ease of task accomplishment.

6.7 Incentives

Incentives are important, particularly in the early stages of acceptance, and when there is substantial data entry involved. This may be relevant when system implementation is in addition to regular workload, as is often the case in health care IS implementation. Whether incentives are directly monetarily related through cash subsidies, or indirectly through other incentives such as additional help with data entry, provision of dedicated time to learn a system, payment to attend learning sessions, or hardware improvements, it is hypothesized that these will have an effect on acceptance.

Proposition 11: Direct or Indirect monetary incentives may have expedited CDM Toolkit use, particularly in the early stages of acceptance.

Moreover, some assessment of effect of incentive variables should be included in the UTAUT, specifically under the performance expectancy or facilitating conditions constructs.

Proposition 12: Future studies of technology acceptance, and other iterations of the model would benefit from addressing the role of incentives (other than raises) in technology acceptance.

6.8 Communication and Process Issues

Problems with communication and process issues were evident at the start of the Collaborative. A process issue arose with regards to acquiring certificates, where there was no clarity on who was responsible and how the process worked for non-physicians participating in the Collaborative. This resulted in delays in acquiring certificates and getting started with the Collaborative. Better communication could have occurred around confidentiality and the sharing of patients to ensure that everyone understood the process for sharing patients, particularly the physicians. As well, there was no communication or process to address critical hardware issues.

Proposition 13: A communication process for follow up and to action items needs to be in place prior to starting the training to address process around access, confidentiality, and general computer issues. Preferably, this would be someone involved with the Collaborative such as an IS trainer.

6.8 Conclusion

I suggest in this research, that models of technology acceptance derived from the general IS literature provided a sound evidence base, for the study of CDM Toolkit acceptance in the Collaborative. Further, I generate propositions that could have contributed further to the understanding of variables and constructs determining CDM Toolkit acceptance. I also propose that social influence was a key construct with regards to CDM Toolkit acceptance and that further study is needed to determine the extent of social influence in acceptance, and who are most influential, professional colleagues, other colleagues, or administrators. Further, social influence may be salient across all stages of adoption and acceptance. I suggest that items in the individual constructs and models need further investigation and refinement to make them more relevant to the environment under study. In addition, variables addressing the role of incentives would have been useful for understanding their role in acceptance of the CDM Toolkit. Finally, a multi-method approach to the study of user acceptance of the CDM Toolkit, and particularly interviews, helped to understand more clearly the influence of specific constructs and variables on acceptance.

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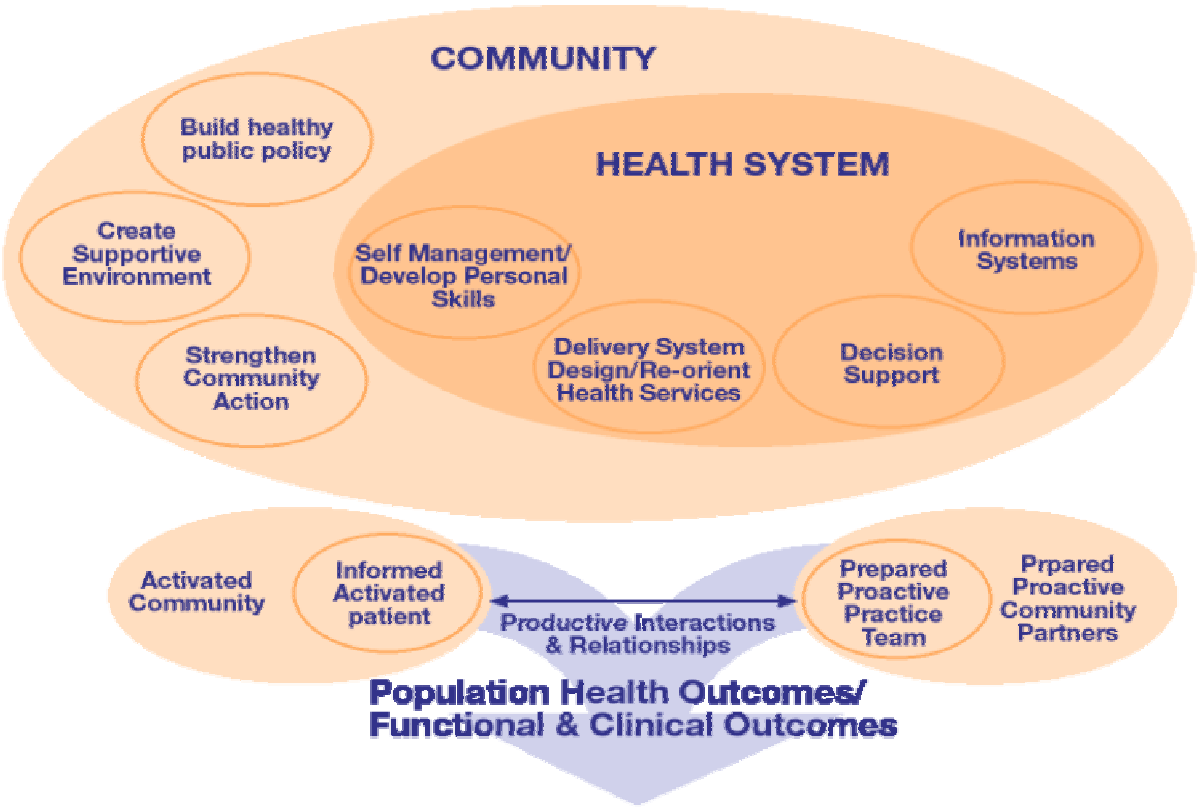
APPENDIX A: B.C. EXPANDED CHRONIC CARE MODEL

B.C.'s Expanded Chronic Care Model



Created by: Victoria Barr, Sylvia Robinson, brenda Marin-Link, Lisa Underhill, Anita Dotts & Darlene Ravensdale (2002)
Adapted from Glasgow, R., Orleans, C., Wagner, E., Curry, S., Solberg, L. (2001). Does the Chronic Care Model also serve as a template for improving prevention? The Milbank Quarterly, 79(4), *and* World Health Organization, Health and Welfare Canada and Canadian Public Health Association. (1986). Ottawa Charter of Health Promotion.

APPENDIX B: CONSENT FORM

An Action Research Investigation of Clinician Acceptanceof a Patient Registry System for Chronic Disease Management

You are being invited to participate in a study entitled: An Action Research Investigation of Clinician Adoption of a Patient Registry System for Chronic Disease Management Using the UTAUT model that is being conducted by Patricia Fortin who is a MSc Candidate in the School of Health Information Science at the University of Victoria. You may contact Patricia Fortin, Drs. Francis Lau and Malcolm Maclure, and Prof. Denis Protti if you have further questions by phone or e-mail: Patricia Fortin: pfortin@uvic.ca, 250-995-0251, Dr. Francis Lau: fylau@uvic.ca 250-721-8576, Dr. Malcolm Maclure: malcolmmaclure@shaw.ca 250-472-5132, Prof. Denis Protti: dprotti@uvic.ca, 250-721-8814.

As a graduate student, I am required to conduct research as part of the requirements for a degree in Health Informatics. It is being conducted under the supervision of Dr. Francis Lau. You may contact my supervisor at 250-721-8576.

The purpose of this research project is to answer the question: What variables are influencing clinician adoption of the CDM Toolkit in the Northern Health Authority Community Collaborative??

Research of this type is important because clinician adoption is a critical issue in health systems implementation. This research will add to the knowledge base on factors influencing clinician adoption.

You are being asked to participate in this study because you have agreed to participate in the Northern Health Authorities Community Collaborative and are learning how to use the CDM Toolkit.

If you agree to voluntarily participate in this research, your participation may include participating in an interview, which will require approximately 30 minutes of your time, and which will be audio recorded with your permission. Also you will be asked to respond to a questionnaire, which will require approximately 15 minutes of your time. In addition, the researcher will be observing and recording any identified problems or issues around the CDM Toolkit or general problems in using the Toolkit, as well as any feedback on the system provided to the researcher.

There are no known or anticipated risks to you by participating in this research.

Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. If you do withdraw from the study we will seek written permission to use any data you have provided.

Although you cannot be provided anonymity as the researcher will know your identity, your confidentiality and the confidentiality of the data will be protected by not using any data that may identify an individual or a team.

Data from this study will be disposed of after two year, or if publication should result, after 5 years. Once these minimum requirements for data retention have been met, paper will be shredded and electronic files deleted and audio recordings will be erased or destroyed.

It is anticipated that the results of this study will be shared with others in the following ways: thesis, conference presentations, and perhaps journal publication.

In addition to being able to contact the researcher and supervisors at the above phone numbers, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Associate Vice-President, Research at the University of Victoria (250-472-4362).

Your signature below indicates that you understand the above conditions of participation in this study and that you have had the opportunity to have your questions answered by the researchers.

_____	_____	_____
Name of Participant	*Signature*	*Date*

Your signature below indicates consent to be audio taped should you grant an interview to the researcher.

_____	_____	_____
Name of Participant	*Signature*	*Date*

A copy of this consent will be left with you, and a copy will be taken by the researcher.

APPENDIX C : SCREEN SHOT OF UTAUT SURVEY ONLINE

APPENDIX D: UTAUT SURVEY

Your cooperation in filling out this survey is greatly appreciated. It is an essential component of the research I am conducting on clinician acceptance of the CDM Toolkit. The Survey is a published, validated tool that has been standardized to capture user acceptance of technology. Please take a few moments to complete and fax back to Patricia Fortin at UVIC: 250-472-4751

Circle the number on the right which best describes how much you agree or disagree with each statement listed below	**Strongly Disagree**	Disagree	Somewhat Disagree	**Neutral**	Somewhat Agree	Agree	**Strongly Agree**
	1	2	3	4	5	6	7

1. I intend to use the CDM Toolkit in the next 12 months.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. I find CDM Toolkit useful in my job.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. My interaction with the CDM Toolkit is clear and understandable	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. People who influence my behaviour think that I should use the CDM Toolkit	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. I have the resources necessary to use the CDM Toolkit	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6. Although it might be helpful, using the CDM Toolkit is certainly not compulsory in my job	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I could complete a job or task using the system…							
7. If there was no one around to tell me what to do as I go	**1**	**2**	**3**	**4**	**5**	**6**	**7**
8. If I could call someone for help if I got stuck	**1**	**2**	**3**	**4**	**5**	**6**	**7**
9. If I had a lot of time to complete the job for which the software was provided	**1**	**2**	**3**	**4**	**5**	**6**	**7**
10. If I had just the built-in help facility for assistance	**1**	**2**	**3**	**4**	**5**	**6**	**7**
11. I feel apprehensive about using the system	**1**	**2**	**3**	**4**	**5**	**6**	**7**
12. Using the system is a bad idea	**1**	**2**	**3**	**4**	**5**	**6**	**7**

13. I predict I will use the CDM Toolkit in the next 12 months	**1**	**2**	**3**	**4**	**5**	**6**	**7**
14. Using the CDM Toolkit enables me to accomplish task asks more quickly.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
15. It is easy for me to become skilful at using the CDM Toolkit	**1**	**2**	**3**	**4**	**5**	**6**	**7**
16. People who are important to me think I should use the CDM Toolkit	**1**	**2**	**3**	**4**	**5**	**6**	**7**
17. I have the knowledge necessary to use the CDM Toolkit	**1**	**2**	**3**	**4**	**5**	**6**	**7**
18. My boss does not require me to use the CDM Toolkit	**1**	**2**	**3**	**4**	**5**	**6**	**7**
19. It scares me to think that I could lose a lot of information using the system by hitting the wrong key	**1**	**2**	**3**	**4**	**5**	**6**	**7**
20. Using the system is a good idea	**1**	**2**	**3**	**4**	**5**	**6**	**7**
21. I plan to use the CDM Toolkit in the next 12 months	**1**	**2**	**3**	**4**	**5**	**6**	**7**
22. Using the CDM Toolkit increases my productivity	**1**	**2**	**3**	**4**	**5**	**6**	**7**
23. I find the CDM Toolkit easy to use.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
24. The senior management of this collaborative has been helpful in the use of the CDM Toolkit	**1**	**2**	**3**	**4**	**5**	**6**	**7**
25. The system is not compatible with other systems I use.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
26. My superiors expect me to use the CDM Toolkit	**1**	**2**	**3**	**4**	**5**	**6**	**7**
27. I hesitate to use the system for fear of making mistakes I cannot correct	**1**	**2**	**3**	**4**	**5**	**6**	**7**
28. The system makes work more interesting	**1**	**2**	**3**	**4**	**5**	**6**	**7**
29. If I use the CDM Toolkit I will increase my chances of getting a raise.	**1**	**2**	**3**	**4**	**5**	**6**	**7**
30. Learning to operate the CDM Toolkit is easy for me	**1**	**2**	**3**	**4**	**5**	**6**	**7**
31. In general, the organization has supported the use of the CDM Toolkit	**1**	**2**	**3**	**4**	**5**	**6**	**7**
32. A specific person (or group) is available for	**1**	**2**	**3**	**4**	**5**	**6**	**7**

assistance with system difficulties							
33. Working with the system is fun	**1**	**2**	**3**	**4**	**5**	**6**	**7**
34. The system is somewhat intimidating to me	**1**	**2**	**3**	**4**	**5**	**6**	**7**
35. I like working with the system	**1**	**2**	**3**	**4**	**5**	**6**	**7**
On a scale of 1 (never used) to 7 (I am an expert user), my level of usage of the toolkit is:	**1**	**2**	**3**	**4**	**5**	**6**	**7**

Gender:

____ Male

____ Female

Age:

____ 18-24 yrs

____25-34 yrs

____35-44 yrs

____45-54 yrs

____55-64 yrs

____65+yrs

Occupation: (physician, nurse, moa, dietician, etc.)

