

EVALUATION OF A FEEDBACK KIOSK SYSTEM IN A TEACHING HOSPITAL

by MARCEL SERRA-JULIA, B.Sc.

A Thesis Submitted to the School of Graduate Studies in Partial Fulfilment of the
Requirements for the Degree Master of Science

McMaster University © Copyright by Marcel Serra-Julià, September 2011

DEGREE: Master of Science

YEAR: 2011

PROGRAM eHealth (Computing and Software)

UNIVERSITY NAME and LOCATION: McMaster University, Hamilton, Ontario

TITLE: Evaluation of a Feedback Kiosk System in a Teaching Hospital

AUTHOR: Marcel Serra-Julià, B.Sc. in Mathematics

SUPERVISOR: Professor Norm Archer

NUMBER OF PAGES: viii, 76

Abstract

The practice of medicine has evolved from individual practice, mainly led by physicians, towards an interdisciplinary team-based activity that takes into consideration patients' needs, preferences and values. This shift towards what is known as the patient-centered care (PCC) model requires better communication among medical staff and patients. Feedback is a key factor to improve team learning processes and also to understand patient perspectives. The objective of this thesis was to create a system to facilitate feedback processes within the Toronto General Hospital (TGH). To do so, a kiosk-based system was designed, allowing patients and health care providers to send feedback messages as well as positive recognition messages in appreciation of other people's commitments and achievements. A pilot test was conducted by placing a kiosk in the General Internal Medicine unit at TGH for seven weeks. During this study, the application running the kiosk registered all user actions, with the objective of understanding how patients and staff interacted with the system. The kiosk was perceived as a positive, easy to use, and valuable tool by patients and providers. The different elements that need to be improved for future upgrades of the system are discussed. Overall, the use of kiosk-based systems to gather feedback should be considered when creating high performing teams in the health care domain.

Acknowledgements

I would like to thank all the staff of the Centre for Innovation in Complex Care for their support during the development of my thesis. My special thanks to Christine Plaza, who was my mentor during my internship at the centre and also supervised my work during the development of the feedback kiosk project. I also want to thank Leslie Beard for helping to solve the different difficulties the project faced. From McMaster University, I am grateful to my host thesis supervisor, Dr. Norm Archer, and Dr. Milena Head for all their contributions while I was writing this thesis. While developing the web application, Jordi Serrano helped me to understand the basics of each technology used; without his help I would probably not have been able to develop the application myself, so thanks for your time.

I also would like to mention Dr. Manel Jordana, who was the instigator of my enrolment at McMaster University and, importantly, always cared for me and my family during the last 6 years.

And now is time to thank my parents Maria and Rafel and my sister Aina for always supporting and accepting my academic adventures; I really appreciate this.

Alba is the person who accompanied me in both good and bad days. She has provided everything I needed to succeed in the completion of this thesis, but importantly I have been lucky enough to receive her love for over eleven years. Jo també t'estim.

Finally, I would like to mention Biel, my young son, who has not directly contributed to the thesis but has been a great motivation to persist with my objective. Also, he has been the best distraction to stay away from work.

Marcel Serra Julià
August 29, 2011

Table of contents

Chapter 1 Introduction	1
Chapter 2 Background	4
2.1 Context: The Health Care Industry	4
2.2 Feedback Interventions	8
2.2.1 Summary of literature reviews on feedback interventions	8
2.2.2 Summary of selected case studies on feedback interventions	11
2.3 Communication Barriers	13
2.4 Literature Review Conclusions	14
Chapter 3 The Feedback Kiosk	16
3.1 Kiosk iteration #1	16
3.2 Kiosk Iteration #2	19
3.2.1 Objectives	19
3.2.2 Design	20
3.2.2.1 Feedback functionality	21
3.2.2.2 Recognition functionality and Honour Your Hero program	21
3.2.2.3 “Give feedback” to improve the kiosk	24
3.2.3 Infrastructure	24
3.2.3.1 Kiosk settings	25
3.2.3.2 Server	26
3.2.3.3 Web application technologies	26
3.2.3.4 Screens	27
3.2.4 Software Implementation	27
3.2.4.1 Interface design	27
3.2.4.1.1 Feedback functionality	31
3.2.4.1.2 Recognition functionality	32
3.2.4.1.3 Evaluation surveys	33
3.2.4.1.4 Honour Your Hero	34
3.2.4.1.5 Give feedback	35
3.2.4.2 Database design	37
3.2.5 Deployment	38
Chapter 4 Results	40
4.1 Distribution of events over time	40
4.2 Distribution of events by functionalities and users	44
4.3 Evaluation surveys	46
4.4 Messages analysis	49

Chapter 5 Conclusions	52
5.1 Contributions to Theory	52
5.2 Contributions to Practice	54
5.3 Future Research	57
References	59
Appendix A, NRC Picker survey	62
Appendix B, project protocol	68
Appendix C, approval notification from REB	73
Appendix D, database tables	74

List of figures and tables

Figure number	Figure Title	Page
Figure 1.1	Pyramid of innovation	2
Figure 3.1	Interface of kiosk #1	17
Figure 3.2	Main screen of the kiosk	30
Figure 3.3	Feedback screen	31
Figure 3.4	Recognition screen	32
Figure 3.5	Evaluation survey for recognition functionality	33
Figure 3.6	Evaluation survey for feedback functionality	33
Figure 3.7	Donation screen	34
Figure 3.8	More information screen	35
Figure 3.9	Give feedback screen	35
Figure 3.10	Application flow diagram	36
Figure 3.11	Database diagram	37
Figure 3.12	Gantt chart of the deployment process	39
Figure 4.1	Number of events and hours that the kiosk was off-line over the duration of the study	41
Figure 4.2	Weekly distribution of kiosk events and off-line time	42
Figure 4.3	Kiosk event distribution over daytime hours	43
Figure 4.4	Distribution of completed and uncompleted kiosk events over one day	44
Figure 4.5	Kiosk evaluation scores	47
Figure 4.6	Kiosk keyboard	48

Table number	Table Title	Page
Table 4.1	Distribution of events based on the type of task performed and their conclusion	45
Table 4.2	Distribution of events based on the task performed and the role of the user	45
Table 4.3	Typed answers in the qualitative survey. The exact text written by users is shown	47
Table 4.4	Answers to feedback	50
Table 4.5	Recognition messages	51

List of abbreviations and acronyms

CICC: Centre for Innovation in Complex Care

TGH: Toronto General Hospital

UHN: University Health Network

FIs: Feedback Interventions

PCC: Patient-Centered Care

DCC: Disease Centered Care

OECD: Organization for Economic Co-Operation and Development

GDP: Gross Domestic Product

US: United States

GIM: General Internal Medicine

CEO: Chief Executive Office

REB: Research Ethics Board

NRC: National Research Corporation

WHO: World Health Organization

OS: Operating System

Chapter 1

Introduction

This thesis is the result of the work done by the author during an internship at the Centre for Innovation in Complex Care (CICC) between May 2010 and December 2011 and a further collaboration with the Centre until the summer of 2011.

The CICC is physically located at Toronto General Hospital (TGH). This hospital, together with Princess Margaret Hospital and Western Hospital, form the University Health Network (UHN). Since 1999, UHN has been the organization that embraces the three hospitals, to become the largest teaching hospital in Canada through its affiliation with the University of Toronto's Faculty of Medicine. The strategic union of the three hospitals into UHN has become an international reference for excellence in responding to the new challenges that health care faces. The unification has led the three institutions to establish a coordinated strategy with a common set of goals, including a commitment to research, the introduction of new technologies, and the adoption of a patient-centered care model.

The CICC is a young centre within UHN that responds to its strategic goals. Its focus is on conducting research to improve and create new processes of care for patients with complex problems. The CICC is made of an interdisciplinary team of physicians, nurses and designers, and other specialists. The Centre is currently running about 15 projects simultaneously. The ultimate goal of any project at the CICC is to achieve global system impact. To do so the Centre created its own process, known as the Pyramid of Innovation (Figure 1.1). The different steps in the pyramid's process are: Understand an issue and create a project; Implement a pilot project; Evaluate the project; Create a program; and Commercialise it.

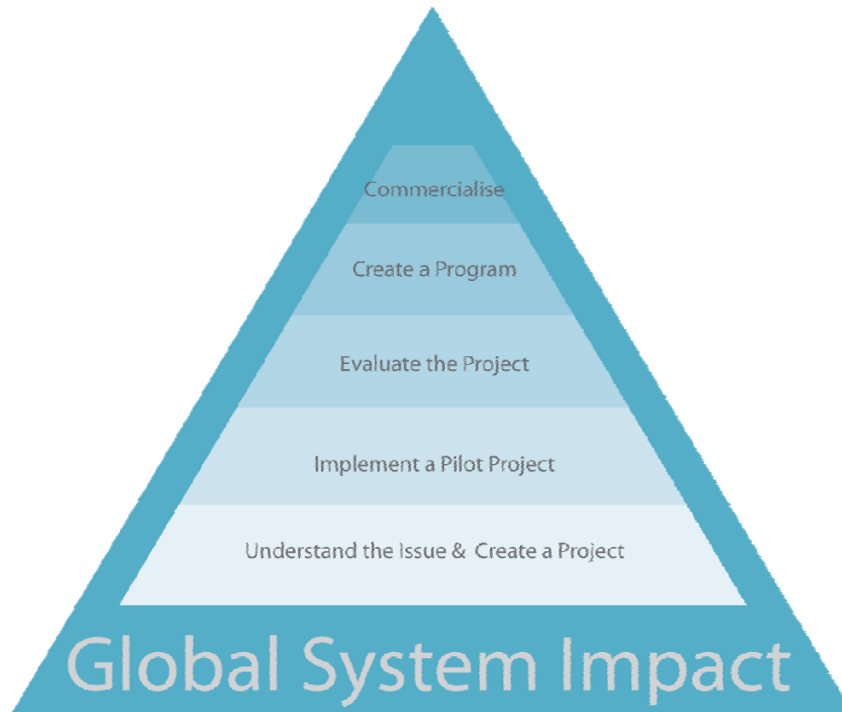


Figure 1.1. Pyramid of innovation [CICC]

The *feedback kiosk* project presented in this thesis was part of a larger project called the *team feedback tool*. The overall objective of the *team feedback tool* project is to investigate ways to promote feedback within hospitals. This is important because feedback is a key factor in creating high performing teams and the practice of medicine is becoming a more interdisciplinary and team based activity. Hence, the ability of teams to improve their performance is critical to reach high quality of service. A key element to enable feedback processes to occur within organizations is having an adequate environment that allows fluid communication. However, large organizations, hospitals in particular, usually have many communication barriers that prevent fluid communication to happen. This limits the effectiveness of the feedback process.

The first phase of the *team feedback tool* project consisted of evaluating the use of Rypple. This is a web based platform that allows members of a team to get anonymous feedback from others in the team. The results of this work were published in Health Care Quarterly [Plaza, 2011]. The second phase of this project is the *feedback kiosk*, which became my main

undertaking at the CICC during my internship and the resulting research in which I was involved. The objective of this project was to create and evaluate a kiosk-based system to gather feedback. A kiosk was used because it can collect anonymous feedback in real time and is accessible to everybody, including patients and staff. The project, which spanned one year, involved understanding the problem and designing a project, implementing a pilot project, and evaluating the project. These activities represent the first three steps in the Pyramid of Innovation process.

This thesis is divided into five Chapters. Chapter 2 summarizes relevant *background*, which corresponds to the first step of the pyramid: the understanding of a problem and the identification of the project requirements. As the second pyramid process step, Chapter 3 presents the design and implementation of two pilot projects named *kiosk iteration #1* and *kiosk iteration #2*. Chapter 4 shows the results of the pilot study and Chapter 5 the conclusions of the thesis. These two final chapters correspond to the evaluation step, which is the third step in the pyramid process.

Overall, the objective of this research was to evaluate whether a kiosk-based system is an appropriate tool for collecting feedback in a hospital setting. A pilot test was done in order to gather relevant information to be used for the design of future larger kiosk-based feedback interventions.