_____

APPENDIX E: ITEM FREQUENCIES AND CORRELATIONS WITH BEHAVIOURAL INTENTION

Constructs and Variables	*1* # %	*2* # %	*3* # %	*4* # %	*5* # %	*6* # %	*7* # %	*Correlation with Behabioural Intention*
BEHAVIOURAL INTENTION								
I intend to use the Toolkit in the next 12 months	1 5.9	0 0	0 0	0 0	2 11.8	2 11.8	12 70.6	
I predict I will use the Toolkit in the next 12 months	1 5.9	0 0	0 0	1 5.9	2 11.8	1 5.9	12 70.6	
I plan to use the toolkit in the next 12 months	1 5.9	0 0	0 0	0 0	3 17.6	1 5.9	12 70.6	
PERFORMANCE EXPECTANCY								**.176**
I find CDM Toolkit useful in my job	1 5.9	0 0	0 0	3 17.6	5 29.4	2 11.8	6 35.3	**.800**
Using the CDM Toolkit increases my productivity	0 0	0 0	0 0	3 17.6	5 29.4	5 29.4	4 23.5	**.037**
Using the CDM Toolkit enables me to accomplish task asks more quickly.	1 5.9	1 5.9	2 11.8	3 17.6	3 17.6	3 17.6	4 23.5	**-.166**
If I use the CDM Toolkit I will increase my chances of getting a raise.	12 70.6	0	2 11.8	3 17.6	0 0	0 0	0 0	**-.408**
EFFORT EXPECTANCY								**.275**
I find the CDM Toolkit easy to use.	0 0	0 0	1 5.9	3 17.6	3 17.6	3 17.6	7 41.2	**.281**
Learning to operate the CDM Toolkit is easy for me	0 0	1 5.9	0 0	3 17.6	5 29.4	3 17.6	5 29.4	**.246**
It is easy for me to become skilful at using the CDM Toolkit	0 0	0 0	1 5.9	3 17.6	2 11.8	5 29.4	6 35,3	**.219**
My interaction with the system is clear and understandable	0 0	0 0	0 0	2 11.8	4 23.5	8 47.1	3 17.6	**.139**

FACILITATING CONDITIONS								**.300**
The system is not compatible with other systems I use	5 29.4	3 17.6	0 0	2 11.8	4 23.5	2 11.8	1 5.9	**.283**
I have the knowledge necessary to use the CDM Toolkit	0 0	0 0	1 5.9	0 0	5 29.4	2 11.8	9 52.9	**.148**
I have the resources necessary to use the CDM Toolkit	1 5.9	0 0	0 0	1 5.9	4 23.5	5 29.4	6 35.3	**.092**
A specific person (or group) is available for assistance with system difficulties	0 0	1 5.9	0 0	4 23.5	0 0	6 35.3	6 35.3	**.082**

SOCIAL INFLUENCE								**.562**
People who influence my behaviour think that I should use the CDM Toolkit	1 5.9	1 5.9	0 0	2 11.8	4 23.5	3 17.6	6 35.3	**.696**
People who are important to me think I should use the CDM Toolkit	1 5.9	1 5.9	0 0	4 23.5	1 5.9	6 35.3	4 23.5	**.511**
The senior management of this collaborative has been helpful in the use of the CDM Toolkit	0 0	0 0	0 0	1 5.9	4 23.5	7 41.2	5 29.4	**.219**
In general, the organization has supported the use of the CDM Toolkit	1 5.9	0 0	1 5.9	0 0	3 17.6	7 41.2	5 29.4	**.078**

SELF-EFFICACY								**.319**
I could complete a job or task using the system If I had a lot of time to complete the job for which the software was provided	2 11.8	0 0	1 5.9	4 23.5	3 17.6	4 23.5	3 17.6	**.326**
I could complete a job or task using the system If I had just the built-in help facility for assistance	0 0	1 5.9	6 35.3	5 29.4	2 11.8	1 5.9	2 11.8	**.180**
I could complete a job or task using the system If I could call someone for help if I got stuck	0 0	0 0	0 0	2 11.8	3 17.6	5 29.4	7 41.2	**.126**
I could complete a job or task using the system If there was no one around to tell me what to do as I go	0 0	0 0	2 11.8	3 17.6	1 5.9	4 3.5	7 41.2	**.074**

ATTITUDE								**.083**
Using the system is a good idea	0 0	0 0	0 0	0 0	3 17.6	6 35.3	8 47.1	**.372**
I like working with the system	0 0	0 0	0 0	1 5.9	8 47.1	3 17.6	5 29.4	**.224**
Using the system is a bad idea	15 88.2	1 5.9	1 5.9	0 0	0 0	0 0	0 0	**.048**
The system makes work more interesting	1 5.9	0 0	0 0	6 35.3	6 35.3	1 5.9	3 17.6	**-.081**
Working with the system is fun	0 0	0 0	2 11.8	7 41.2	5 29.4	1 5.9	2 11.8	**-.054**

ANXIETY								**-.008**
It scares me to think that I could lose a lot of information using the system by hitting the wrong key	8 47.1	4 23.5	0 0	2 11.8	2 11.8	0 0	1 5.9	**.200**
I feel apprehensive about using the system	8 47.1	5 29.4	1 5.9	2 11.8	0 0	0 0	1 5.9	**.063**
The system is somewhat intimidating to me	5 29.4	6 35.3	2 11.8	1 5.9	2 11.8	1 5.9	0 0	**-.070**
I hesitate to use the system for fear of making mistakes I cannot correct	8 47.1	5 29.4	2 11.8	0 0	1 5.9	0 0	0 0	**-.238**

APPENDIX F: THE CHRONIC DISEASE MANAGEMENT (CDM) TOOLIT: SYSTEM DESCRIPTION

Introduction

The CDM Toolkit originated in the Vancouver Island Health Authority, where the system prototype was developed to support a chronic disease management collaborative of approximately 30 doctors and the project management team. The system was designed as a patient registry system to capture baseline data and measurements relevant to the management of three chronic diseases: diabetes, congestive heart failure, and depression. The system is extensible and can accommodate for the management of any chronic disease, and has since been extended to include kidney diseases, asthma, and hypertension.

The prototype was eventually transferred to the Ministry of Health (MOH). The MOH further enhanced the development of the system and made it available province-wide on their website.

The system is web-based and developed on an Oracle DBMS. In order to access the Toolkit users require:

- A computer with a reliable connection to the internet.
- Microsoft Internet Explorer 5.5 or higher with 128-bit encryption ability (Cipher Strength).
- Adobe Acrobat Reader 5.01 or newer.
- A screen capable of 800x600 resolutions.
- A username, password, and certificate assigned by Healthnet Access Services.

To make full use of the system, users need to have the following:

- A screen capable to 1024x768 resolutions.
- A printer (laser or inkjet).

The Toolkit operates as a probabilistic register. When doctors register to use the Toolkit, the patient registry is populated with the doctor's patients from a logarithm that combines msp and/or pharmacare data to determine which of the doctors' patients have the diseases being monitored based on ICD coding and medications.

The doctor (or MOA or other office nurse, assistant) goes through the register to remove or add patients and to ensure that the patients have the proper diagnosis. From there, a chart audit is done and baseline data is input based on the date on which the last indicator or measurement was done. It is at this point that guideline based management of the patient's chronic disease can begin.

Toolkit Security

The CDM Toolkit is a secure Internet-based information system. The toolkit contains patient specific clinical data, and in order to protect this data from being accessed by unauthorized users, the Toolkit employs a 2-factor security model.

Users are "authenticated" through this 2-factor security model. The 2 factors are: a digital certificate that identifies the organization, and a user ID and password. Constraints apply to this model as follows:

- Every user ID is attached to an Organization.
- Every Organization has a digital certificate that must be installed in the user's web browser for the user to be able to login (the certificate organization ID and the first part of the user ID must match).

Toolkit access ensures that the connection to the Toolkit is secure so that data transmitted between a user and the Toolkit are protected, and that the user is properly identified, then authenticated. The secure connection is established using 128-bit encryption between a users' web browser and the CDM Toolkit website.

Restricted access to patient-level data means that users can only see data for patients they are allowed to see. This includes a Most Responsible Provider (MRP) being able to see their patients, as well as any users being able to see patients who they have been granted access to by an MRP.

The following scenario extracted from an MOH document for users of the Toolkit, describes how certificates are set up and how users are granted access. (ref Word document Understanding Toolkit Security)

> *Jane Doe works for Dr. John Smith. Dr. Smith applied for Jane and himself to have access to the CDM Toolkit. Dr. Smith was assigned the organization id 1000, and Jane and John were assigned user names 1000-jdoe, and 1000-jsmith.*
> *The digital certificate identifying Dr Smith's Organization 1000 was installed on both Jane's and John's computers. Both of their computers have web browsers capable of secure connections installed (e.g. Internet Explorer v6.0).*
> *When Jane wants to login to the CDM Toolkit she opens her web browser and goes to https://healthregistry.moh.hnet.bc.ca. The web site asks for identification, and Jane selects her Organization's certificate (the certificate for Dr Smith's Organization 1000) and clicks OK. The login screen appears, and Jane enters her user id (1000-jdoe),her password and clicks "Sign in".*
> *Jane selects Chronic Disease Management and is taken into the CDM Toolkit.*

The second piece of the CDM Toolkit is patient level access. Since Jane is a delegate of Dr. Smith, she cannot have any patients of her own. Therefore Dr. Smith must grant her access to his patients, if she is going to be able to see any patient-level data for those patients.

> *As Jane logs into the CDM Toolkit she finds that she cannot see any patient information; so she asks Dr. Smith to grant her access to his patients.*
> *Dr. Smith logs into the CDM Toolkit using his digital certificate, user ID and password. He then clicks on Grant Access to Patient Records. On the right he clicks on Grant Full Access. He then highlights Doe, Jane in the list and clicks Select so she is on the right under Selected Users. Dr. Smith then clicks Grant Access at the bottom to allow Jane Full access to his patient list.*
> *Jane then clicks on Patient List / Maintain Patient Records, and she can see all of Dr. Smith's patients on her Shared Patients list.*

Jane also works part-time for Dr. Ken Jones. He also has applied for the CDM Toolkit and has been assigned the organization ID 2000. His user name is 2000-kjones. He also logs in with his own certificate, user ID and password, and grants full access to Jane.
Jane can now log in with her certificate (organization ID 1000, user ID 1000-jdoe) and she sees both Dr. Jones's and Dr. Smith's patients on her Shared Patients list. Since Drs. Jones and Smith have not granted access to each other, they cannot see each others' patients.

Other interesting facts about this example:

- Jane could login on Dr. Smith's computer because the certificate is the same.
- Jane could install Dr. Smith's certificate on Dr. Jones's computer; then she could access the CDM Toolkit from Dr. Jones's office provided she selects Dr. Smith's certificate when asked. Even though Dr. Jones could select Dr. Smith's certificate, he couldn't login as Dr. Smith because his user ID only works under his own certificate.
- Jane can add and remove patients for both doctors since they have granted her full access.

The example above illustrates the general principles of the CDM Toolkit security:

- Users are authenticated by a certificate, user ID and password.
- Users must login using the certificate that corresponds to their user ID.
- Once successfully logged in, users have access to any patients to whom they have been granted access, regardless of the MRP's organization ID.
- Users can login from any computer that has the correct certificate installed (the correct certificate is the certificate that corresponds to the user's Organization ID).
- Multiple certificates can be installed on a single computer, so users from different Organizations can log in to the Toolkit using their own user IDs and certificates.
- Multiple users of the same organization can login from the same computer using the same certificate. (Ref: Understanding Toolkit Security)

Toolkit Functions/Operations

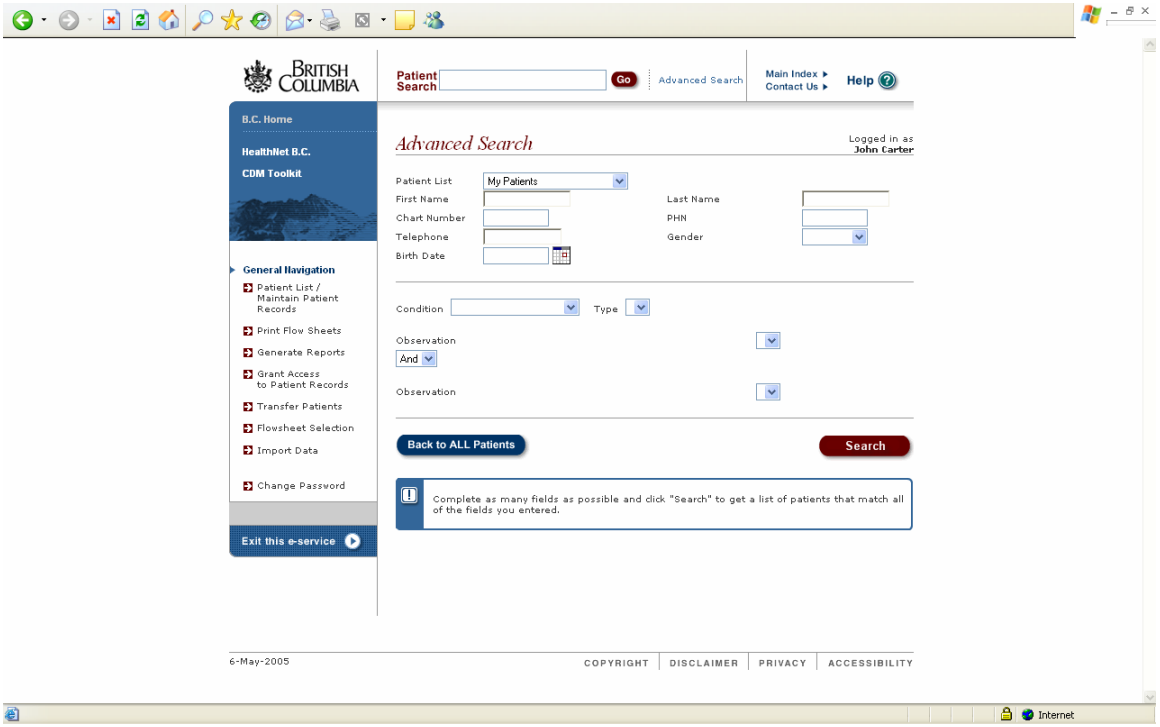
Once the user has installed their digital certificate and have signed in, they can start viewing, inputting, changing or updating patient data in the Toolkit. The user can also view and print flow sheets, as well as run and print reports. This section provides a description of Toolkit functions.

Patient Management:

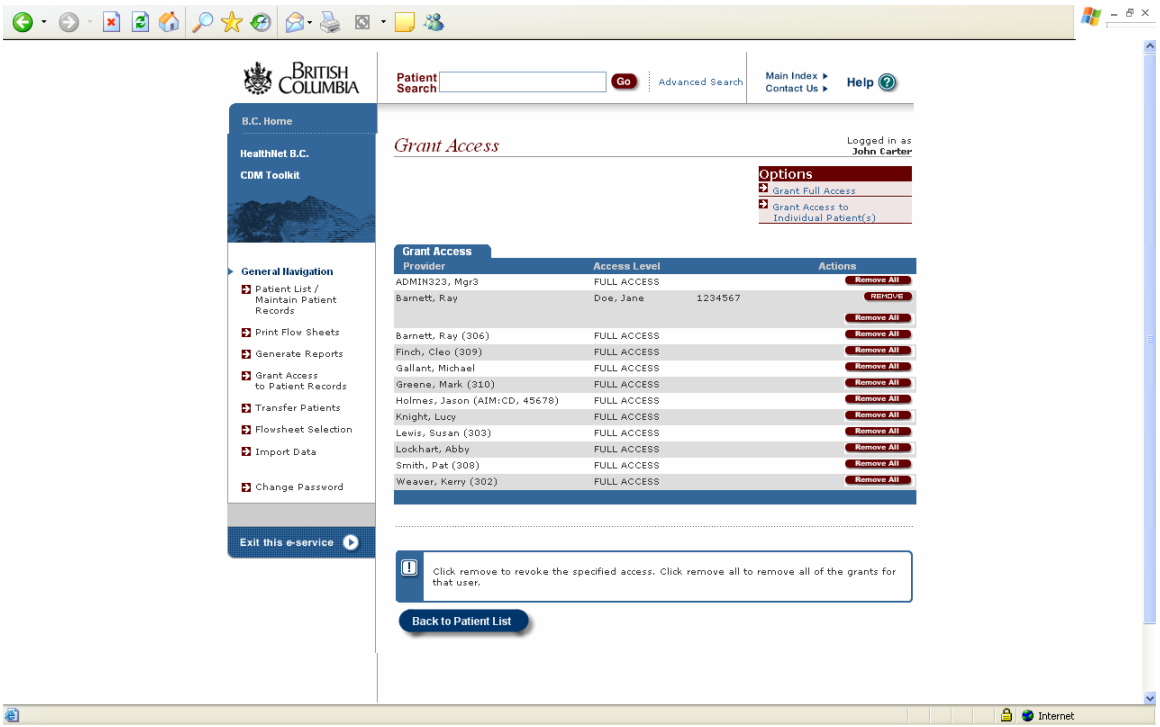
Patient management functions include searching for a patient, granting access or sharing patients, and transferring patients.

Searching for patients is done through the built in **search engine**, and patients can be searched on their PHN, last name, or first name. In advanced search options, clinical indicators can be input to

focus the search on a patient or group of patients with specific indicators (i.e. HA1C >7). Patients can also be viewed through the screen display, which allows a screen listing of 10-50 patients in alphabetical order. Finally, typing in the first few letters of the last name in the navigation bar with retrieve all the patients in the practice with these parameters.



A doctor can grant access to his patients to other health care providers including other doctors, MOA's, and other clinicians (nurses, diabetic educators, nutritionists, etc.) who assist with management of the patient. Full access can be granted, which gives access to the entire roster of patients, or the provider can grant access to individual patients only. Only MRPs are allowed to grant access.



Patients can also be transferred to other doctors, and again, this function can only be performed by the MRP. A patient is not transferred until the accepting doctor actually clicks on the "Accept" button. Similarly, a physician can refuse to accept a patient transfer.

Patient Data:

All data entry and management functions are performed through the Patient List/Maintain Patient Records link on the navigation bar in the main menu screen.

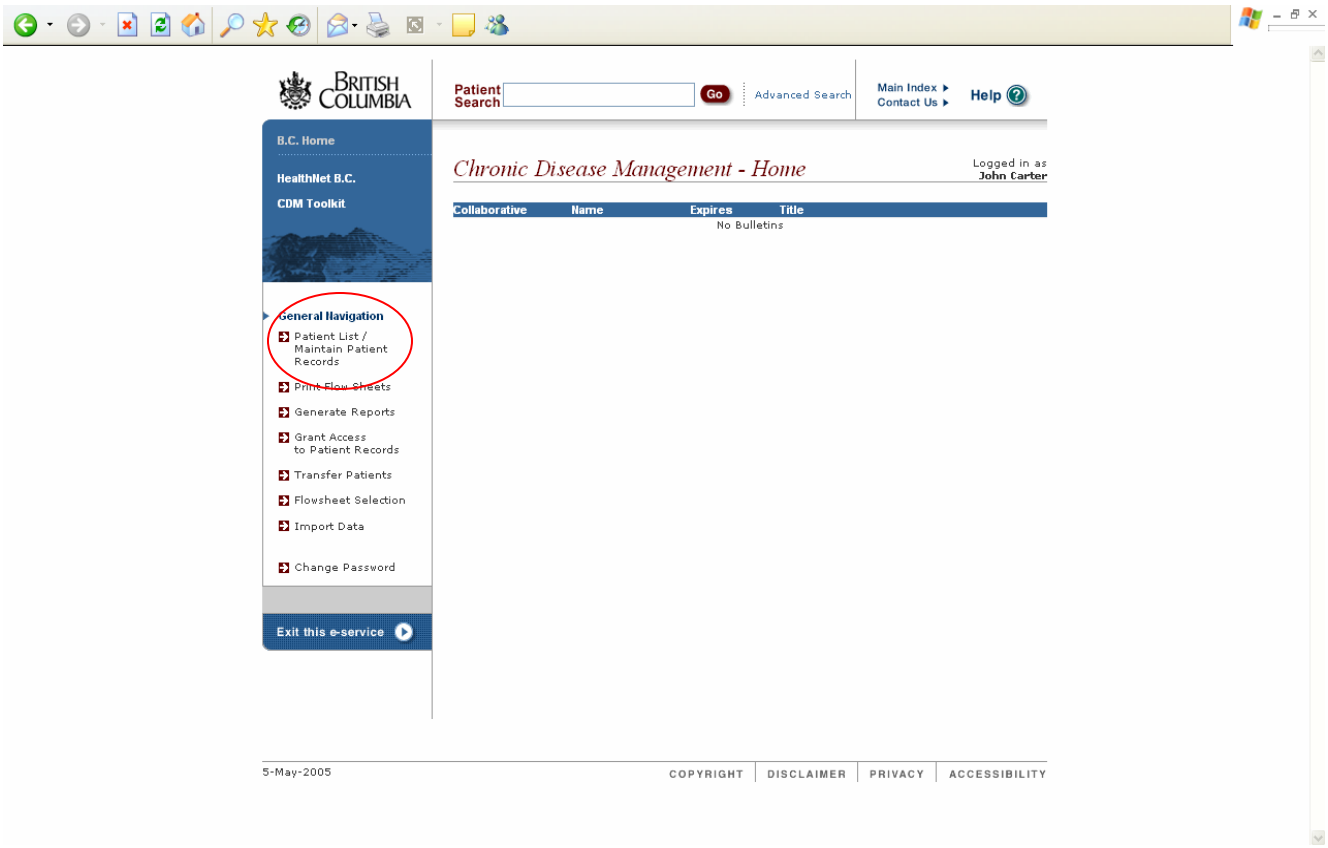


Figure 1: Main Menu Screen

From the patient list/maintain patient record menu all data maintenance activities take place. The data maintenance activities include:

1. Adding a new patient. This is done when the patient's name does not appear in the initial registry populations and/or a new patient is being added to participate in the Collaborative. As well, if a patient declines to participate, or does not belong to the doctor, the patient can be removed from the list, simply by clicking "remove"
2. Adding Baseline Data: From the drop down menu choose **Add Baseline Data**, which is the first step in data entry in the Toolkit. Baseline data is obtained from the patient chart (electronic or paper) and includes the date of the last measurement pertaining to the disease in question was taken. This may be the last time a blood pressure was done on a patient or the last time a patient A1C was done on the patient. In order to add baseline data, one just clicks on the patient name and then a blank flow sheet appears, and data entry can begin.