Chapter 2

Background

The objective of this chapter is to provide background information on the relevance of Feedback Interventions (FIs) in the health care industry; in particular in institutions engaged in the process of adopting the Patient-Centred Care (PCC) model. This chapter is presented in four sections. The first one includes a quick overview of the health care industry, the sector for which this project is being developed. The second section reviews the literature on FIs. The third section presents the different types of communication barriers that exist in hospitals. Finally, information from the previous parts is summarized to create a set of requirements that were used as a starting point to design the pilot study.

2.1 Context: The Health Care Industry

One of the most relevant achievements of developed countries since the end of the Second World War has been the development of health care systems to provide citizens broad access to health care at an affordable cost. These health care systems, together with the constant evolution of medicine, have been critical factors for countries that are members of the Organization for Economic Co-Operation and Development (OECD), resulting in the extension of average life expectancy in these countries by approximately 10 years during the last 4 decades (OECD, 2011). This gain in life expectancy has required a constant increase in the health care budgets in these countries; indeed, the health care budget represented on average about 5% of the Gross Domestic Product (GDP) of OECD countries in 1970 and this has increased to 9.1% in 2010 for the same countries (OECD, 2011).

The structure of the health care system varies across countries. Hence, different countries have different coverage plans, different models for care access, and different models to

deliver care. Despite these differences, all developed countries face common challenges. The most important is aging of the population, and the related health conditions, but also the growing prevalence of health conditions associated with the Western life style such as obesity and depression. The health care industry is facing a new paradigm where an old person suffering from several chronic conditions is becoming the average patient. Data from Statistics Canada exemplifies these trends. From 2005 to 2010, the overweight population increased by 10% in Canada and, more striking, the prevalence of diabetes, a chronic disease highly associated with overweight and sedentary life, increased by 38% also based on Statistics Canada data (StatsCan 2011).

Health care systems need to find effective and more efficient strategies to be sustainable and to be able to handle higher population demands. In other words, more needs to be done with the same or less money. Due to the recent economic recession, some European countries are already being forced to significantly reduce their health care budgets.

The intense debate ongoing in the United States (US) and other countries, regarding the most adequate regulatory frame for the health care industry, is one of the hot topics in this sector. The core of this debate is whether the free market is a good solution for providing health care assistance to the entire population. Despite this debate at governmental levels, many health care organizations facing the pressure of higher demands are already looking for ways to satisfy patient needs with more limited resources. It is for this reason that, at the delivery level, a new trend towards a Patient Centred Care (PCC) model has emerged. This type of care not only considers the disease but, importantly, also the context of the patient. It has been claimed that PCC is more efficient and better than conventional methods for improving health outcomes for patients [Steward, 2000] [Green, 2002].

Before the implementation of PCC, many organizations have not intentionally adopted any model of care. These pre-existing models or ways of delivering care arose while new treatments and procedures were being adopted by the health care system. In contrast to the new PCC model, the previous way to deliver care has been called the Disease-Based Model or Disease Centred Care (DCC). Green (2002) has criticized the DCC as not being effective present-day scenarios; he argues that the focus of the DCC is on the disease and not on the

patient. Focusing on the disease is effective for developing new treatments and medical technologies, but diseases are not the right focus when delivering care to patients.

The PCC model was first mentioned 50 years ago; however, it was not until 2001 when a US report from the Institute of Medicine moved PCC to the centre of the debate [Bloom, 2011]. Although it is possible to find many definitions for PCC, a largely accepted definition is suggested by the Institute of Medicine: “providing care that is respectful of and responsive to individual patient preferences, needs, and values and ensuring that patient values guide all clinical decisions” [BMA, 2011]. Importantly, the real challenge goes beyond this definition. Tools are needed to evaluate health care systems and determine their level of compliance with the PCC model.

The Picker Institute is an institution that, among others, has the objective to promote education and research on PCC. The work of this institute is used as a reference by many health care institutions in the application of PCC initiatives. A joint report conducted by The Picker Institute and the Commonwealth Fund determined seven key factors contributing to PCC [Shaller, 2007]. These factors are summarized as follows. Having **leadership** at the high level of health care institutions is important to generate sustained engagement in the organization and to ensure PCC as a common mission. But it is not enough to have leaders committed to PCC; leaders need to have a **strategic vision** and **constantly communicate** in a clear way so the whole organization can understand and follow the leaders’ strategy. In addition, caregivers need to feel the **support from leaders**, and be taken into consideration when designing new strategies. It is also important that they are being treated with the same respect and dignity that is expected from them when treating patients. To provide channels for **constant measurement of outputs and feedback** is required, and this is particularly important when new strategies and initiatives of care are being deployed. The relationship between caregivers and patients has to occur within a **comfortable space** that satisfies both patient and caregiver needs. Finally, having a **supportive technology** is very important for caregivers to deliver better care and to engage patients and families in their self management, using appropriate tools to enhance their self monitoring and communication with the care givers.

One of the key factors described in this thesis is the need to establish systems to improve communication, evaluate performance, and obtain feedback within health care organizations. These are the goals of the team feedback tool project at the CICC and, in particular, the kiosk project described in this thesis.

In addition to the importance of feedback to improve patient care, there is a trend toward establishing hospital executive compensation based on performance. An important indicator of performance is the evaluation of patient satisfaction. For example, 2% of the Nipigon District Memorial Hospital CEO's base salary or 1% of the salary of the Chief of Staff and Chief of Nursing executives are linked to achieving specific targets on parameters of patient satisfaction [Nipigon Salaries, 2011]. Several similar examples can be found for other hospital CEO salaries across Ontario.

Despite the need to measure patient satisfaction, current evaluation methods have important limitations. Therefore, research to find more agile systems to interact with patients will help in the design of patient satisfaction methods. The case of UHN, where the kiosk project was developed, is helpful in understanding some drawbacks of actual methods to measure patient satisfaction. Like many other health care institutions in Canada, UHN uses the National Research Corporation (NRC) surveys to measure patient satisfaction. Every month, UHN reports to NRC Picker a list of discharged patients that satisfy an exclusion/inclusion criteria; a random sample of 10% is selected from this list and NRC Picker mails a survey to this sample. This usually happens 3 or 4 months after discharge; around 30% of patients complete the survey and mail it back to NRC Picker. NRC Picker compiles the results, posts them on their website and sends raw data files to the Performance Measurement Group at UHN. Finally, Performance Measurement prepares reports in Excel spreadsheet format that are posted on the UHN intranet and distributed to the UHN leadership team. Thus, completed surveys are available from very few patients after more than 4 months after discharge and dissemination of the results happens 2 months later, so the process takes at least 6 months. Other surveys conducted by the hospital among staff follow a similar process.

The following limitations can be identified in the process of measuring UHN patient satisfaction. First, the delay between the time patients have their experiences in the hospital

to the time they respond to the surveys is too long. It can be difficult for patients to remember their experience in order to answer the 59 detailed questions included in the NRC Picker survey (see a sample of this survey in *Appendix A*). Second, due to the high readmission rate at General Internal Medicine (GIM), it can happen that a patient is back in the hospital after the discharge that triggered the survey process, and patients can easily confuse the different hospitalization visits or experiences. Third, due to the typically low response rate, it is difficult to make conclusions at the unit level. After applying the exclusion criteria to a list of approximately 80 patients per month, at most 8 patients will receive the survey and about 3 will respond each month. Fourth, for feedback to be effective it is very important to close the feedback loop [Mugford, 1991]. In other words, the information gathered has to get to the hospital staff, so they can improve the care delivered. The effectiveness of the actual dissemination process is not known; however, studies being conducted at the CICC suggest that staff at GIM do not know where to obtain patient feedback.

2.2 Feedback Interventions

Given the situation presented above, alternative feedback processes were investigated to improve the quality of care, according to patient and staff experiences and needs. This included a thorough search of the literature for studies on Feedback Interventions, to learn about what has been done and is known in the field. The proposed new intervention was based on this information.

2.2.1 Summary of literature review on feedback interventions

FIs have been conducted systematically and reported to scientific journals for approximately the last 100 years. The first reference to a feedback theory is the *law of effect* published by Thorndike in 1913 [Kluger, 1998]. This theory relates positive feedback to reinforcement and negative feedback to punishment. Thorndike's argument, which was summarized by Kluger (1998) says that both positive and negative types of feedback should

improve performance, one by reinforcing correct behaviour and the other by punishing incorrect behaviour [Kluger, 1998]. Kluger (1996) criticized the *law of effect* by pointing out several inconsistencies between the data and the theory presented in Thorndike (1913) [Kluger, 1996].

Inconclusive FI results were reported throughout the first century of research on feedback interventions. Ammons (1956) published the first review on feedback interventions, which examined 50 years of literature and became an important reference to support the use of FIs [Kluger, 1996]. This review focused on experiments to evaluate specific types of feedback, known as knowledge of performance interventions or knowledge of results, which report reviews of performance or results. Kluger (1996) studied this review, and showed that many of Ammons' conclusions were supported by weak evidence. In certain instances, the data suggested the opposite of Ammons' conclusions, since knowledge of performance interventions did not result in improvement of performance. Moreover, of a systematic literature review selected only 131 articles out of 3000 articles found, or less than 5% of the articles satisfied the eligibility criteria. The pool of effects observed due to feedback interventions was statistically analysed and showed a moderate positive effect. It is also relevant to note that 38% of the interventions produced a negative effect [Kluger, 1996]. This extensive review by Kluger only detected one general theory, the *law of effect* by Thorndike, to explain the rationale of feedback interventions; thus, this seems to be the only formal theory of feedback intervention ever published to that date. This theory had been used extensively to support experimental data, even though the data frequently contradicted the theory [Kluger, 1996]. One of the main conclusions of Kluger's review was that there is a large variability in the effects of feedback interventions on performance.

More recently, a review conducted by Parmelli (2011) looked at more than 4000 studies evaluating the effectiveness of different strategies on improving health care performance. The review concluded that no strategy satisfied the quality criteria that the Effective Practice and Organisation of Care (EPOC) group uses. This group, housed at the University of Ottawa, creates reviews following the Cochrane Library guidelines to reduce bias. Parmelli (2011) suggested that "research efforts should focus on strengthening the evidence about the effectiveness of methods to change organizational culture to improve health care performance" [Parmelli, 2011; page 2].

A shorter review by Mugford (1991) looked at 36 intervention studies and suggested the following: “Information feedback was most likely to influence clinical practice if it was part of a strategy to target decision makers who had already agreed to review their practice. A more direct effect was discernable if the information was presented close to the time of decision making. The question of optimum layout and quantity of information were not addressed” [Mugford, 1991; page 398]. This statement has been quoted because the General Internal Medicine unit at Toronto General Hospital has had similar experiences. At GIM there is a lack of a consensus on the strategy to get feedback. As suggested by Mugford (1991), it is hard to engage anyone in a feedback process when there is a delay of 6 months between the moment a decision is made and when feedback about this decision is received. GIM also lacks a dissemination strategy for the feedback compiled. Mugford’s review (1991) points out the need of research to address this question and identifies the following relevant factors that influence the success of feedback interventions:

1. Person receiving the information: feedback has more effect on junior staff than senior staff.
2. Format of the information: little is known about the effect of showing the feedback in tabular versus graphics format or on paper versus computer screens, or the effect of the amount of data presented.
3. Timing of feedback: the shorter the time from obtaining to distributing the information the better.
4. Validation of statistical data: the data has to be robust in order for the feedback to be accepted.

Similarly, at GIM the process of distributing results is not clearly defined, the timing is too long, and the statistical validity of the data is not ensured. Regarding point 2 above, although the field of data visualization has evolved significantly since 1991, the CICC experience from other projects running at GIM has shown that, in this context, it is still unclear what the best strategy is for presenting information. There are too many factors affecting the people who receive the data, hence testing different options and adjusting elements based on feedback becomes the best approach.

2.2.2 Summary of selected case studies on feedback interventions

In this section, selected case studies are presented that are deemed to be particularly relevant to the domain and objectives of this thesis.

A study conducted in US hospitals by Bradley (2003) interviewed administrative and clinical staff from eight US hospitals about their perceptions on the effectiveness of data feedback. From these interviews, seven themes were identified that can make data feedback more effective in a hospital setting:

1. Data must be perceived by physicians as valid, in order to motivate change.
2. It takes time to develop the credibility of feedback data gathered within a hospital.
3. The sources and timelines of data are critical to perceive validity.
4. Benchmarking improves the meaningfulness of data feedback.
5. Physician leaders can enhance the effectiveness of data feedback.
6. Data feedback that profiles an individual physician's practices can be effective but may be perceived as punitive.
7. Data feedback must persist to sustain improved performance.

Some of the factors presented by Bradley (2003) are common to those discussed previously from Mugford (1991); however, Bradley introduced some new elements. Points 2 and 7 above indicate that there is a need to design feedback interventions that collect data for long periods of time in order to be perceived as credible and to achieve performance improvements. As intimated by point 6, feedback at GIM is sometimes seen as negative by physicians or staff members.

Regarding the issue of the length of the interventions, Brooker (1998) conducted interviews of patients and staff in a mental health service. This study showed the effect of a feedback process sustained over five years. It is valuable to have this long term perspective, as most studies focus on short term interventions, where few feedback iterations are evaluated. The study showed an increase in positive comments from both patients and staff during the five year period. These comments can be correlated with changes initiated in the ward due to patient and staff suggestions (13 from staff and 11 from patients during the 5 years period). Interestingly, the study showed that staff interviews become very valuable when staff

morale is low. Additionally, interviews of patients tend to provide more valuable information when there is no morale burden among staff. The authors' conclusion was that "we cannot assume that the view of patients and staff are interchangeable" [Brooker, 1998; page 75]. The authors also point out the relevance of interviews as a source of ideas for service improvements. In this regard, they state that it is convenient to have skilled people conducting the interviews so they can help patients and staff to express their ideas and arrange them into real measures instead of getting just a general view of things that work or do not work. However, this methodology is time consuming and expensive.

Raleigh (2008) conducted one of the largest studies ever done on FIs by interviewing 69,500 staff and 81,000 patients from 166 National Health Service facilities in England. The study detected several statistically significant associations between patients and staff responses in the survey. For example, having enough hand-washing material available for staff was positively associated with patient feedback on cleanliness and hand washing by doctors/nurses. Although causality cannot be assumed from the regression analysis performed in this study, Raleigh (2008) indicates: "staff feedback is a useful marker for patient's experience" [Raleigh, 2008; page 353].

Finally, an article by Ursprung (2005) evaluates feedback interventions specifically designed to improve patient safety. This article presents the need to introduce industry safety standards, such as checklists, continuous quality improvements, statistical process control, and lean production, in the health care sector. The study audited a Neonatal Intensive Care Unit (NICU) for 13 days by randomly following and observing the care activities for different patients for 36 predetermined items. The audit detected errors every day during the audit, summing to a total of 303 errors. The care processes with more errors included alarm settings, patient identification, hand hygiene, and labelling of tubing, syringes and medication, which are important patient safety issues. The audits led to the implementation of six different initiatives to improve patient care and safety, including education programs on specific topics and changes in processes such as the identification system used in the NICU [Ursprung, 2005]. This article points out the need for having environments where errors can be reported without assessing blame, since errors are a key element for redesigning processes.

One reason why there is a lack of blame-free environments in hospitals is the presence of several types of communication barriers. These barriers are discussed briefly in the next section since the success of feedback interventions is highly dependent on communication. Allegedly, teams with excellent interpersonal communication habits do not need formal processes to provide feedback because team members can openly mention and discuss potential improvements without affecting the feelings of other team members.

2.3 Communication Barriers

The different elements that contribute to miscommunication in hospitals are generally known as communication barriers. Examples of key communication barriers are outlined in this section.

Feedback processes can be seen as organizational learning processes, allowing organizations to improve the way they do things. The most effective way to improve processes is having teams engage in continuous learning [Edmonson, 2001]. However, this is not simple. Edmonson (2001) states that continuous learning requires creating supportive learning environments. To create such environments the same author (1999) proposed psychological safety as a main requirement for teams to be able to learn, a concept first introduced by Kahn (1990). A psychologically safe team is considered to have people who feel comfortable asking questions, admitting errors, and exposing new ideas. Allowing team members to take these interpersonal risks is critical for learning.

Since most feedback processes require some degree of interpersonal communication, having psychologically safe environments is crucial for feedback processes to succeed. However, health care organizations tend to have several communication barriers that prevent learning processes or feedback interventions from being effective. The literature shows many examples of these barriers that make teams non-psychologically safe places. For example, Walton (2006) indicated that hierarchy is an important barrier, in particular in teaching hospitals that prevent junior physicians from speaking up when they disagree with their attending physicians [Walton, 2006]. The fear of speaking up has been mentioned by other authors. Sutcliffe (2004) exposes the case of residents feeling uncomfortable about

expressing their opinions or ideas to their attending physicians [Sutcliffe, 2004]. Kroll (2008) reported an incident where a student was threatened by a tutor after criticizing a senior physician. Kroll (2008) also indicates another barrier present in hospitals: high loyalty among doctors. Loyalty becomes a barrier when doctors or other care givers do not report the errors of others and hide them to protect each other. This behaviour is negative because hidden errors are lost opportunities for improvement.

Another important communication barrier in teaching hospitals is the frequent rotation of personnel. Such rotations hinder the establishment of personal relationships, resulting in some issues and problems not being properly addressed. In addition, frequent staff rotation hinders the leveraging of feelings of belonging to a hospital community or to a group. Without this feeling, it is more difficult to get involved in improving processes [Reeves, 2011].

Reeves (2011) also pointed out two other elements that may impede fluid communication. The first is team size, as more than 12 people in a team are not effective. The second is cultural differences, which is particularly relevant in countries employing large numbers of immigrants in health care, such as Canada.

2.4 Literature Review Conclusions

As pointed out in Kluger's (1996) review of FIs across many fields, the literature shows a lack of a formal theory to explain how feedback processes may improve performance and quality. Data show that there is a large variability of effects of feedback intervention on performance. Hence, there is a need for more reliable data to conclude whether or not feedback can improve performance. However, the literature emphasizes the following elements that are relevant to succeed in the implementation of feedback interventions:

- **Engagement:** the introduction of feedback interventions in organizations has to be done with the agreement and consensus of those who will receive the feedback data. It is important to incorporate staff with less experience who are in their education phase, since feedback interventions have a larger impact on these individuals.

- Data validation and format: the data distributed has to be statistically reliable. Hospital staff, including physicians in particular, is used to seeing data and they are taught to look at it critically. In addition, the presentation format of the data needs to be studied since the best ways to display data are not clear.
- Timing to close the loop: feedback interventions consist of a loop process sustained over time. In order to increase the effectiveness of feedback it is critical to reduce the time interval delay between performance and distribution of results.
- Sustainability over time: the effect of providing feedback on performance is likely to be larger on studies sustained over time when several feedback cycles are completed. In addition, the data are perceived to be more valuable and valid when the dissemination is sustained over time.
- Avoid negative perceptions: feedback can be perceived as something negative, as a trigger for punishment. It is important to design feedback interventions that avoid this perception and enhance the strengths of feedback.
- Patient and staff feedback: feedback from patients and staff can be valuable and even strengthen their relationships. Disagreements among them can be indicators of a lack of alignment between patient and staff interests.
- Economically sustainable: feedback interventions should be designed to be economically sustainable so they can be incorporated in organizations as permanent programs. Most such programs tend to be human resource intensive.
- Low impact on workflow: new processes introduced in health care that are not directly related with patient care can be negative if attention and focus deviate from the main goal of the staff, which is patient care. These processes have to be designed to have as little impact as possible on existing workflows.

While a truly psychologically safe environment may not exist, by taking into consideration the above factors, the success and usefulness of feedback mechanisms can be maximized.

Chapter 3

The Feedback Kiosk

The objective of this Chapter is to discuss the design aspects of the *feedback kiosk* project. The *feedback kiosk* project started with an informal study that was never published. This informal study will be called kiosk iteration #1 in this thesis. The first section of this chapter briefly describes kiosk iteration #1 and the rest of the chapter is dedicated to kiosk iteration #2, which was entirely developed by the author of this thesis.

3.1 Kiosk iteration #1

The CICC has been interested in projects pertaining to the design and deployment of tools to obtain feedback from patients and health care providers since its founding. In May 2010, the Centre tested a kiosk system to obtain feedback from the hospital GIM unit. As shown in Figure 3.1, the kiosk had a simple interface that allowed both patients and providers to answer three different questions:

- 1- What is one thing TEAM 6 can do to improve?
- 2- What is one thing GIM can do to improve?
- 3- What is one way this kiosk could be improved?

WE WANT TO HEAR FROM YOU GIVE US YOUR ANONYMOUS FEEDBACK



Figure 3.1. Interface of kiosk #1

Questions 1 and 2 of this kiosk were aimed at getting suggestions from both patients and providers to improve behaviours, processes and performance of the GIM unit and one of the work teams, Team 6, from the same hospital unit. Team 6 was led by the director of the CICC who was highly motivated to use the kiosk. The goal of question 3 was to get ideas on how to improve any aspect of the kiosk since this was the first pilot project of the CICC involving a kiosk setting. Note that the answers to these three questions were completely anonymous, allowing users to feel psychologically safe and to be more sincere when expressing their opinions. The strategy adopted for this kiosk was similar to the one used in the Team Feedback Project explained in the article *Innovation in Healthcare Team Feedback* by Plaza (2011). Finally, the kiosk also provided a link for users wishing to access *trialx.com*, a site that lists many ongoing clinical trials that are looking for participants.

Access to Kiosk #1 was through a web-based application developed using Rypple. Rypple is a web-based application that manages questions and anonymous answers; the main functionality of Rypple is to allow team members to provide anonymous feedback to team members asking specific questions. For example, a group of people meet to see someone else's work presentation. After the meeting, the presenter sends an email with a Rypple question asking for feedback from all the meeting attendees. This person then receives feedback without knowing the author of each answer. This provides people a second

opportunity to speak and the option of making comments that they do not want to make in public. In our case, the use of Rypple simplified the development of the interface for the first kiosk iteration since its platform handled the management of all information, questions and answers.

The main objective of this first kiosk intervention was to gain experience in improved design of the next kiosk iteration. Key learnings included:

- 1- Patients need to be able to differentiate the kiosk from other medical devices, otherwise they do not feel welcome to use it. It has to be clear to them that they can use it.
- 2- There has to be something that immediately indicates to users that the device uses a touch screen. This increases the user's ability to navigate through the application.
- 3- The keyboard has to be simplified, eliminating any key that is not necessary to use the application. This facilitates its use by non-computer savvy users.
- 4- The main kiosk application should always be in full screen mode and users should not be able to use the kiosk for other purposes.
- 5- All the operating system key shortcuts need to be disabled.
- 6- Some people perceive feedback as something negative. As such, positive feedback elements should be emphasized.
- 7- The kiosk application should be designed to be as easy as possible to set up; ideally, a plug and run system.

The majority of these points are technical aspects that need to be improved; however, point 6 introduces an interesting aspect, the user's perception of the kiosk. It is relevant that some users saw the kiosk as a threat. There are two possible explanations for this negative perception. First, it is known that in some instances feedback and accountability are perceived to be negative by workers and, second, there are people who disagree with spending resources not directly related to health care; they do not see the value of getting feedback, and believe that hospital priorities should not include a feedback kiosk. This point was considered in the design phase discussed in the design of kiosk iteration #2.

Valuable feedback answers were also obtained through the kiosk application. However, data or results from this first kiosk cannot be published since the intervention was done as a part of a confidential quality improvement process at the hospital.