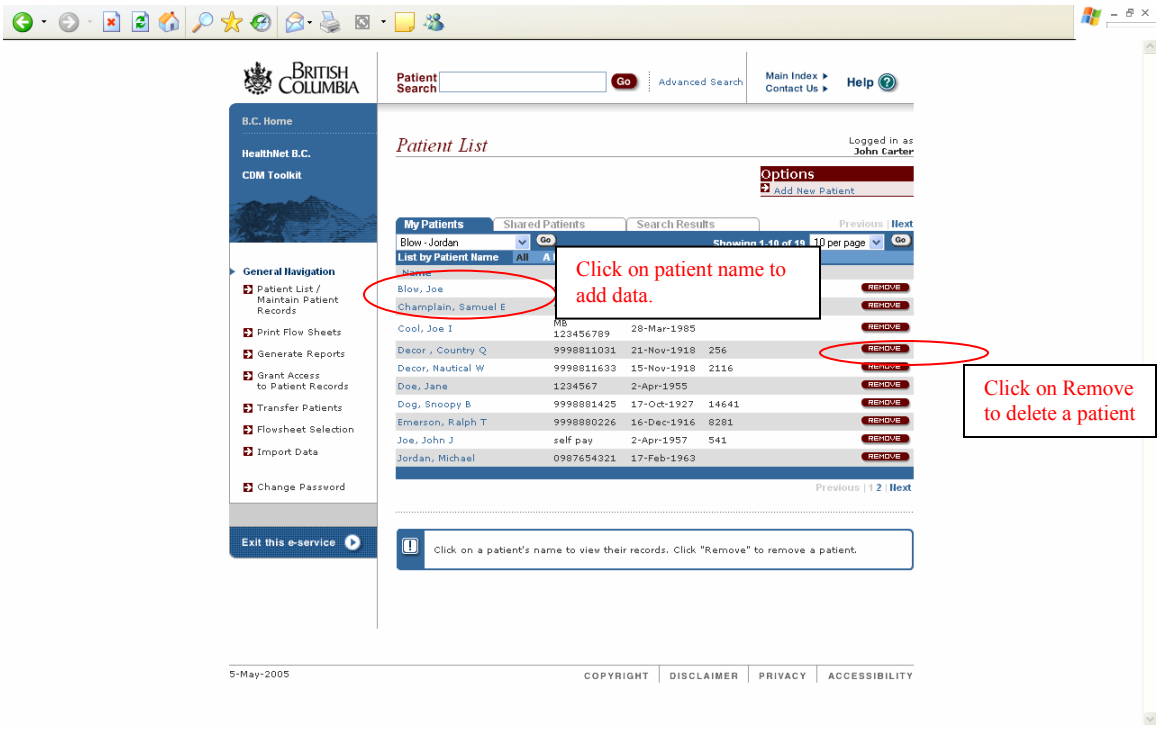


Figure 2: Patient List

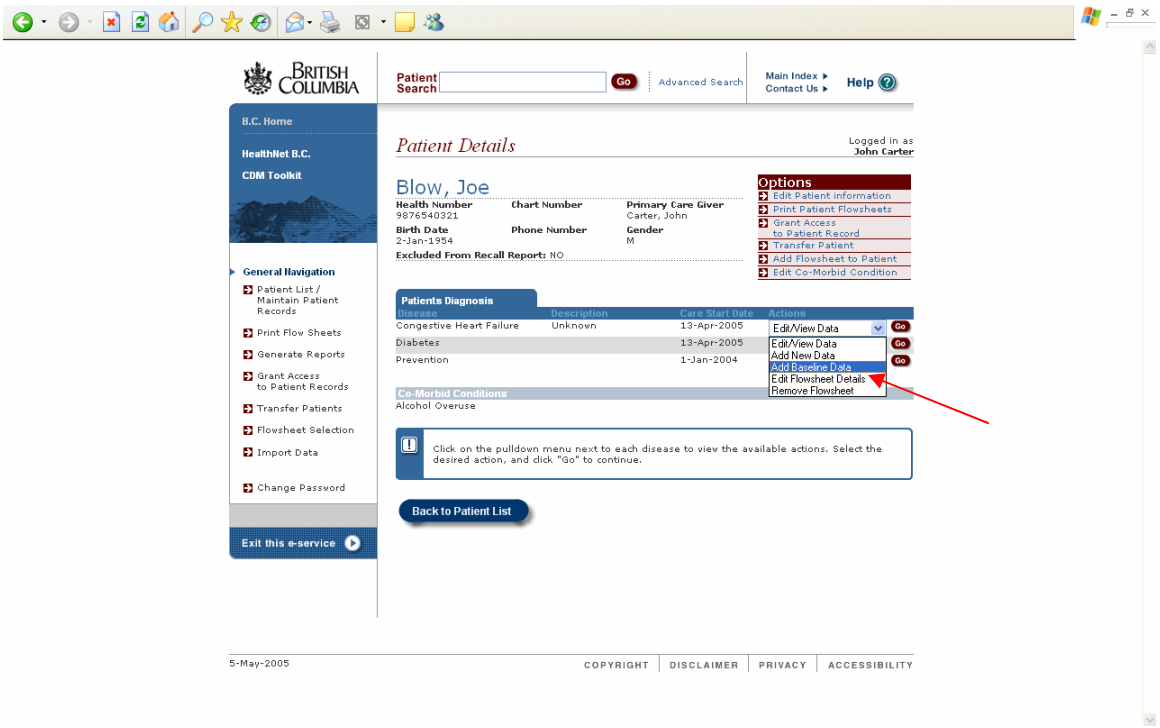


Figure 3: Add Baseline Data

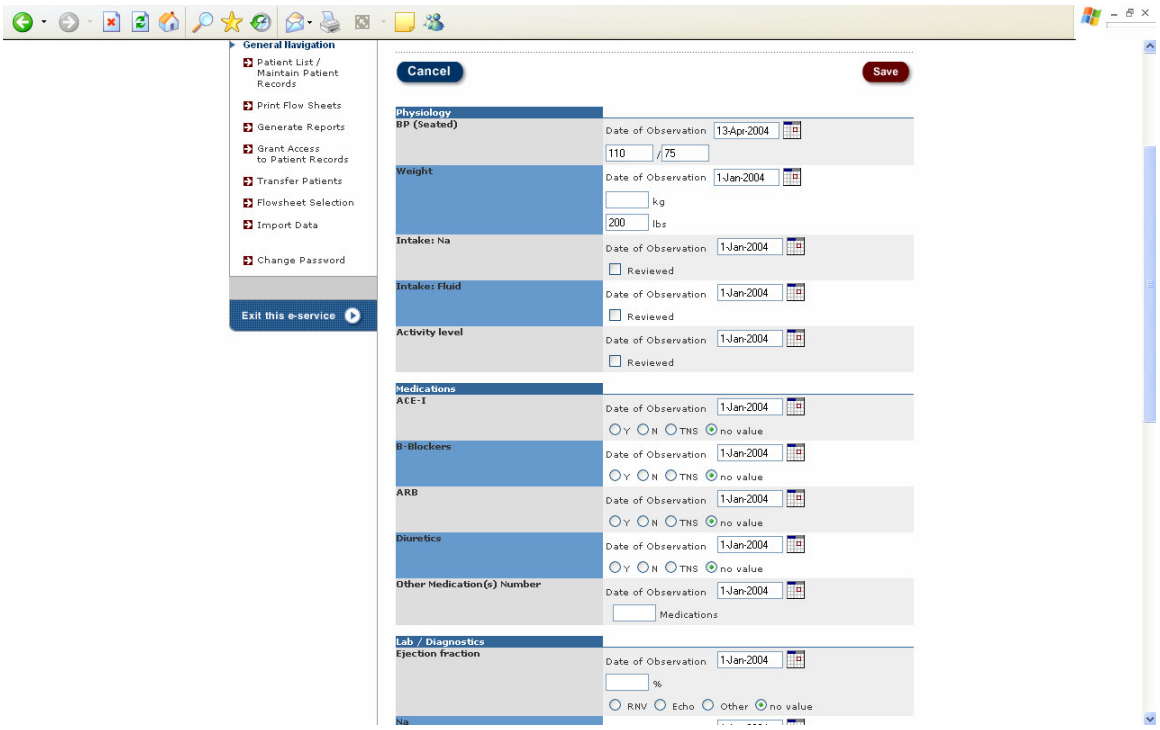


Figure 4: Flow sheet with baseline data added

In addition to adding baseline data, the patient data can also be viewed, edited, or updated as new patient data is available from recent visits to the doctor. Once new data is added, the flow sheet displays a column with the dates of when the most recent data were added. In this way, a clinicians can determine if another BP or other type of measurement is due.

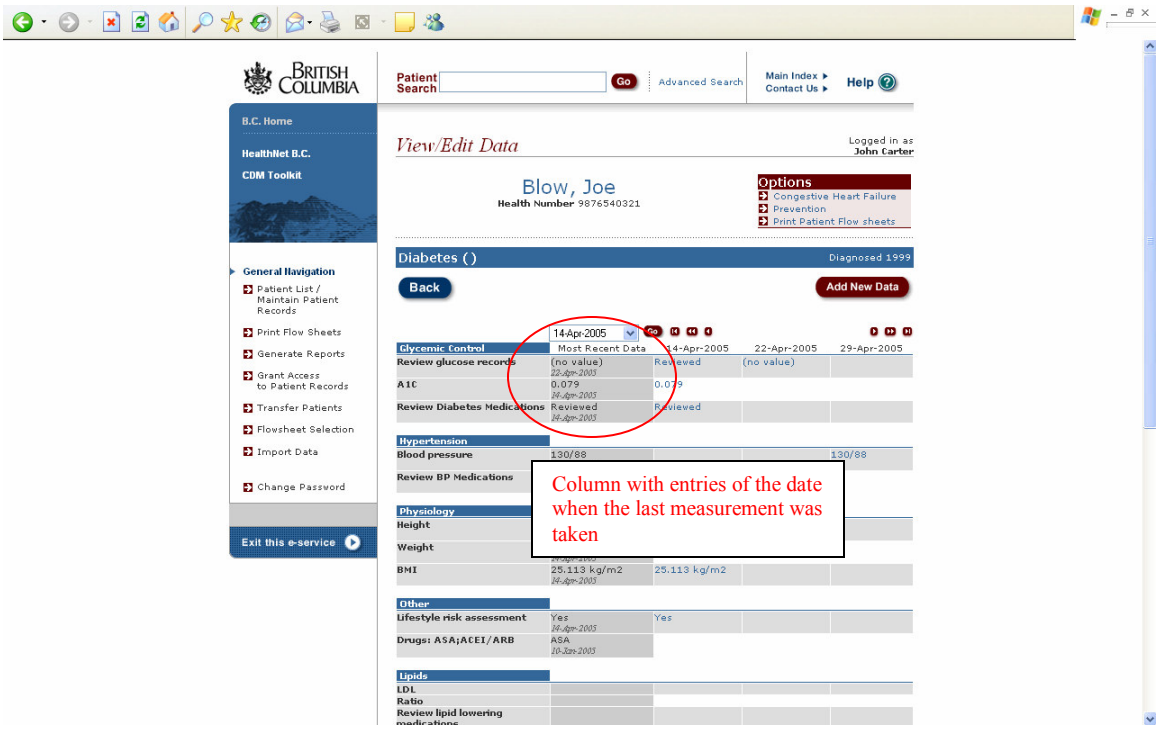


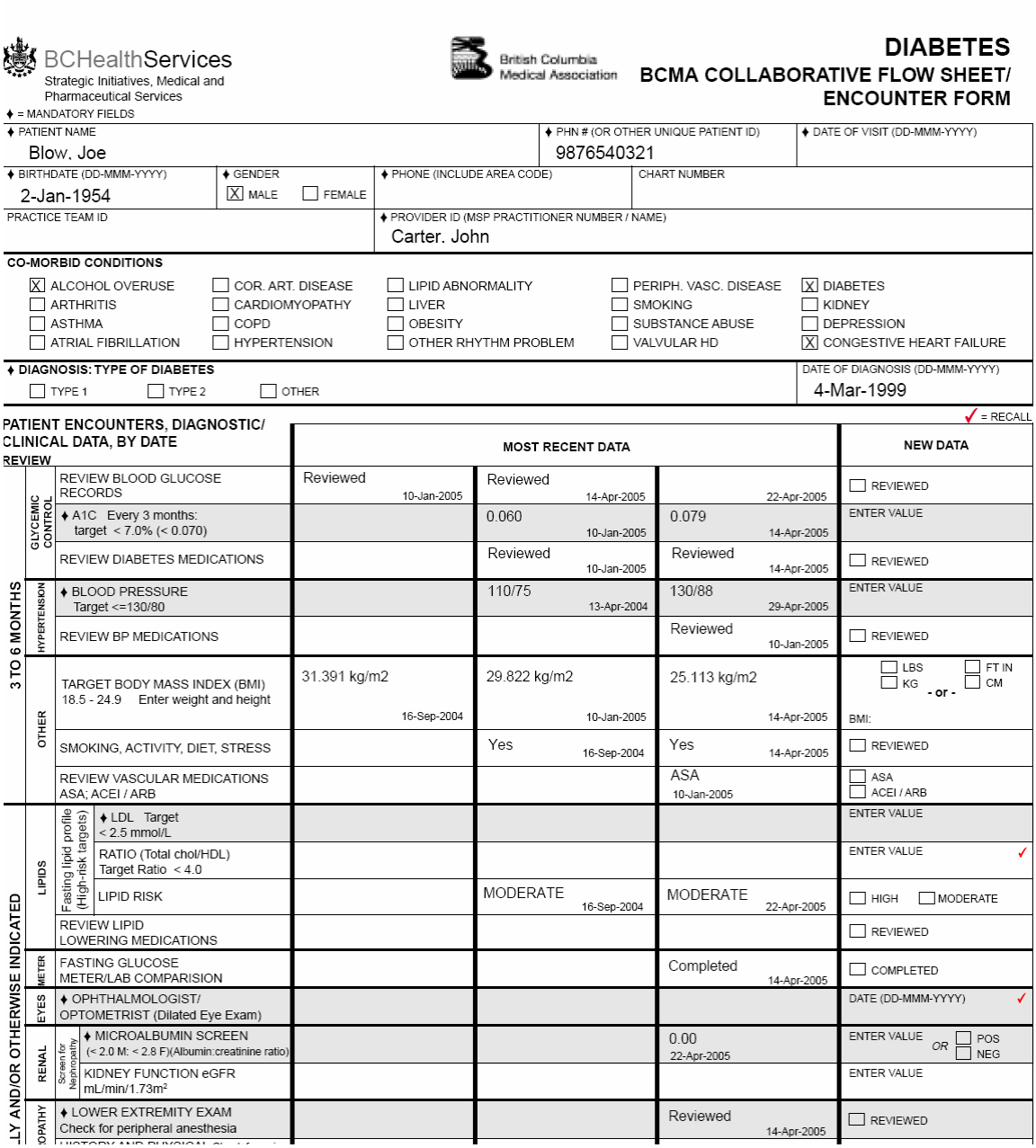
Figure 5: View Patient Data

Flow Sheets

Once patient data has been added, the flow sheets can be viewed and or printed out for the doctor to add data manually, and or to be inserted into the patient chart until the next encounter when new data is added.