3.2 Kiosk Iteration #2

After the first kiosk iteration, it was decided that a more rigorous study was needed. The long term goal of the CICC for this project is to run an intervention for a long period of time to evaluate the effects of a feedback kiosk based system on behaviours, processes and performance. However, it was considered necessary to run a pilot study to learn how users interact with the kiosk and, hence, better design a larger and more ambitious intervention where more time and resources can be allocated. This pilot study is herein called the second kiosk iteration.

3.2.1 Objectives

The intervention of this second iteration was designed as a research study instead of a quality improvement study because the objective was to be able to publish the data acquired. This has important implications since a formal research study requires going through a long and involved process to obtain ethical approval from the University Health Network Research Ethics Board (REB). *Appendix B* contains the approved project protocol, explaining step by step the study, and *Appendix C* contains the approval notification from REB that approved the research study as well as all the written material that was used during the study.

Usability tests could have been developed in a controlled environment where study participants used the application being tested while they were observed. Different measurements could be gathered during such a study such as time to develop a task or number of attempts needed to do a task. However, the kiosk setting in the hospital was believed to be an important variable that affects user behaviour. Hospital staff stress is difficult to reproduce in a laboratory setting. For this reason, the study was designed to test

the kiosk directly in the GIM ward to understand how real users in real situations would interact with the new device.

To conduct the pilot test, an application was designed that would run the kiosk as well as take different measurements. It was decided that for each task performed on the kiosk the following variables would be recorded: a) the type of task being performed, b) the date and time, c) the kiosk's specific location, d) the time when the task is completed, e) the message content and f) the position/role of the user doing the task. The list of role groups was designed in such a way that user identity could not be guessed. The groups are: a) patient, family or friend of patient; b) nurse; c) physician, resident or medical student; d) other hospital staff; and e) other. In addition to these measurements, a short survey was developed (see the 5 questions below) for kiosk users to complete after performing tasks on the kiosk. The first three questions in the survey were rated different themes on a Likert-type scale from 1 to 7 and the last two questions were open ended questions where users could discuss what they liked and disliked about the kiosk.

- 1- Using the kiosk to [perform the task just completed] is very valuable.
- 2- The kiosk is self explanatory and easy to use.
- 3- I would like to continue having access to the kiosk after the end of the study.
- 4- What did you dislike the most about this kiosk?
- 5- What did you like the most about the kiosk?

3.2.2 Design

This section describes the design process of the second kiosk iteration. The design was based on the learning achieved during the first kiosk experience as well as background research. As a result of this work, a system was created with four functionalities. First, the *feedback* functionality already existing in the first iteration was reshaped; second, the *recognition* functionality was created to allow people to send positive public messages; third, a link to the *Honour Your Hero* program was included; and fourth, the option to give feedback to improve the kiosk was maintained.

3.2.2.1 Feedback functionality

Obtaining feedback was the initial goal of the kiosk project. In the first iteration, the strategy used to obtain feedback was to ask for specific improvements in a general way. By displaying a question like “What is one thing GIM can do to improve?” on the kiosk main screen it was expected that each person would mention what they considered to be important. Instead, the strategy adopted in the second iteration was to focus the questions towards more specific points. As previously shown, this facilitates thinking and talking about specific issues on each of the questions [Brooker, 1998]. In order to generate a list of questions to cover the most relevant topics, the following three strategies were used. First, the CICC staff was asked to contribute to this list with ideas and suggestions based on their experience with treating patients. Second, a list of published topics, mentioned by hospital staff and patients during feedback interventions, was reviewed [Brooker, 1998]. Third, the nurse manager in GIM provided further interesting insights. However, the problem of having so many questions is that they all cannot be displayed on the screen. The solution adopted was to develop a system where the questions displayed would change over time so that all the topics would be covered.

The final workflow for feedback functionality is as follows: two questions from the initial question list are displayed for one week on the kiosk. Then questions are changed in order to obtain feedback on different topics. Kiosk users can select any of the feedback questions and answer them anonymously. Then the research team compiles and reviews the feedback answers to eliminate any personal information that may appear in the messages. Finally, answers are shared with managers as appropriate.

3.2.2.2 Recognition functionality and *Honour Your Hero* program

This section explains the design process for recognition functionality and how this process triggered a collaboration with the Toronto General and Western Hospital Foundation. This collaboration resulted in the inclusion of the *Honour Your Hero* program as one of the kiosk functionalities.

Both the literature and experience with the first iteration suggested the incorporation of an explicit way to give positive feedback to hospital staff. To this end, a new functionality element called *recognition* was incorporated in the kiosk which was clearly differentiated from the *feedback* functionality. Two general types of recognition initiatives were in place at the hospital: 1) local initiatives at the unit level, led by nurse managers; and 2) recognition programs across the hospital. The following is a summary of the recognition initiatives ongoing at TGH.

Local Initiatives:

- 1- *Kudos board*. This is a notice board where mainly nurses post messages to recognize their colleagues for their efforts at work. Nurses leave their messages in a drop box located near the board. Then, every two weeks a different nurse takes all the messages and posts them on the board. These messages are always signed and generally congratulate someone else for something well done.
- 2- *Patients white board*. In another unit there is a white board with pens available for patients to write their message. Interestingly, all the messages thank the hospital staff for their work.
- 3- *Postcards board*. Another unit has a notice board where postcards from patients are posted.

Across Hospital Initiatives:

- 1- *Send an e-Card*. This is a tool accessible through the hospital intranet that allows staff to send an on-line recognition message to a colleague. The person sending the message can describe an action performed by the recipient person and indicates the value this person has demonstrated in his/her action.
- 2- *Tell us about* or *Random Acts of Kindness*. This is an initiative to gather stories of people doing exceptional acts for others. Periodically, these stories are put together in a book that can be bought at the hospital shop.
- 3- *You're a Star to Us*. This allows people to nominate others to receive a gold star in appreciation for something they have done. This is done by sending an email to the person responsible for this program.

- 4- *Honour Your Hero*. Patients can appreciate the care received by making a donation to the hospital foundation. The person who has made a difference to patients receives a recognition pin and a card.

In order to learn about these programs, interviews were conducted with the person responsible for each recognition initiative. These interviews had three objectives: a) inform individuals about the kiosk project to avoid any conflict when launching the kiosk, b) obtain feedback for their recognition initiatives, and c) investigate possibilities for collaboration with their initiatives.

As a result of these meetings a collaboration was established with the Toronto General and Western Hospital Foundation. The reason for this collaboration was the shared goal for recognizing people who perform an excellent job every day in the hospital. The foundation is responsible for a fund raising program called *Honour Your Hero*. This program aims to give patients and family patients an opportunity to thank those in the hospital who made a difference for them, those who they see as heroes. Patients and patient families can make a donation to the hospital foundation in behalf of their hero and send a card with a pin to the person who is being honoured. The materialization of this collaboration was the incorporation of a link to the *Honour Your Hero* program on the kiosk main screen. Because of the similarity of both programs, it was hoped that one initiative could enhance the other. The Foundation decided to present the kiosk project as a program where donors could allocate their donations. Fortunately, the Foundation was able to find a donor who paid for the cost of the kiosk.

The final workflow for this feedback functionality is as follows: Users send a recognition message and they can optionally identify themselves. Then, they have to enter the name of the person or group they want to recognize and, finally, they have to type the recognition message. This message is then reviewed by the research group. If the message is considered appropriate, it is posted on a flat screen at GIM. This screen is located in a common space where everyone, including staff and patients, can see its content.

3.2.2.3 “Give feedback” to improve the kiosk

We included an option for users to give feedback on how to improve the kiosk itself. It works like the other feedback functionalities but the question displayed is always the same: How would you improve this kiosk? This kiosk was in a pilot phase to test its usability, so feedback from users in real situations can be very useful to improve future design iterations.

3.2.3 Infrastructure

This section reviews the infrastructure and features required to create a system like the one described in the previous section. The section is divided into the main elements needed to develop the project: kiosk, kiosk setting, server, web application technologies, and screens.

Kiosk

To develop this project a kiosk with the following features was used:

- Touch screen. Touch screens make user interactions agile and simple. Often potential kiosk users are hospital staff who are very busy and have little time, so design agility and simplicity is important.
- External keyboard. The application running on the kiosk requires users to type certain content into text boxes. Although it is possible to display a keyboard on a touch screen, it was considered that it would be more intuitive and easier for most of the users to type on an external keyboard. In addition, developing an application on a device without keyboard is more complicated since it requires readjusting the screen display every time the users clicks on a textbox, to fit the keyboard on the screen so they can type in the content. A trackball was included on the keyboard; this gave the option to users of using the trackball instead of the touch screen for navigating through the application.
- Wireless connection. A wireless connection is critical as the hospital is not equipped with land network connections in common areas like corridors or halls where the kiosk was placed.

After considering different kiosk models from different companies a PLYNTH G6 kiosk from KING Products and Solutions was purchased. This model was selected because it satisfied our requirements, and also because the Centre for Global eHealth Innovation located in the TGH reported good experience using a kiosk purchased from this company for information and Internet access purposes.

The Linux operating system (OS) was considered for the kiosk because it is free; however, Windows 7 was finally selected because in the future this kiosk may have other uses and the CICC personnel have experience working on Windows but not Linux. As explained below, it was decided to use a web based technology to develop the software to run on the kiosk. This requires a browser to run the client application. The selection of browser was based on technical reasons since all browsers are available for free. Our initial intention was to use Google Chrome because of its high performance [Gube, 2011] and it supports the HTML extension named *web kit*, which facilitates web design and allows reducing the size of the files transferred between server and client.

3.2.3.1 Kiosk settings

In a kiosk setting the main application should always operate in full screen mode. Web browser menus should not be accessible because they can distract users and they become a source of problems when the kiosk is set up for public use. Google Chrome provides full screen mode but this mode is very easy to exit, even unintentionally. Therefore, other browsers were considered and Firefox was selected. The reason was that a Firefox extension, R-kiosk, is available for free and was developed specifically for the purpose of keeping the browser in full screen mode.

Unfortunately, the use of the R-kiosk extension does not ensure that users can only use the kiosk for the main application. The reason is that a large number of Firefox and Windows key shortcuts allow users to do different tasks, such as opening the main Windows menu, closing the active application, or starting the Windows task manager. Experienced users could take advantage of these key shortcuts to use the kiosk for other purposes, such as browsing. However, non computer literate users could accidentally press some of these key

combinations and become confused by unexpected actions. To avoid this, all shortcut keys were disabled using the AutoHotKey function.

3.2.3.2 Server

This project required a server with the MySQL database engine and PHP parser and interpreter. The CICC had a server on its institutional website that satisfied these needs; however, it could not be used for our study because it was located in the United States. The Personal Health Information Protection Act (PHIPA) does not allow personal health information of Canadians to be allocated in servers outside Canadian borders. For this reason, another server provider was contracted to run this study. The provider selected was Netfirms who satisfied our technical requirements and also could certify that the information located in their server is within Canada.

3.2.3.3 Web application technologies

To run the kiosk, a web based application was used instead of a program running locally on the kiosk. There are several advantages to this approach: first, the application works independently of the Operating System (OS) on the kiosk; second, application updates do not require stopping the service since they can be done remotely on the server; third, monitoring data can be collected in real time without interrupting the data acquisition process; and finally, the system can be scaled to an environment with several kiosks in place.

In order to develop the web application, a combination of technologies was chosen. On the server side, MySQL is the database engine and PHP is the programming language. On the client side, HTML was used to develop the user interfaces, and Javascript was the programming language. MySQL and PHP are fully available under free licence and HTML and Javascript are open standards supported by all web browsers and available for free. The main reason for selecting this combination of technologies is its zero cost and also its proven reliability. Facebook is one example application developed with this same

combination of technologies. The AJAX technology was considered in order to make the application faster and more agile since it allows refreshing parts of a website independently. However, given the characteristics of the application, this technology would have represented a real advantage only in a few situations. As such, this option was discarded.