There are varying procedures around the use of the patient Flow Sheet. Offices with manual charts tend to print out the flow sheet and insert it into the patient chart. Offices that have electronic health records (EHR) in place can download into the EHR, the data entered into the Toolkit or upload from an EHR to Toolkit.

Whatever the procedure used, the flow sheet provides a convenient way of viewing all clinical data on a specific patient, and to see what needs to be updated.



BCHealthServices
Strategic Initiatives, Medical and Pharmaceutical Services

British Columbia Medical Association

DIABETES
BCMA COLLABORATIVE FLOW SHEET/ ENCOUNTER FORM

♦ = MANDATORY FIELDS

♦ PATIENT NAME	♦ PHN # (OR OTHER UNIQUE PATIENT ID)	♦ DATE OF VISIT (DD-MMM-YYYY)
Blow, Joe	9876540321	

♦ BIRTHDATE (DD-MMM-YYYY)	♦ GENDER	♦ PHONE (INCLUDE AREA CODE)	CHART NUMBER
2-Jan-1954	☒ MALE ☐ FEMALE		

PRACTICE TEAM ID	♦ PROVIDER ID (MSP PRACTITIONER NUMBER / NAME)
	Carter. John

CO-MORBID CONDITIONS

☒ ALCOHOL OVERUSE	☐ COR. ART. DISEASE	☐ LIPID ABNORMALITY	☐ PERIPH. VASC. DISEASE	☒ DIABETES
☐ ARTHRITIS	☐ CARDIOMYOPATHY	☐ LIVER	☐ SMOKING	☐ KIDNEY
☐ ASTHMA	☐ COPD	☐ OBESITY	☐ SUBSTANCE ABUSE	☐ DEPRESSION
☐ ATRIAL FIBRILLATION	☐ HYPERTENSION	☐ OTHER RHYTHM PROBLEM	☐ VALVULAR HD	☒ CONGESTIVE HEART FAILURE

♦ DIAGNOSIS: TYPE OF DIABETES	DATE OF DIAGNOSIS (DD-MMM-YYYY)
☐ TYPE 1 ☐ TYPE 2 ☐ OTHER	4-Mar-1999

✓ = RECALL

PATIENT ENCOUNTERS, DIAGNOSTIC/ CLINICAL DATA, BY DATE REVIEW			MOST RECENT DATA			NEW DATA
3 TO 6 MONTHS	GLYCEMIC CONTROL	REVIEW BLOOD GLUCOSE RECORDS	Reviewed 10-Jan-2005	Reviewed 14-Apr-2005	22-Apr-2005	☐ REVIEWED
		♦ A1C Every 3 months: target < 7.0% (< 0.070)		0.060 10-Jan-2005	0.079 14-Apr-2005	ENTER VALUE
		REVIEW DIABETES MEDICATIONS		Reviewed 10-Jan-2005	Reviewed 14-Apr-2005	☐ REVIEWED
	HYPERTENSION	♦ BLOOD PRESSURE Target <=130/80		110/75 13-Apr-2004	130/88 29-Apr-2005	ENTER VALUE
		REVIEW BP MEDICATIONS			Reviewed 10-Jan-2005	☐ REVIEWED
	OTHER	TARGET BODY MASS INDEX (BMI) 18.5 - 24.9 Enter weight and height	31.391 kg/m2 16-Sep-2004	29.822 kg/m2 10-Jan-2005	25.113 kg/m2 14-Apr-2005	☐ LBS ☐ FT IN ☐ KG ☐ CM - or - BMI:
		SMOKING, ACTIVITY, DIET, STRESS		Yes 16-Sep-2004	Yes 14-Apr-2005	☐ REVIEWED
		REVIEW VASCULAR MEDICATIONS ASA; ACEI / ARB			ASA 10-Jan-2005	☐ ASA ☐ ACEI / ARB
ALL AND/OR OTHERWISE INDICATED	LIPIDS	Fasting lipid profile (High-risk targets) ♦ LDL Target < 2.5 mmol/L				ENTER VALUE
		Fasting lipid profile (High-risk targets) RATIO (Total chol/HDL) Target Ratio < 4.0				ENTER VALUE ✓
		Fasting lipid profile (High-risk targets) LIPID RISK		MODERATE 16-Sep-2004	MODERATE 22-Apr-2005	☐ HIGH ☐ MODERATE
		REVIEW LIPID LOWERING MEDICATIONS				☐ REVIEWED
	METER	FASTING GLUCOSE METER/LAB COMPARISION			Completed 14-Apr-2005	☐ COMPLETED
	EYES	♦ OPHTHALMOLOGIST/ OPTOMETRIST (Dilated Eye Exam)				DATE (DD-MMM-YYYY) ✓
	RENAL	Screen for Nephropathy ♦ MICROALBUMIN SCREEN (< 2.0 M: < 2.8 F)(Albumin:creatinine ratio)			0.00 22-Apr-2005	ENTER VALUE OR ☐ POS ☐ NEG
		Screen for Nephropathy KIDNEY FUNCTION eGFR mL/min/1.73m²				ENTER VALUE
	OPATHY	♦ LOWER EXTREMITY EXAM Check for peripheral anesthesia			Reviewed 14-Apr-2005	☐ REVIEWED

Figure 6: Patient Flow Sheet/Encounter Form

Reports

One of the main advantages and functionalities of the Toolkit, is the ability to generate a variety of reports to assist with practice management of the Doctors' patients with chronic diseases. Currently there are nine report types available in the Toolkit and most reports are generated as a PDF file in Adobe Acrobat.

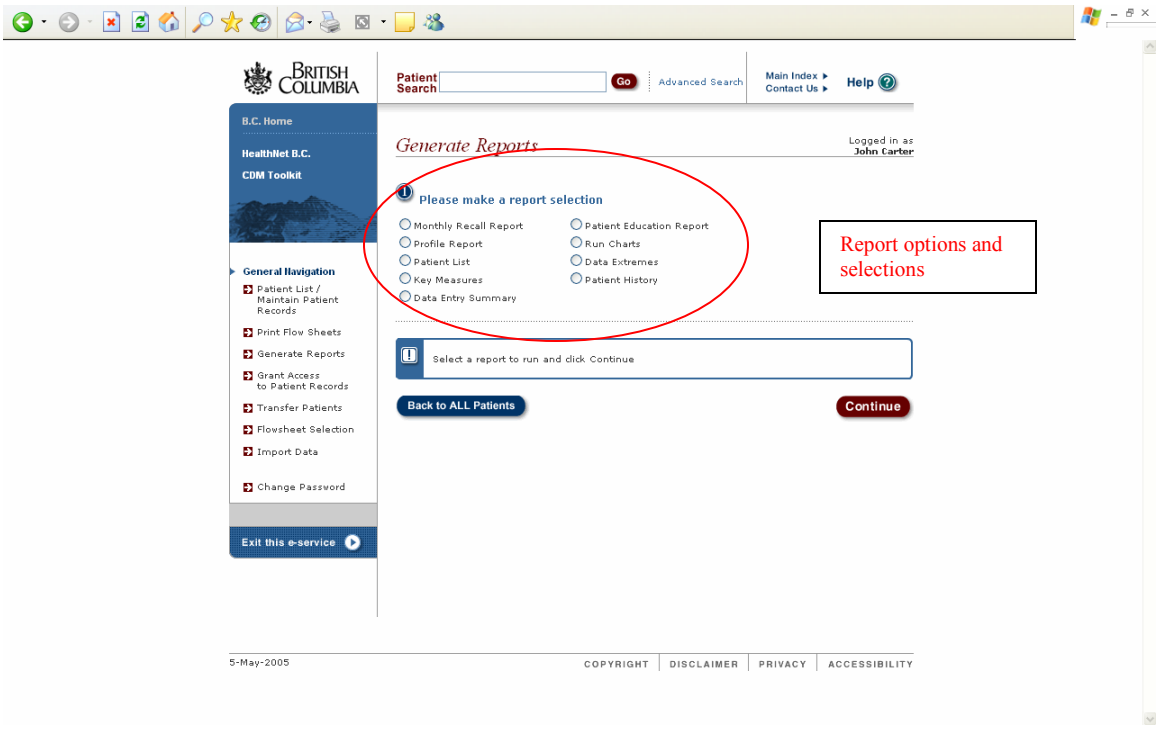


Figure 7: Reports Screen

Report type in the Toolkit include the following:

1. **Monthly Recall**: The Monthly Recall Report produces a list of patients that are due to be called in for a visit based on the guidelines. For example, any patients that should have an HbA1C test every 6 months, will appear in the Recall Report for HbA1C 4 months after their most recent test, allowing 2 months to book appointments. This report consists of patient names, and an indication of which observation(s) are due to be recorded for each.

BRITISH COLUMBIA

RECALL REPORT

CARTER, JOHN
05-MAY-2005 14:20

Diabetes

Patient		6 MON	BP	FLUV	A1C	SM	LRAT	MICRO	EE	LEE
Blow, Joe				X			X		X	
Champlain, Samuel				X	3	X	X	X	X	X
Cool, Joe			X				X	X	X	X
Decor , Country			3	X	X	X	X	X	X	X
Decor, Nautical				X	X	X	X	X	X	X
Doe, Jane			X	X	0		X	X	X	
Dog, Snoopy			X	X	X	X	X	X	X	X
Joe, John	555-5555			X	2		X	X	X	
Jordan, Michael	555-1212		2		2	X	X	X	X	X
Jordan, Mike				X		X	X	X	X	X
Mantel, Mickey	555-1234		2	X	X	X	X	X	X	X
Smith, Ben	250-555-5555			X	X	X	X	X	X	X
Stooge, Larry		X	X	X	X	X	X	X	X	X
smith, jo		X	X	X	X	X	X	X	X	X
thompson, garfield		X	X	X	X	X	X	X	X	X

A number indicates the months until the patient is due to be recalled; "X" indicates that the patient is overdue for a recall.

6 MON - Recent Visit

"X" indicates the patient has not been in for a visit in over 6 months.

BP - Systolic blood pressure

"X" indicates a patient has not had their Blood Pressure recorded in over 6 months and is due to be recalled to have it checked. A number indicates the months until an upcoming recall is due.

FLUV - Annual influenza vaccine

"X" indicates a patient has not had a Flu shot in over 12 months and is due to be recalled for one. A number indicates the months until an upcoming recall is due.

A1C

"X" indicates a patient has not had a A1C test in over 6 months and is due to be recalled for one. A number indicates the months until an upcoming recall is due.

SM - Self-management (Diabetes)

"X" indicates a patient has not had a specific visit for self-management of diabetes in over 12 months and is due to be recalled for one. A number indicates the months until an upcoming recall is due.

LRAT - Lipid Ratio

"X" indicates a patient has not had their Chol/HDL ratio recorded in over 12 months and is due to be recalled to have it checked. A number indicates the months until an upcoming recall is due.

MICRO - Microalbumin Screen

"X" indicates a patient has not had a Microalbum screen recorded in over 12 months and is due to be recalled to have it checked. A number indicates the months until an upcoming recall is due.

EE - Eye exam date

"X" indicates a patient has not had an eye exam recorded in over 12 months and is due to be recalled for one. A number indicates the months until an upcoming recall is due.

LEE - Lower extremity exam performed

"X" indicates a patient has not had a lower extremity exam in over 6 months and is due to be recalled for one. A number indicates the months until an upcoming recall is due.