While developing the web application, a web server needed to be installed locally to emulate the server where the application would finally work. For this purpose, a WAMP Server (Windows, Apache, MySQL and PHP) package was used. In addition to the zero cost associated with the local WAMP Server, it is important to appreciate its simple installation process. It took less than one day to install and start developing the web application.

3.2.3.4 Screens

At TGH, there is a network of flat screens controlled by the department of Nursing Informatics (NI). Almost all the units and services at TGH have one screen placed in a way that is visible by staff as well as patients. The CICC established collaboration with the NI department so it was possible to use existing screens to display the recognition messages obtained on the kiosk. Importantly, this system allows the display of different content on each screen so messages could be displayed in the specific department where they were gathered.

3.2.4 Software Implementation

This section discusses the implementation of the software that was developed to run the kiosk. The section is divided into two parts: interface and database.

3.2.4.1 Interface design

When developing the application interface two important facts have been taken into consideration: first, the application runs on a touch screen device that is going to be used

from a standing position; and second, there is a large variability of computer skills in the target population for our application, i.e. ranging from older patients who may have never used a computer to highly educated and technically savvy physicians. Hence, using the application had to be as intuitive as possible.

The design of the main kiosk screen had to accomplish two objectives, both equally important. On the one hand, it had to invite people to use it and, in this way, served as an advertising tool. On the other hand, it has to provide a clear explanation of its functionalities for users. To satisfy these two objectives, several iterations were required before deciding on the final design.

Before developing the first iterations of the interface, the literature on user interface design was reviewed. Although there is a lot of information on web usability there is less published on design of kiosk interfaces. There are important differences when designing interfaces where users interact using a mouse or a touch screen. Nielsen's work on web usability was considered (Nielsen, 2006), but importantly, the recommendations provided by Maguire (1999) on his review of User-Interface Design for Public Kiosk Systems were implemented [Maguire, 1999]. Most of their recommendations are very specific design aspects that will be referenced when the detail of each application's screen is explained. Next, some of the general principles and recommendations from Nielsen (2006) and Maguire (1999) that have been considered are discussed.

Nielsen (2006) suggests using real-world language. In order to use the same language on the kiosk as on GIM, the staff at GIM was asked how they name things. For example, the screens that are used to display the recognition messages are managed by the Department of Nursing Informatics and they call them the Digital Signage System. However, the people on the GIM ward refer to them as "TV screens" so this is the term that was chosen for the application. The hospital foundation staff also contributed in writing the description of the *Honour Your Hero* program, to be consistent with their promotional material, posters, and brochures.

Another recommendation from Nielsen (2006) is to eliminate any irrelevant information. Therefore, all the text on the interface was written to be as clear as possible while keeping it

short. Having short text statements facilitates following another of Nielsen's recommendations: "making things visible". This was done by using large fonts or including text in coloured boxes. Regarding the font size, Nielsen and Hoa [Nielsen, 2006] recommend using 14 points for text that has to be read by older adults or people with visual problems. This recommendation was followed, and no text smaller than 14 points was used in the kiosk interface. However, since the distance between user eyes and the kiosk screen is larger than in a typical workstation setting it was decided to use a larger font on the main text of the application. The font type selected was News Gothic from the family of Sans-serif fonts that are made to be read easily on digital screens. In order to make things visible, Maguire (1999) suggests using white and grey as the main colours, or the Microsoft Windows look with pseudo 3D elements, or saturated bright colours with 3D elements. The latter was used for this project.

It was decided to implement three main functionalities on the kiosk: *feedback*, *recognition* and *Honour Your Hero*. The same prominence was given to these three functionalities by creating dedicated vertical panels of equal size on the initial screen (see Figure 3.2). Each of these panels has its own colour and the specific colours are used to identify the functionalities throughout the application. The three panels have the same structure: a title on the top, a short task description, and big red buttons to access the functionalities on the lower part of the panels. Maguire (1999) recommends using buttons as big as possible since it facilitates users ability to hit them. This is especially important in a hospital setting where the percentage of population with motor limitations is higher than in a general population setting. Maguire (1999) also recommends providing feedback to users after pressing any button on the screen so a sound was set to be heard every time users touched a button.

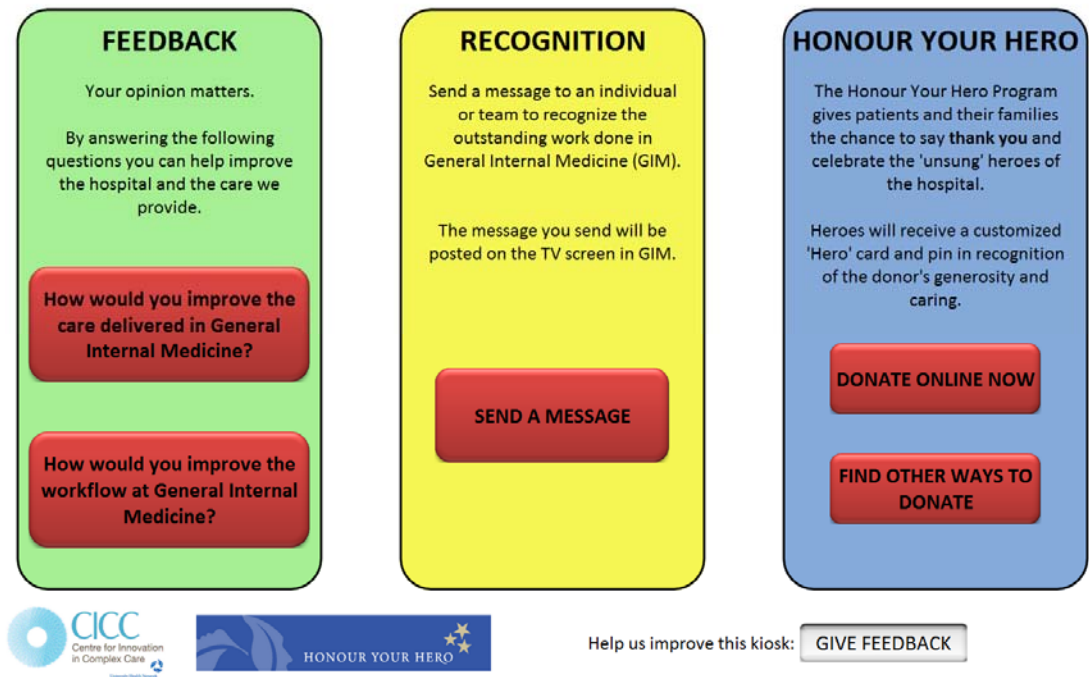


Figure 3.2. Main screen of the kiosk.

From left to right in Figure 3.2, the first panel is the *feedback* panel. This is a green panel with two big buttons showing one question each; the user has to choose the question to answer and touch the specific button. These questions change over time. The second panel is the *recognition* panel. This yellow panel initially has an explanation and then a big button to invite people to send a recognition message. Finally, the last panel is the *Honour Your Hero* panel, which is in blue and has two buttons; one is a link to the foundation website to make donations, and the other button links to a page with more information about ways to donate. At the bottom left of the main screen, there are the institutional logos of CICC and *Honour Your Hero* program. On the right, there is a button that says “Give Feedback”. The purpose of this button is to send users to a page where they can provide feedback about the kiosk itself.

One of the most difficult things to design on this screen was the buttons. These had to be specially created since the buttons defined through standard HTML are not adequate for use on a touch screen.

3.2.4.1.1 Feedback functionality

When users click on one of the two questions from the feedback panel, the application opens the feedback functionality on the same window. As recommended by Maguire (1999) and Nielsen (2006), popup windows were not used since users do not like them. Also, a window that is not open in full screen mode on a touch screen easily becomes a problem because users can touch the screen below and, consequently, hide the smaller window behind a full size window. The application was designed in such a way that users could only navigate through the application following a specified flow. The feedback functionality screen is headed by a disclosure message to let users know that the data they are providing is going to be used for research purposes. As shown in Figure 3.3, the feedback screen initially requests users to identify their role among one of the following groups: a) patient, family or friend of patient, b) nurse, c) physician, resident or medical student, d) other hospital staff and e) other. Then, there is a text box area where users can type their answer to the question. When they finish, they can send their feedback by touching the Send button.

This kiosk is in a research stage. Our purpose is to evaluate the usability of this new tool. Please note that by using this kiosk you are consenting to participate in a research study. Participation is voluntary and the data entered will be anonymized and secured. Thank you for your participation.

The screenshot shows a green feedback screen with the following elements:

- Header:** "FEEDBACK" in bold black text.
- Question 1:** "1- Please select the group you belong to."
- Selection Buttons:** Five white buttons with rounded corners: "Patient, family or friend of patient", "Nurse", "Physician, resident or medical student", "Other hospital staff", and "Other".
- Question 2:** "2- How would you improve the care delivered in General Internal Medicine?"
- Text Input:** A large white text box for entering feedback.
- Buttons:** "Close" and "Send" buttons at the bottom.

Figure 3.3. Feedback screen

When creating this page another limitation of the HTML standard surfaced. In particular, HTML forms are not designed for touch screens. Also, radio buttons in HTML are usually used to let people choose only one among different options, which is what was needed; however, these small rounded buttons are not easy to touch on a touch screen device and there are no attributes to change their look. Hence, this interface had to be created using Javascript.

3.2.4.1.2 Recognition functionality

When users touch the “send a message” button, the recognition functionality is opened. As in the feedback functionality, users must select their role first. Then, they have a text box to enter their name, a box to enter the name of the person or team they want to recognize, and a text box to write the message. The difficulty in this case was to find the proper wording to explain succinctly what users have to enter in each text area. On this screen numbers were assigned to each task to guide users while completing the form (see Figure 3.4). In order to maintain consistency, it was decided to introduce these identifying numbers across all screens of the application.

This kiosk is in a research stage. Our purpose is to evaluate the usability of this new tool. Please note that by using this kiosk you are consenting to participate in a research study. Participation is voluntary and the data entered will be anonymized and secured. Thank you for your participation.

RECOGNITION

1- Please select the group you belong to.

Patient, family or friend of patient Nurse

Physician, resident or medical student Other hospital staff Other

2- Type **your first name**:
you may leave this blank if you wish to remain anonymous

3- Type the **team** name or the **first name** of the individual you want to recognize:

4- Type the recognition **message** that you want to send:

Close Send

Figure 3.4. Recognition screen

3.2.4.1.3 Evaluation surveys

When users completed and sent the feedback or recognition text, a new page opens (see Figures 3.5 and 3.6). On this page, users are asked to participate in a short survey with 5 questions to evaluate the task they have just finished.

Thank you. Your message will be reviewed by the research team and posted on the TV screen in General Internal Medicine (GIM). You are invited to answer a brief survey regarding your experience using this kiosk. Thank you for your cooperation.

Evaluation Survey

1- Using the kiosk to **send recognition messages** is very valuable.

strongly disagree neutral strongly agree

1 2 3 4 5 6 7

2- The kiosk is self explanatory and **easy to use**.

strongly disagree neutral strongly agree

1 2 3 4 5 6 7

3- I would like to **continue having access to the kiosk** after the end of the study.

strongly disagree neutral strongly agree

1 2 3 4 5 6 7

4- What did you **dislike** the most about this kiosk?

5- What did you **like** the most about the kiosk?

Close Send

Figure 3.5. Evaluation survey for recognition functionality

Thank you for your feedback. You are invited to answer a brief survey regarding your experience using this kiosk. Thank you for your cooperation.

Evaluation Survey

1- Using this kiosk to **give feedback** is very valuable.

strongly disagree neutral strongly agree

1 2 3 4 5 6 7

2- The kiosk is self explanatory and **easy to use**.

strongly disagree neutral strongly agree

1 2 3 4 5 6 7

3- I would like to **continue having access to the kiosk** after the end of the study.

strongly disagree neutral strongly agree

1 2 3 4 5 6 7

4- What did you **dislike** the most about this kiosk?

5- What did you **like** the most about the kiosk?