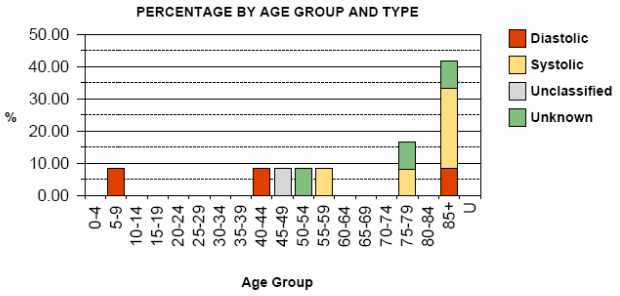
Figure 8: Recall Report

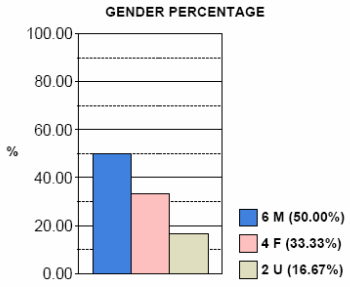
2. **Profile Report**: This report provides a profile by age, gender, and disease of all the practice specific patients with chronic diseases that are being managed in the Toolkit. The report allows the user to select his/her patients, or a greater population for comparison.

BRITISH COLUMBIA **PROFILE REPORT**

CARTER, JOHN
05-MAY-2005 12:07

Congestive Heart Failure





Total

	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	U	TOTAL
M	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	2	0	6
F	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	0	4
U	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	2
TOTAL	0	1	0	0	0	0	0	0	1	1	1	1	0	0	0	2	0	5	0	12

Diastolic

	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	U	TOTAL
M	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	2
F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
TOTAL	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	3

Systolic

	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	U	TOTAL
M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	3
F	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	2
U	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	3	0	5

Unclassified

	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65-69	70-74	75-79	80-84	85+	U	TOTAL
M	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
F	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
TOTAL	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1

Condition: **All Conditions**
Population: **My Patients**

Age Grouping: **5 Years**

PAGE 2

Figure 9: Profile Report

3. **Patient List:** This report provides a list of the Doctors' patients by diagnosis. The list includes patient name, phn, phone, and lists any other diagnoses associated with the particular patient. In .CSV format for Microsoft Excel (or other spreadsheet software), it displays complete data for the patient and allows manipulation of the data.

BRITISH COLUMBIA

PATIENT LIST REPORT

CARTER, JOHN
05-MAY-2005 12:30

Congestive Heart Failure

Number of Patients: 12

Patient Name	Patient PHN	Phone	Also Diagnosed With
Blow, Joe	9876540321		Diabetes, Prevention
Champlain, Samuel	9998831294		Diabetes, Prevention
Decor , Country	9998811031		Diabetes, Kidney
Decor, Nautical	9998811633		Diabetes, Prevention
Dog, Snoopy	9998881425		Diabetes, Kidney
Emerson, Ralph	9998880226		
Joe, John	self pay	555-5555	Diabetes
Jordan, Michael	0987654321	555-1212	Depression, Diabetes, Prevention
Luther, Martin	9998881117		
Mantel, Mickey	9876543210	555-1234	Depression, Diabetes, Kidney
smith, jo	1234567		Depression, Diabetes, Kidney
Stooge, Larry	9998810022		Diabetes

Figure 10: Patient List Report

4. **Key Measures:** A report that provides a count and list of patients for each condition type and which ones are receiving particular treatments. So far, only Diabetes and Congestive Heart Failure Key Measure Reports may be produced. This report may be useful for monitoring patients who may need additional assistance with managing their disease or who just need to be managed more closely.

BRITISH COLUMBIA

DIABETES KEY MEASURES REPORT

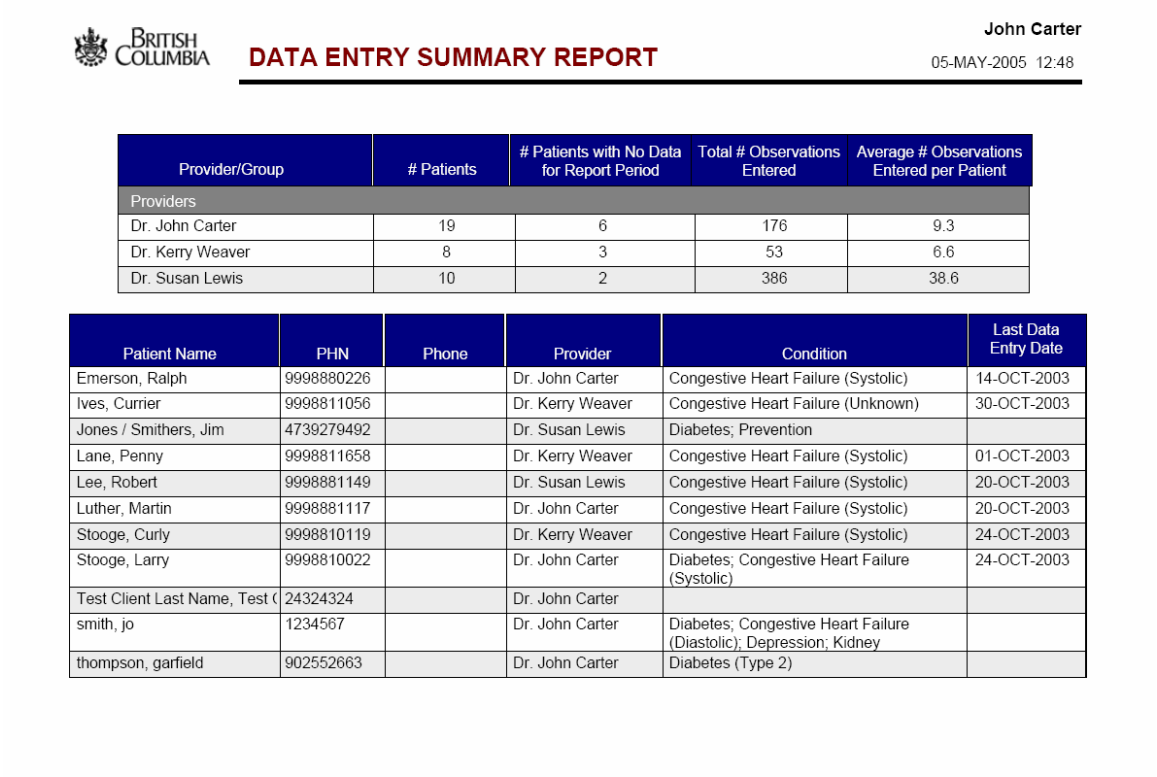
John Carter
05-MAY-2005 12:38

DM Type	# DM Patients	A1C > 8%		eGFR < 60		Lipid ratio		Systolic BP > 130	
		#	%	#	%	#	%	#	%
Type 1	1	0	0.0	0	0.0	0	0.0	0	0.0
Type 2	7	3	42.9	0	0.0	0	0.0	1	14.3
Unknown	7	0	0.0	0	0.0	0	0.0	2	28.6
All	15	3	20.0	0	0.0	0	0.0	3	20.0

Patient Name	PHN	Phone	A1c > 8%	eGFR < 60	Lipid ratio	Lipid Risk flag	Systolic BP > 130
Cool, Joe I	MB 1234567		**.085**				**135**
Doe, Jane	1234567		**.09**				
Jordan, Mike	1234568		**.09**				120
Champlain, Samuel E	9998831294		.079				**150**
Stooge, Larry B	9998810022						**160**

Figure 11: Key Measures Report

5. **Data Entry Summary:** The Data Entry Summary Report displays a list of patients that have not had any new data entered into their records within the report's selected time frame.



BRITISH COLUMBIA

DATA ENTRY SUMMARY REPORT

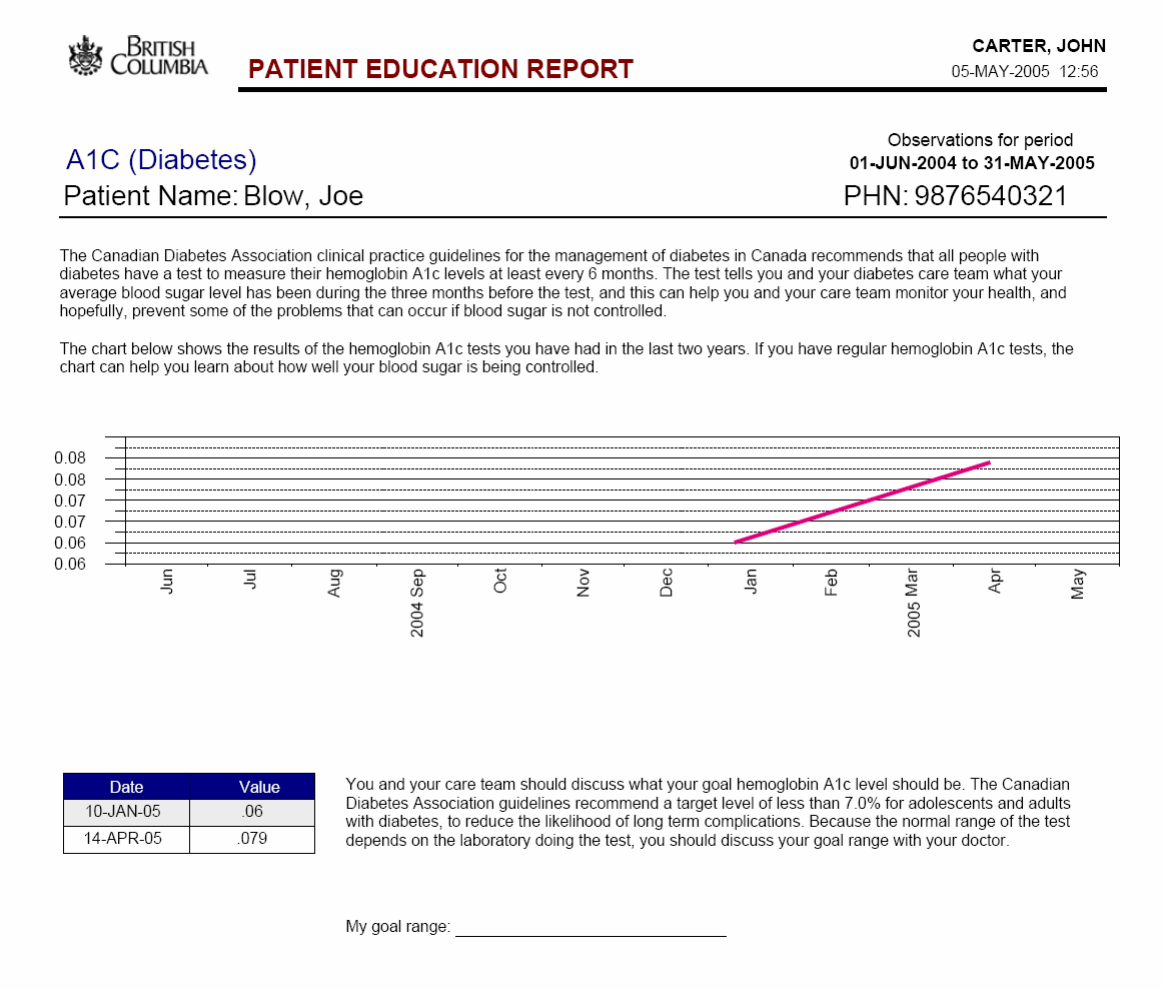
John Carter
05-MAY-2005 12:48

Provider/Group	# Patients	# Patients with No Data for Report Period	Total # Observations Entered	Average # Observations Entered per Patient
Providers				
Dr. John Carter	19	6	176	9.3
Dr. Kerry Weaver	8	3	53	6.6
Dr. Susan Lewis	10	2	386	38.6

Patient Name	PHN	Phone	Provider	Condition	Last Data Entry Date
Emerson, Ralph	9998880226		Dr. John Carter	Congestive Heart Failure (Systolic)	14-OCT-2003
Ives, Currier	9998811056		Dr. Kerry Weaver	Congestive Heart Failure (Unknown)	30-OCT-2003
Jones / Smithers, Jim	4739279492		Dr. Susan Lewis	Diabetes; Prevention	
Lane, Penny	9998811658		Dr. Kerry Weaver	Congestive Heart Failure (Systolic)	01-OCT-2003
Lee, Robert	9998881149		Dr. Susan Lewis	Congestive Heart Failure (Systolic)	20-OCT-2003
Luther, Martin	9998881117		Dr. John Carter	Congestive Heart Failure (Systolic)	20-OCT-2003
Stooge, Curly	9998810119		Dr. Kerry Weaver	Congestive Heart Failure (Systolic)	24-OCT-2003
Stooge, Larry	9998810022		Dr. John Carter	Diabetes; Congestive Heart Failure (Systolic)	24-OCT-2003
Test Client Last Name, Test (	24324324		Dr. John Carter		
smith, jo	1234567		Dr. John Carter	Diabetes; Congestive Heart Failure (Diastolic); Depression; Kidney	
thompson, garfield	902552663		Dr. John Carter	Diabetes (Type 2)	

Figure 12: Data Entry Report

6. **Patient Education Report:** One of the more interesting capabilities of the system is to provide patient specific progress reports on the status of any of the attributes for the disease being monitored. For instance, a report can be run for patient with congestive heart failure to show blood pressure measurements over the last year, with recommendations on optimal blood pressure. In this way, the patient can set personal goals to achieve optimal blood pressure management.