Close Send

Figure 3.6. Evaluation survey for feedback functionality

3.2.4.1.4 Honour Your Hero

The third main kiosk functionality is *Honour Your Hero*. Its implementation was simple since it only contains two links: the first link was to donate online using the already existing website created by the Foundation (see Figure 3.7), and the second link connects to an information page where more details about different ways to make a donation are provided (Figure 3.8). Another recommendation from Nielsen (2006) is to give users control and freedom to exit any task at any time. Up until now, all screens mentioned have a *Close* button beside the *Send* option. Since the donation site was already developed, this site was nested into another page where the *Close* button was added. This made the application consistent throughout.

Figure 3.7. Donation screen

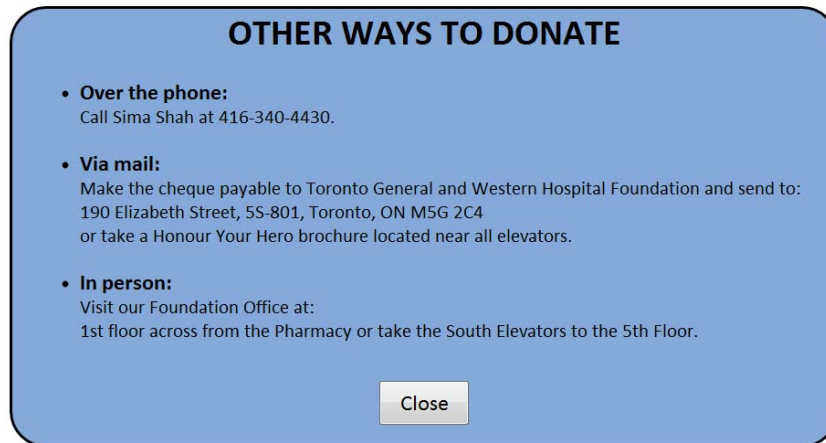


Figure 3.8. More information screen

3.2.4.1.5 Give feedback

The last kiosk functionality is the “Give Feedback”. It has the same structure as the feedback screen in green, (see Figure 3.9), but it always displays the same question: “What is one way this kiosk could be improved?” The objective of this was to obtain feedback to improve future kiosk iterations.

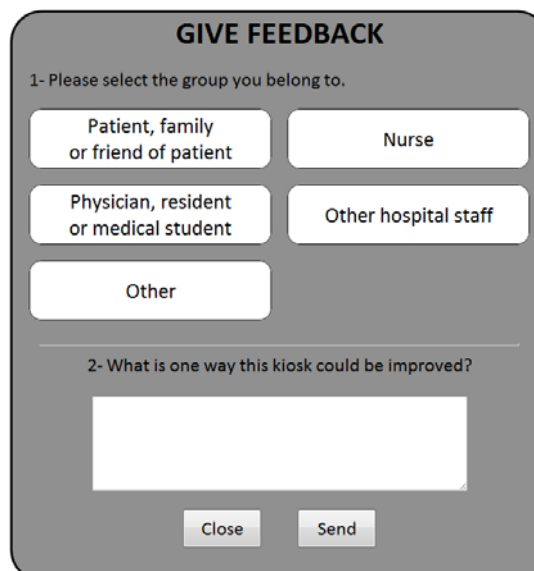


Figure 3.9. Give feedback screen

All the functionality screens of this application have a time out system that goes back to the main kiosk screen after five to ten minutes of inactivity. The main screen has an automatic reloading system so when something such as the feedback questions are changed the website is updated on the kiosk.

The application running behind this interface has a more complex file structure than just the files containing the code for each of the screens presented. Figure 3.10 is a flow diagram with the application structure. The boxes in colour represent files that display something to kiosk users. The boxes in white represent files that do not display anything to kiosk users but do some tasks like getting data from forms and storing it in the database. This diagram is for maintenance purposes, so it is easier for anyone to find the piece of code that is needed for maintenance/modification.

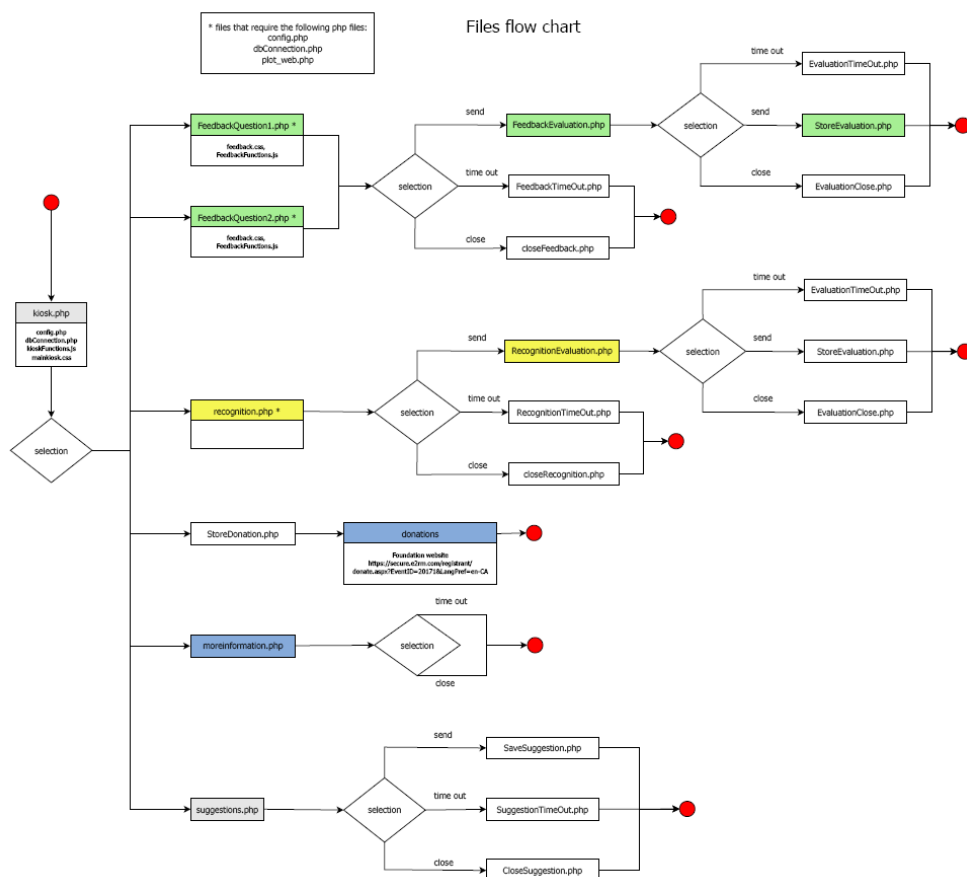


Figure 3.10. Application flow diagram

3.2.4.2 Database design

The system database was built to store the specific information that users entered through the kiosk. It also stores some of the interface content such as the feedback questions. Importantly, it also stores different parameters, such as date and time of use, to better understand how users were using the kiosk. To create the MySQL database, phpMyAdmin was used, which is a free database manager that facilitates creating and managing MySQL databases. In total, this database has 6 tables. The structure and description of each of these tables can be seen on *Appendix D*. Figure 3.11 shows the relationships among these tables.

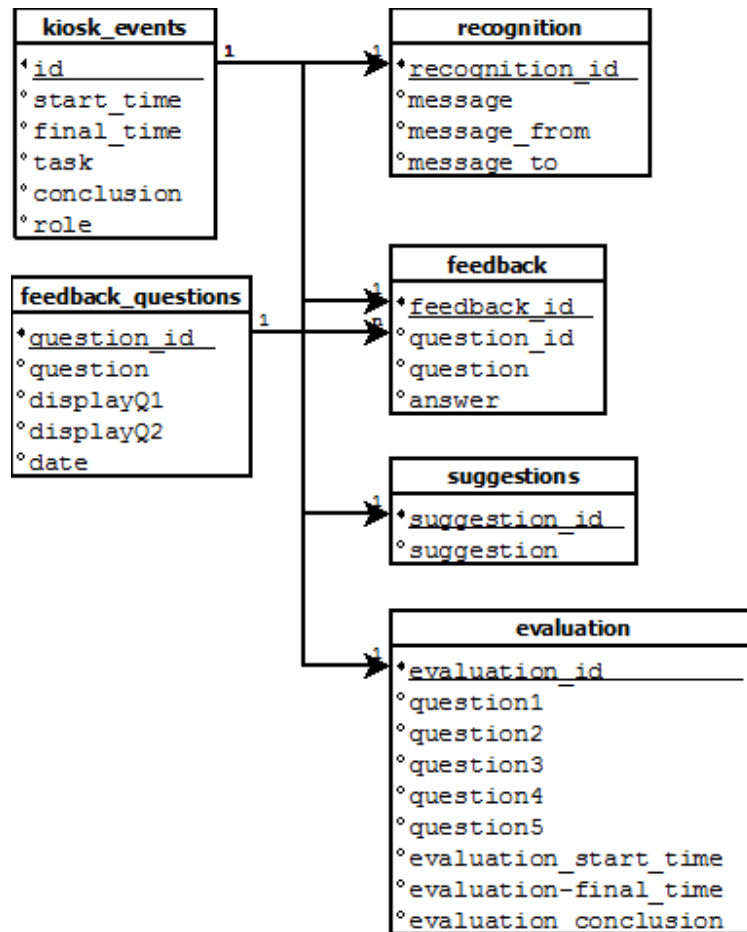


Figure 3.11. Database diagram

3.2.5 Deployment

The deployment process for the kiosk Iteration #2 started when the kiosk was delivered at the CICC. One day of work was needed to install the required software to run the application and one week was used for testing purposes as well as for making minor changes to the application interface to adjust it better to the kiosk.

The main objective of this testing period was to evaluate the stability of the Internet connection. The kiosk is connected to the UHN guest wireless network, which provided a continuous connection over the testing week.

Following the testing week, the kiosk was located at the GIM ward. The review from Maguire (1999) discusses the difficulty of finding a good kiosk location because of the need to find a visible place where passers-by can see it, and the need to provide users enough privacy to feel comfortable while interacting with the kiosk. In addition, it was considered that it would be important to locate the kiosk close to the TV screen where the recognition messages are displayed. In order to find this best location, the assessment from the Head of Nursing was considered. The final place was a corridor near the nursing station but on the other side from the main entrance to the unit. From this location, kiosk users can have direct visual contact with the TV screen.

Following a Maguire (1999) recommendation, initiatives were undertaken to generate awareness among staff and patients. It was planned to conduct these initiatives during the first week after placing the kiosk in the ward; however, due to conflicting agendas it was not possible to finish these initiatives until the end of the second week. First, posters were fixed on the wall behind the kiosk to invite people to use it. Second, an email was sent to GIM staff explaining the kiosk initiative. Third, brief presentations at nursing rounds and care rounds were given to introduce the kiosk, and information brochures were distributed to the nurses and physicians. Finally, an advertisement was displayed on the TV screens in the unit inviting people to use the kiosk. After the first week, these screens also started to display the recognition messages received.

The data collection period was divided into cycles. Every Monday the feedback questions displayed on the kiosk screen were changed and the recognition messages from the

previous week were displayed on the TV screens. Figure 3.12 is a Gantt chart that summarizes the deployment process.