BRITISH COLUMBIA

PATIENT EDUCATION REPORT

CARTER, JOHN
05-MAY-2005 12:56

A1C (Diabetes)

Observations for period
01-JUN-2004 to 31-MAY-2005

Patient Name: Blow, Joe

PHN: 9876540321

The Canadian Diabetes Association clinical practice guidelines for the management of diabetes in Canada recommends that all people with diabetes have a test to measure their hemoglobin A1c levels at least every 6 months. The test tells you and your diabetes care team what your average blood sugar level has been during the three months before the test, and this can help you and your care team monitor your health, and hopefully, prevent some of the problems that can occur if blood sugar is not controlled.

The chart below shows the results of the hemoglobin A1c tests you have had in the last two years. If you have regular hemoglobin A1c tests, the chart can help you learn about how well your blood sugar is being controlled.

Date	Value
10-JAN-05	.06
14-APR-05	.079

You and your care team should discuss what your goal hemoglobin A1c level should be. The Canadian Diabetes Association guidelines recommend a target level of less than 7.0% for adolescents and adults with diabetes, to reduce the likelihood of long term complications. Because the normal range of the test depends on the laboratory doing the test, you should discuss your goal range with your doctor.

My goal range: _____

Figure 13: Patient Education Report

7. **Run Charts:** Perhaps one of the more useful reports, run charts provide the doctor with aggregated data on a specific indicator for a disease for all patients being monitored over a period of time. Not only does the report display completion rates and average values over time, but it also offers the Doctor the option to compare her performance with Collaborative performance as a whole, or with other individual doctors in the Collaborative. The report provides both a graphical and tabular display of the data.

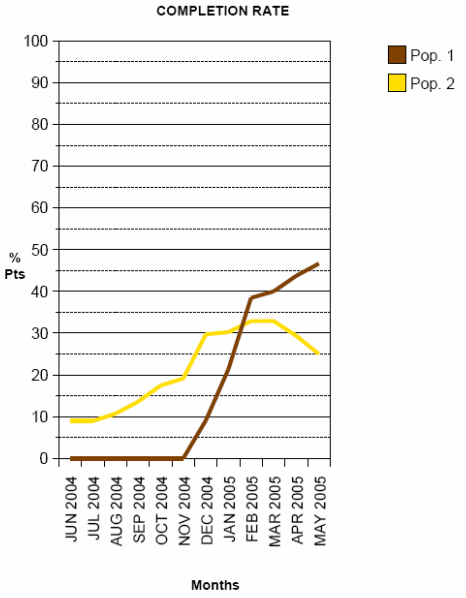
BRITISH COLUMBIA

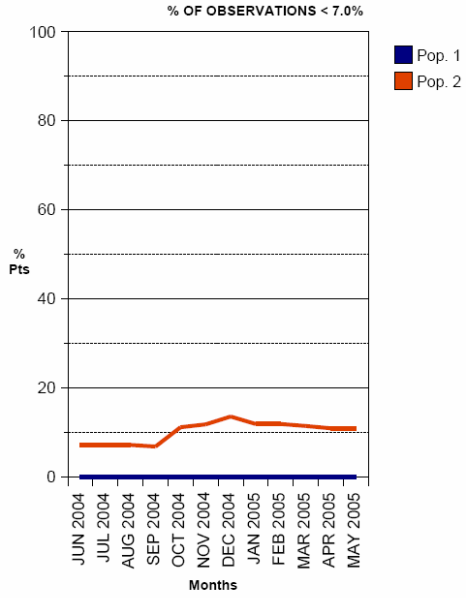
RUN CHART REPORT

CARTER, JOHN
05-MAY-2005 13:29

Diabetes

A1C





	JUN 2004	JUL 2004	AUG 2004	SEP 2004	OCT 2004	NOV 2004	DEC 2004	JAN 2005	FEB 2005	MAR 2005	APR 2005	MAY 2005
COMPLETION RATE												
Pop. 1	0	0	0	0	0	0	9.09	21.43	38.46	40	43.75	46.67
Pop. 2	8.93	8.93	10.71	13.56	17.46	19.12	29.73	30.26	32.89	32.91	29.35	25
PATIENT POPULATIONS												
Pop. 1	7	7	7	8	9	10	11	14	13	15	16	15
Pop. 2	56	56	56	59	63	68	74	76	76	79	92	92
% OF OBSERVATIONS < 7.0%												
Pop. 1	0	0	0	0	0	0	0	0	0	0	0	0
Pop. 2	7.14	7.14	7.14	6.78	11.11	11.76	13.51	11.84	11.84	11.39	10.87	10.87

Start Date: **01 JUN 2004**
End Date: **31 MAY 2005**
Date Range: **Monthly**
Pop. 1: **My Patients**

Rep. Type: **Run Chart Detail**
Attrib.: **A1C**
Attrib.: **BP medications**

Condition: **Diabetes**
Attrib.:
Attrib.:
Pop. 2: **All BC Providers**

Attrib.:
Attrib.:

Figure 14: Diabetes A1C Report

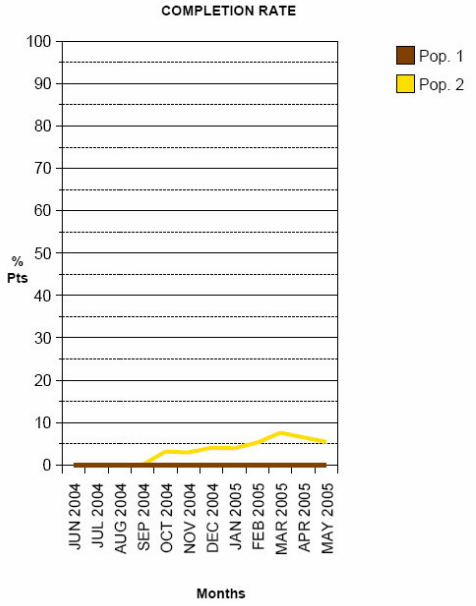
BRITISH COLUMBIA

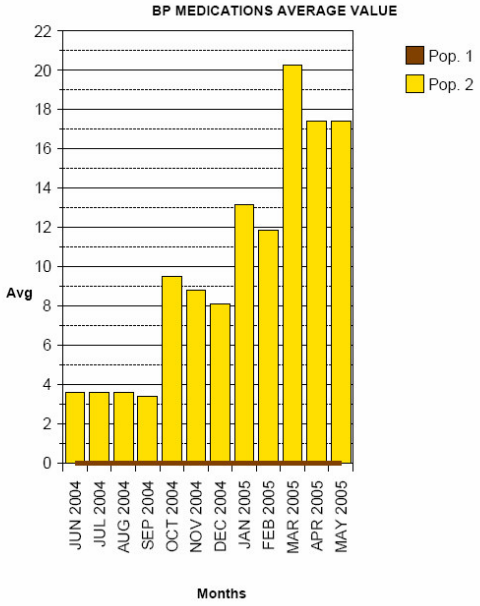
RUN CHART REPORT

CARTER, JOHN
05-MAY-2005 13:29

Diabetes

BP medications





	JUN 2004	JUL 2004	AUG 2004	SEP 2004	OCT 2004	NOV 2004	DEC 2004	JAN 2005	FEB 2005	MAR 2005	APR 2005	MAY 2005
COMPLETION RATE												
Pop. 1	0	0	0	0	0	0	0	0	0	0	0	0
Pop. 2	0	0	0	0	3.17	2.94	4.05	3.95	5.26	7.59	6.52	5.43
PATIENT POPULATIONS												
Pop. 1	7	7	7	8	9	10	11	14	13	15	16	15
Pop. 2	56	56	56	59	63	68	74	76	76	79	92	92
BP MEDICATIONS AVER/												
Pop. 1	0	0	0	0	0	0	0	0	0	0	0	0
Pop. 2	3.57	3.57	3.57	3.39	9.52	8.82	8.11	13.16	11.84	20.25	17.39	17.39

Start Date: **01 JUN 2004**
End Date: **31 MAY 2005**
Date Range: **Monthly**
Pop. 1: **My Patients**

Rep. Type: **Run Chart Detail**
Attrib.: **A1C**
Attrib.: **BP medications**

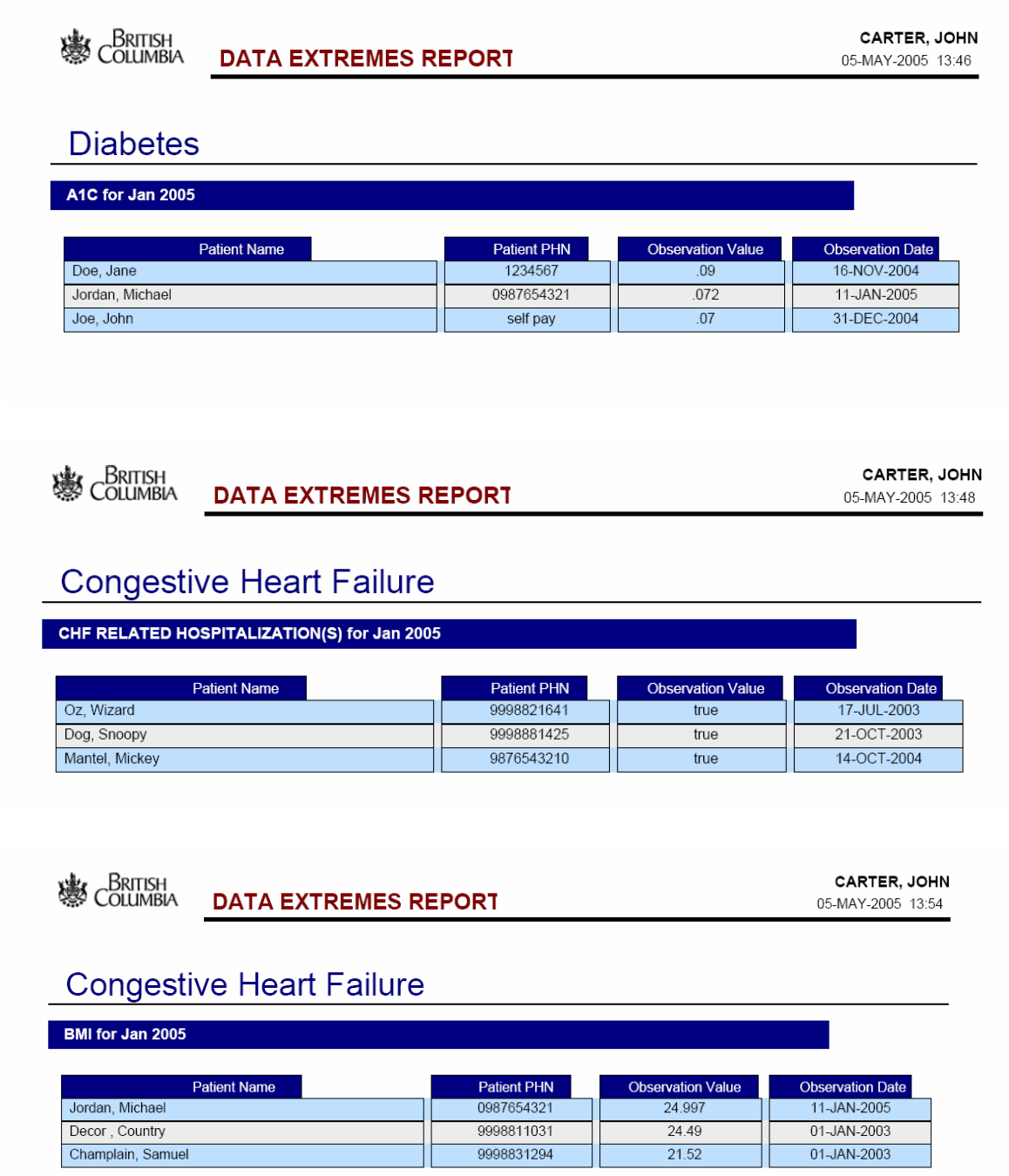
Condition: **Diabetes**
Attrib.:
Attrib.:
Pop. 2: **All BC Providers**

Attrib.:
Attrib.:

PAGE 2

Figure 15: Diabetes BP Report

8. **Date Extremes/Last Value Report:** Shows a patient list for selected conditions and parameters and the date of the last measurement for that condition and parameter prior to a set cut-off date.