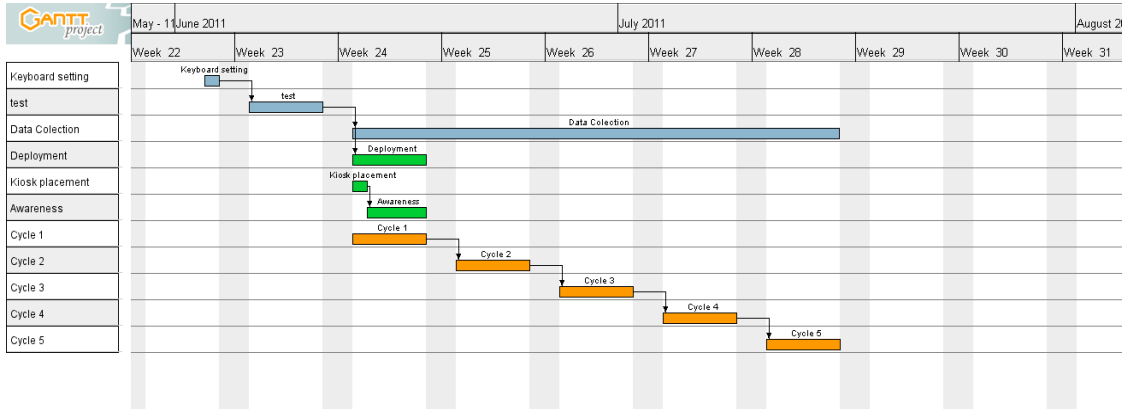


Figure 3.12. Gantt chart of the deployment process

The incidences detected during the deployment period were all related to wireless connection failures, which were out of our control. All connection failures were solved by restarting the kiosk. Importantly, the software never crashed.

Chapter 4

Results

For this study, the kiosk was placed at the General Internal Medicine (GIM) unit on the 13th floor of Toronto General Hospital (TGH). The data analyzed and shown in the graphs below were collected over a span of 49 days.

An event represents any interaction a person had with the kiosk when the system stored data in the database. This includes both completed and uncompleted tasks. Before starting the analysis, the database was cleaned in order to eliminate those events that were originated by CICC members for maintenance purposes. Two groups of several events, which were registered on the database at the same time, were also eliminated. These inconsistent registries on the database were likely due to wireless connection failures that occurred during the study. In the next sections, the type of events and their distribution over different variables, such as time and type/role of kiosk users, are analyzed.

4.1 Distribution of events over time

Figure 4.1 shows the number of events (black bars) registered every day and the time the kiosk was not in operation due to wireless connection failures (grey crosses).

The overall number of events registered during the study was 109, which represents an average of 2.2 events per day. On the weekends, fewer events occurred. Indeed, a total of 96 events (88%) occurred on week days and only 13 (11%) on weekends. Over the study period, there was a decreasing frequency in the number of events registered. In particular, after the failure of the wireless connection on day 35^h of the study, there appears to have been a clear disengagement of users.

During the period, the kiosk was not in service for approximately 5 days. This is a total of all the hours the kiosk was off-line, and represents about 10% of the study period. Note that most of this time coincided with nights or weekends, when nobody from the CICC was available to reset the wireless connection.

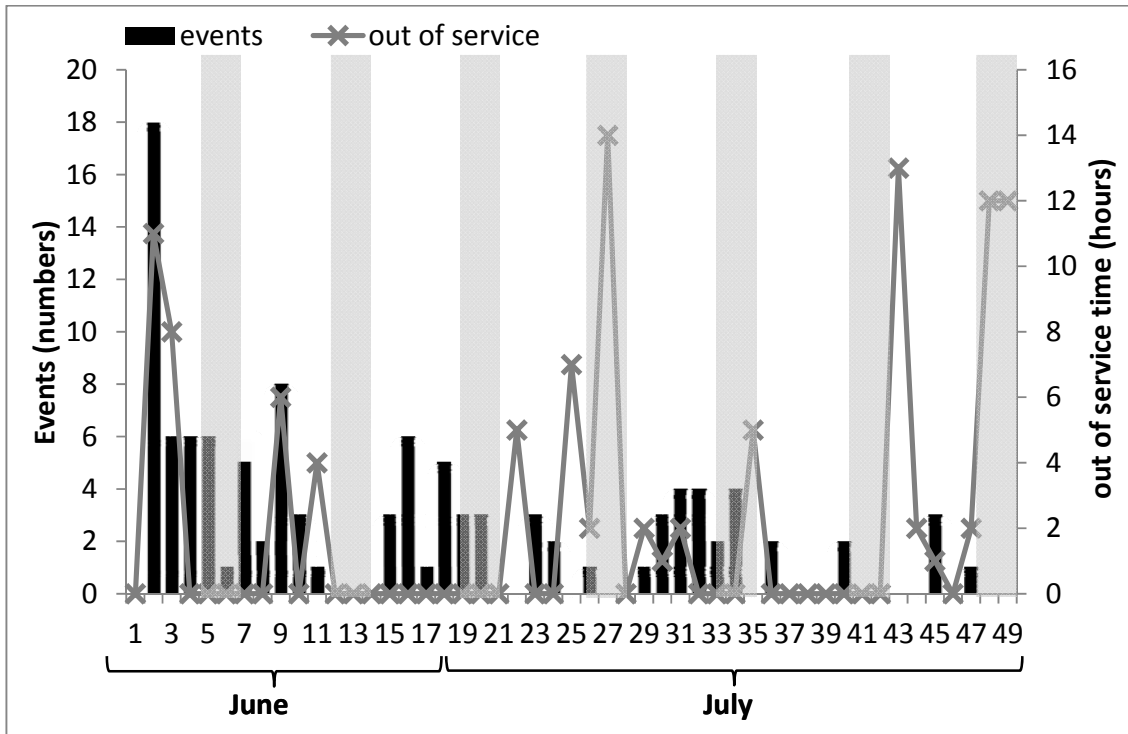


Figure 4.1. Number of events and hours that the kiosk was off-line over the duration of the study.

The distribution of events and the time the kiosk was out of service each day of the week is depicted in Figure 4.2.

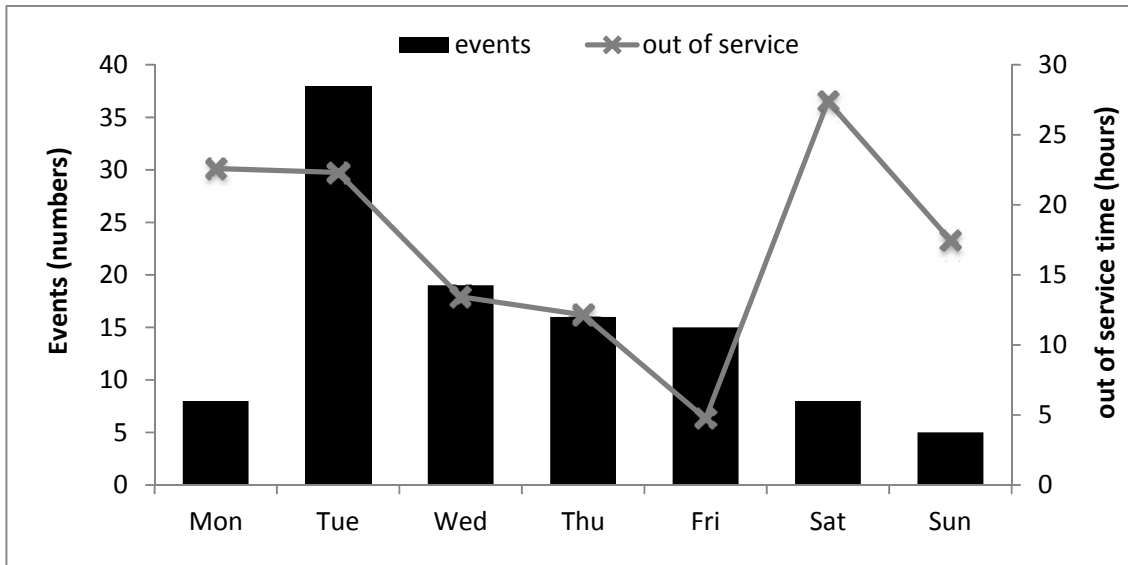


Figure 4.2. Weekly distribution of kiosk events and off-line time.

Figure 4.2 shows that the greatest use of the kiosk was on Tuesday. Sunday was the day with the fewest events registered and activity on Saturdays and Mondays was also low. The periods from Saturdays to Tuesdays were the days that the kiosk was offline most. The more hours the kiosk was not in service, the lower was the number of events registered, with the exception of Tuesdays. Interestingly, wireless failures on Tuesdays were concentrated during night time hours. A potential explanation for the higher use of the kiosk on Tuesdays may be due to CICC rounds, which take place in the CICC (located near the GIM unit at TGH) every Tuesday at noon. These rounds are open to everyone but in particular to GIM staff. Ongoing CICC projects (the kiosk project is one of them) are reviewed and discussed on these rounds. Hence, the CICC rounds might have been promoted by word of mouth for people who were highly motivated about new projects, leading to a higher use of the kiosk on Tuesdays.

Figure 4.3 shows that events were mainly concentrated during daytime hours instead of at night, since 82% were registered between 8 am and 7 pm. In particular, one third of all events were registered between 2 pm and 5 pm.

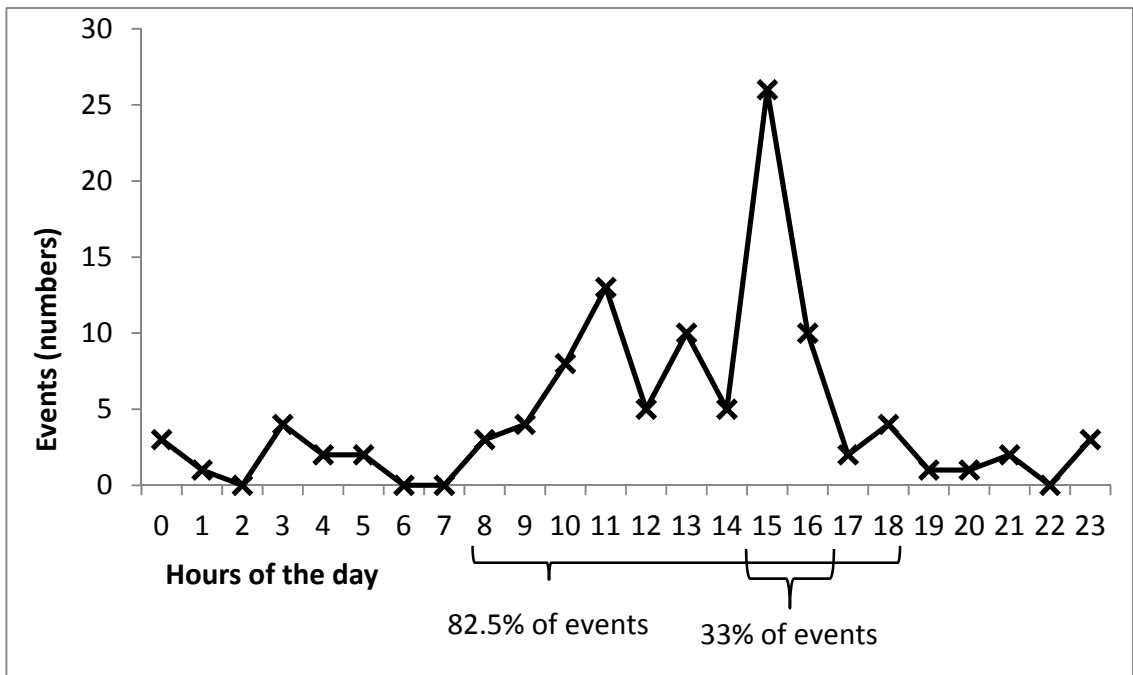


Figure 4.3. Kiosk event distribution over daytime hours.

So far, completed and uncompleted tasks have been included in the analyses of event distribution. Figure 4.4 represents the distribution of completed versus uncompleted tasks over daytime hours. Completed tasks include submitted forms of feedback and recognition as well as users looking for more information about the *Honour Your Hero* Program. In contrast, uncompleted tasks include all the interactions that ended without submitting any information. Among all the events registered on the kiosk, 26 events fully completed the task that was started, representing 24% of all events. From these events, 21 were answers to feedback questions or recognition messages, and 5 were from users interested in the *Honour Your Hero* Program. By comparing completed events and uncompleted events in Figure 4.4 with the total events in Figure 4.3 it can be seen that all of these series follow a similar pattern, indicating that despite the final objectives of kiosk users, all tended to interact according to a similar pattern.