BRITISH COLUMBIA

DATA EXTREMES REPORT

CARTER, JOHN
05-MAY-2005 13:46

Diabetes

A1C for Jan 2005

Patient Name	Patient PHN	Observation Value	Observation Date
Doe, Jane	1234567	.09	16-NOV-2004
Jordan, Michael	0987654321	.072	11-JAN-2005
Joe, John	self pay	.07	31-DEC-2004

BRITISH COLUMBIA

DATA EXTREMES REPORT

CARTER, JOHN
05-MAY-2005 13:48

Congestive Heart Failure

CHF RELATED HOSPITALIZATION(S) for Jan 2005

Patient Name	Patient PHN	Observation Value	Observation Date
Oz, Wizard	9998821641	true	17-JUL-2003
Dog, Snoopy	9998881425	true	21-OCT-2003
Mantel, Mickey	9876543210	true	14-OCT-2004

BRITISH COLUMBIA

DATA EXTREMES REPORT

CARTER, JOHN
05-MAY-2005 13:54

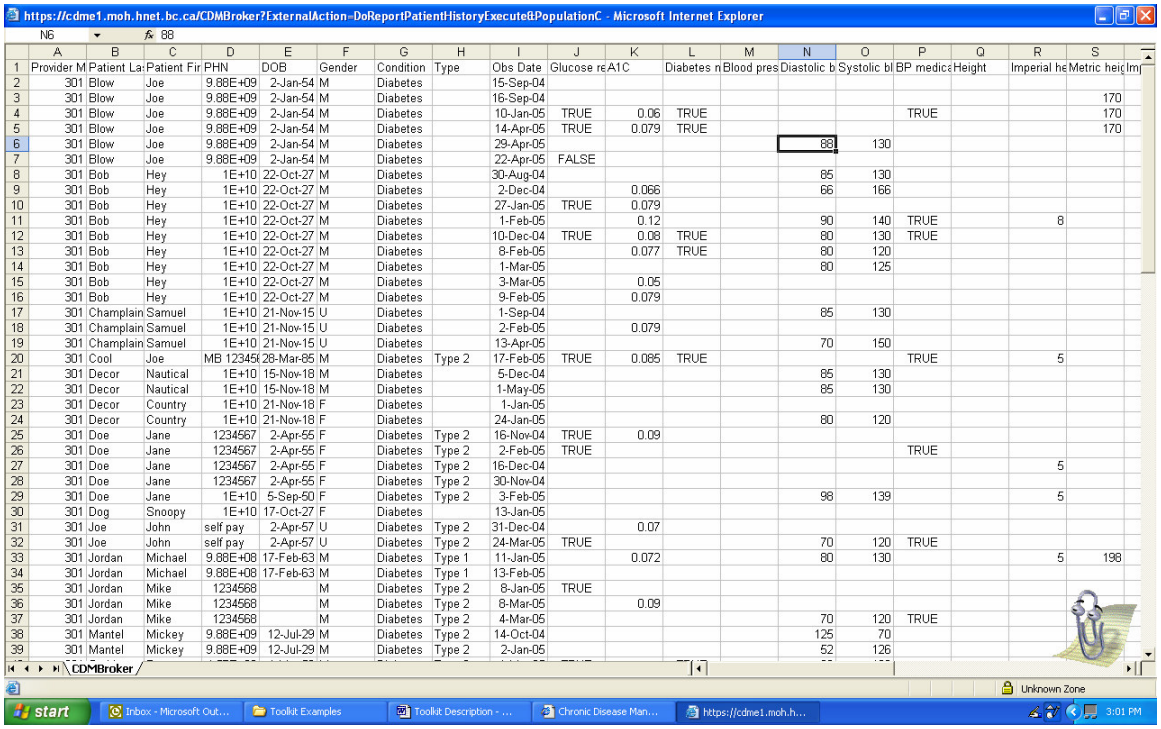
Congestive Heart Failure

BMI for Jan 2005

Patient Name	Patient PHN	Observation Value	Observation Date
Jordan, Michael	0987654321	24.997	11-JAN-2005
Decor , Country	9998811031	24.49	01-JAN-2003
Champlain, Samuel	9998831294	21.52	01-JAN-2003

Figure 16: Data Extremes Reports

9. **Patient History:** The Patient History Report creates a .csv (comma separated value) file containing every observation of the selected condition and parameter, within the selected time frame, for the selected patient population.



Provider M	Patient La	Patient Fir	PHN	DOB	Gender	Condition	Type	Obs Date	Glucose re	A1C	Diabetes n	Blood pres	Diastolic b	Systolic bl	BP medica	Height	Imperial he	Metric heig
301	Blow	Joe	9.88E+09	2-Jan-54	M	Diabetes		15-Sep-04										
301	Blow	Joe	9.88E+09	2-Jan-54	M	Diabetes		16-Sep-04										170
301	Blow	Joe	9.88E+09	2-Jan-54	M	Diabetes		10-Jan-05	TRUE	0.06	TRUE				TRUE			170
301	Blow	Joe	9.88E+09	2-Jan-54	M	Diabetes		14-Apr-05	TRUE	0.079	TRUE							170
301	Blow	Joe	9.88E+09	2-Jan-54	M	Diabetes		29-Apr-05					88	130				
301	Blow	Joe	9.88E+09	2-Jan-54	M	Diabetes		22-Apr-05	FALSE									
301	Bob	Hey	1E+10	22-Oct-27	M	Diabetes		30-Aug-04					85	130				
301	Bob	Hey	1E+10	22-Oct-27	M	Diabetes		2-Dec-04		0.066			66	166				
301	Bob	Hey	1E+10	22-Oct-27	M	Diabetes		27-Jan-05	TRUE	0.079								
301	Bob	Hey	1E+10	22-Oct-27	M	Diabetes		1-Feb-05		0.12			90	140	TRUE		8	
301	Bob	Hey	1E+10	22-Oct-27	M	Diabetes		10-Dec-04	TRUE	0.08	TRUE		80	130	TRUE			
301	Bob	Hey	1E+10	22-Oct-27	M	Diabetes		8-Feb-05		0.077	TRUE		80	120				
301	Bob	Hey	1E+10	22-Oct-27	M	Diabetes		1-Mar-05					80	125				
301	Bob	Hey	1E+10	22-Oct-27	M	Diabetes		3-Mar-05		0.05								
301	Bob	Hey	1E+10	22-Oct-27	M	Diabetes		9-Feb-05		0.079								
301	Champlain	Samuel	1E+10	21-Nov-15	U	Diabetes		1-Sep-04					85	130				
301	Champlain	Samuel	1E+10	21-Nov-15	U	Diabetes		2-Feb-05		0.079								
301	Champlain	Samuel	1E+10	21-Nov-15	U	Diabetes		13-Apr-05					70	150				
301	Cool	Joe	MB 12345	28-Mar-85	M	Diabetes	Type 2	17-Feb-05	TRUE	0.085	TRUE				TRUE		5	
301	Decor	Nautical	1E+10	15-Nov-18	M	Diabetes		5-Dec-04					85	130				
301	Decor	Nautical	1E+10	15-Nov-18	M	Diabetes		1-May-05					85	130				
301	Decor	Country	1E+10	21-Nov-18	F	Diabetes		1-Jan-05										
301	Decor	Country	1E+10	21-Nov-18	F	Diabetes		24-Jan-05					80	120				
301	Doe	Jane	1234567	2-Apr-55	F	Diabetes	Type 2	16-Nov-04	TRUE	0.09								
301	Doe	Jane	1234567	2-Apr-55	F	Diabetes	Type 2	2-Feb-05	TRUE						TRUE			
301	Doe	Jane	1234567	2-Apr-55	F	Diabetes	Type 2	16-Dec-04									5	
301	Doe	Jane	1234567	2-Apr-55	F	Diabetes	Type 2	30-Nov-04										
301	Doe	Jane	1E+10	5-Sep-50	F	Diabetes	Type 2	3-Feb-05					98	139			5	
301	Dog	Snoopy	1E+10	17-Oct-27	F	Diabetes		13-Jan-05										
301	Joe	John	self pay	2-Apr-57	U	Diabetes	Type 2	31-Dec-04		0.07								
301	Joe	John	self pay	2-Apr-57	U	Diabetes	Type 2	24-Mar-05	TRUE				70	120	TRUE			
301	Jordan	Michael	9.88E+08	17-Feb-63	M	Diabetes	Type 1	11-Jan-05		0.072			80	130			5	198
301	Jordan	Michael	9.88E+08	17-Feb-63	M	Diabetes	Type 1	13-Feb-05										
301	Jordan	Mike	1234568		M	Diabetes	Type 2	8-Jan-05	TRUE									
301	Jordan	Mike	1234568		M	Diabetes	Type 2	8-Mar-05		0.09								
301	Jordan	Mike	1234568		M	Diabetes	Type 2	4-Mar-05					70	120	TRUE			
301	Mantel	Mickey	9.88E+09	12-Jul-29	M	Diabetes	Type 2	14-Oct-04					125	70				
301	Mantel	Mickey	9.88E+09	12-Jul-29	M	Diabetes	Type 2	2-Jan-05					52	126				

Figure 17: Patient History Report

Other

Help

Help for users of the Toolkit is available during working hours by calling the MOH Help desk. Also, the NHA provides help through its Informatinon Technology department. As well as the help desk, users can also use the online help. The online help provides clear and straightforward assistance to the user. There is a navigation bar on the left which provides a comprehensive list of topics organized by main system functionalities.

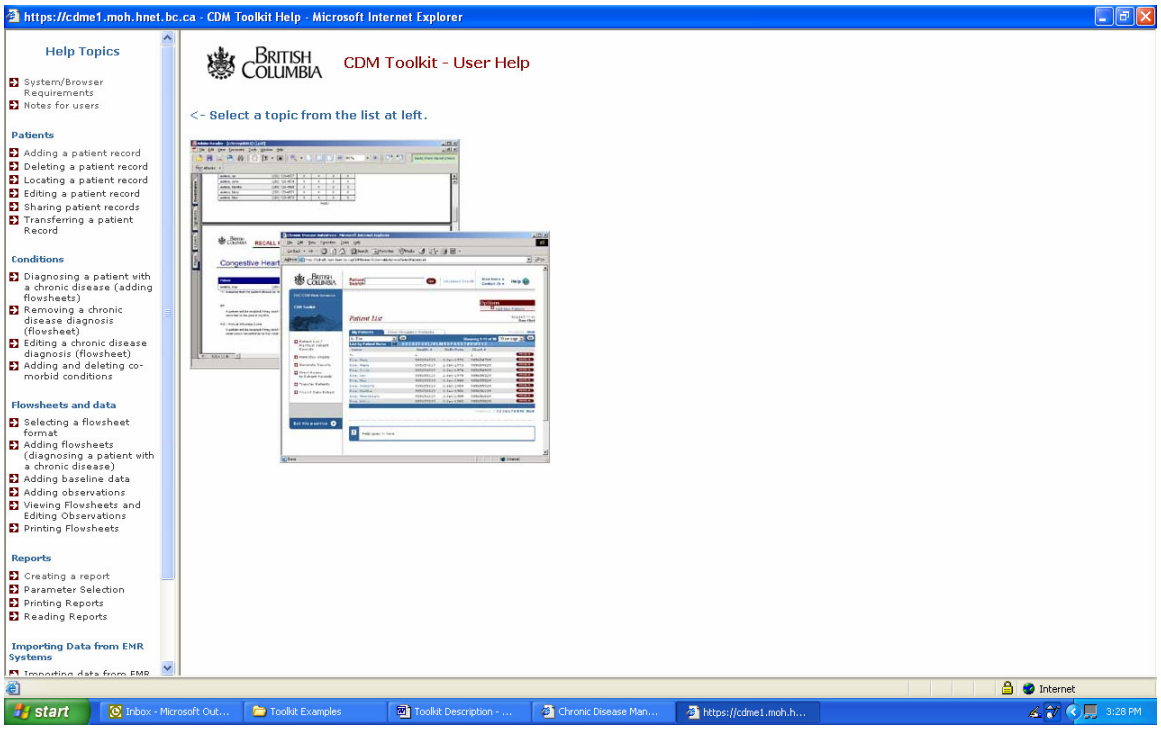


Figure 18: Help Screen