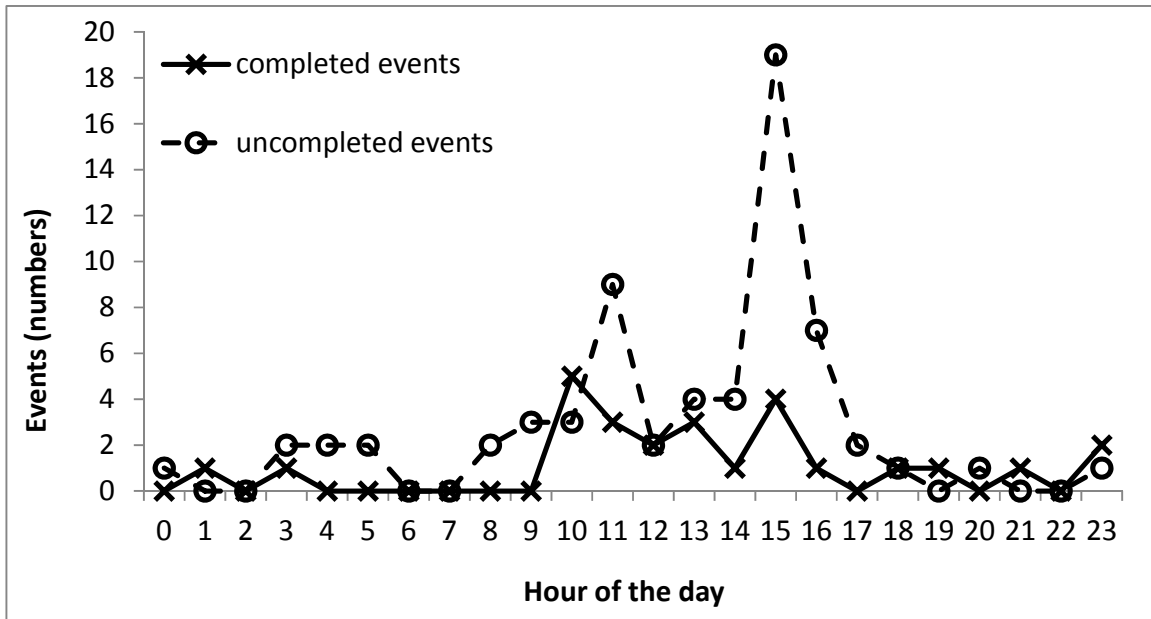


Figure 4.4. Distribution of completed and uncompleted kiosk events over one day.

4.2 Distribution of events by functionalities and users

Through the kiosk, users were able to perform five different tasks: answer feedback questions, send recognition messages, get more information on the *Honour Your Hero* program, make a donation, and provide feedback on ways to improve the kiosk. Table 4.1 summarizes the number of events associated with each task as well as the conclusions of these events. The possible conclusions of each task are: uncompleted task (Close), submitted task (Send), task performance exceeded the allowed time (Time Out), or in the case of donations it is not known (Unknown) whether they completed a donation because the system does not track this information due to privacy issues.

Table 4.1. Distribution of events based on the type of task performed and their conclusions.

	Close	Send	Time Out	Unknown	Total
Feedback	28	13	5	-	46
Question1	19	8	5	-	32
Question2	9	5	0	-	14
Recognition	29	7	6	-	42
Donation	0	-	-	6	6
More Information	5	-	1	-	6
Suggestion	8	1	0	-	9
Total	70	21	12	6	109

The events registered from feedback-related tasks are the sum of the events from Question 1 and Question 2, which correspond to each of the questions displayed on the feedback functionality. The distribution of completed events over the different roles/types of users can be observed in Table 4.2. Users were able to identify themselves as: patient, family or friend of patient (patient), nurse, physician, resident or medical student (physician), other hospital staff (hospital), and other. For the *Honour Your Hero* program, users were not required to identify their role. Note that, due to ethical considerations, any messages left by users were not stored in the database when users ended the task with “close”. Hence, Table 4.2 only contains the numbers of completed events. Moreover, Donation and More Information tasks are not included on Table 4.2. Even though users had the option to perform a task without identifying their role, 20 out of the 21 who submitted a task decided to provide it.

Table 4.2. Distribution of events based on the task performed and the role of the user.

	Patient	Nurse	Physician	Hospital	Other	Unselected	Total
Feedback	4	1	3	2	3	0	13
Question1	3	0	1	2	2	0	8
Question2	1	1	2	0	1	0	5
Recognition	3	1	2	1	0	0	7
Suggestion	0	0	0	0	0	1	1
Total	7	2	5	3	3	1	21

Table 4.2 shows that one third of the users who completed a task were patients and feedback was the most used functionality by all subgroups of users.

4.3 Evaluation surveys

When users finished the feedback or recognition tasks they were asked to complete a survey to evaluate the kiosk. Out of the 20 who submitted feedback or recognition tasks, 16 completed the survey. Of these 16, 4 were completed after the recognition task and 12 after completing the feedback question. This survey had three questions to be ranked between 1 and 7 and then there were two open ended questions where users had the option to write text. The questions were:

1. Using this kiosk to give feedback/send recognition messages is very valuable.
2. The kiosk is self explanatory and easy to use.
3. I would like to continue having access to the kiosk after the end of the study.
4. What did you dislike the most about this kiosk?
5. What did you like the most about the kiosk?

The average ranking of the first three questions is summarized in Figure 4.5. The scores of these questions in both functionalities (feedback and recognition) are all high (over 6/7). Despite being non-significant, there is a trend towards a better ranking of the Recognition functionality, which was considered to be very valuable and all users expressed their willingness (a score of 7/7) to continue having the kiosk available. Regarding its usability, all users considered the kiosk to be easy to use. However, this result can be biased - a user who cannot use the kiosk because it is not easy for him/her will never be able to answer the survey.

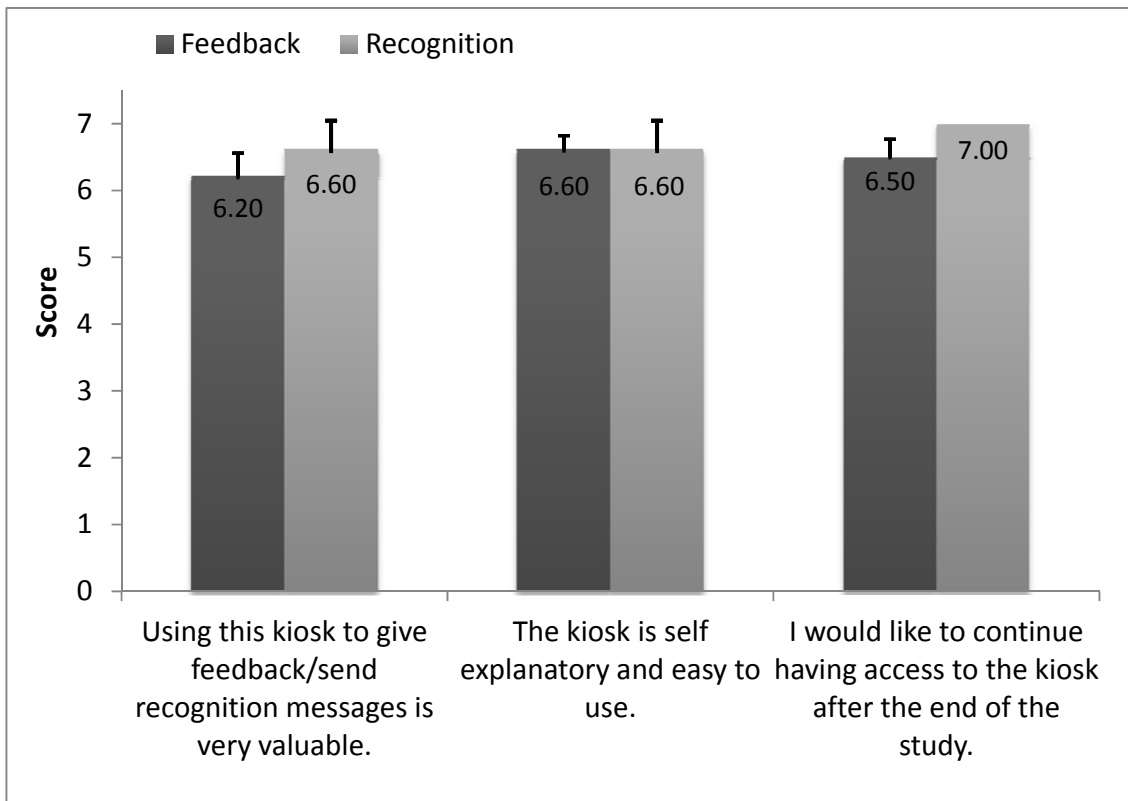


Figure 4.5. Kiosk evaluation scores.

All the written answers provided by users on questions 4 and 5 are presented in Table 4.3.

Table 4.3. Typed answers in the qualitative survey. The exact text written by users is shown.

Id	Role/Position	Dislike (Question 4)	Like (Question 5)
1	physician	the keyboard is not easy to use	the touchscreen
2	physician	the keyboard is a little weird. too low. and buttons are really far apart	high visibility
3	hospital	nothing	easy to use and convenient
4	physician	works well for feedback does	
5	other	couldnt figure out how to hit \ "enter\" when typing text	anonymous opportunity to provide feedback; convenient compared to old fashioned cards etc
6	patient	its purpose is not clearly advertised. seems like a medical computer that is for staff.	getting my opinion heard
7	patient	the keyboard is sensitive	

8	hospital	the keyboard is a little awkward	the touch screen
9	patient	the keyboard - i think i would prefer a touch screen keyboard	the touchscreen options
10	physician	hard to locate and not very well known	to mention the thanks to everyone

Six out of ten users who completed the survey disliked the kiosk keyboard. The different issues they raised were related to the disposition and sensitivity of the keys of the keyboard (Figure 4.6), as well as the position of the keyboard, which was considered to be too low. One user suggested using a touch screen keyboard and a patient mentioned that the kiosk looked like a medical device (recall that both of these were issues that were considered during the design phase). Finally, two people commented on the lack of visibility and advertising, while another user liked the fact that the kiosk was “highly visible”.

Other features that users liked included: the touch screen (mentioned 3/10), and the feedback (2/10) and recognition (1/7) functionalities. Finally, one user also mentioned that the kiosk was easy to use.



Figure 4.6. Kiosk keyboard.

The kiosk application also measured the time users needed to complete each task. Overall, users spent an average of 1 minute 39 seconds to complete their tasks. However, this time is longer in the subgroup of users who fully completed a feedback or recognition task (average of 2 minutes 15 seconds). Indeed, the average for feedback was 1 minute 56 seconds while for recognition it was 2 minutes 50 seconds. note that the application was designed to allow the user to complete each task in 10 minutes before the system would time out the task and return the kiosk to the initial screen. Of all the tasks completed within this 10 minutes window, the maximum time a user required to perform a task, specifically a feedback question, was 4 minutes 50 seconds.

A total of 12 events exceeded the 10 minute maximum time. One of these events was a request for More Information; five were feedback users and six were users of the recognition functionality. It is not possible to know with certainty whether a user was interrupted while performing a task or if someone left the kiosk with a task screen opened. Nevertheless, it is possible to determine if someone tried to use the same task again shortly after the timed out event. This was detected once when, six minutes after a recognition event was timed out, another recognition task was started. Unfortunately, this second task, lasting almost 4 minutes, was not submitted and the user decided to close without submitting any content. It is reasonable to think that this was the only case when someone was interrupted in the middle of a task.

4.4 Message analysis

The main goal of this research was the development of a system to gather feedback and its evaluation, but not the feedback comments themselves. However, it can be relevant for design purposes to evaluate the type of information collected by the kiosk. Table 4.4 shows all the written answers from users to the different feedback questions.

Table 4.4. Answers to feedback questions. Identifying information was eliminated from these answers.

Role	Question	Answer
physician	What is one thing that could be done to improve the care delivered in General Internal Medicine (GIM)?	improve access to palliative care
physician	What is one thing that could be done to improve the General Internal Medicine (GIM) ward?	coffee and snacks for patient visitors
other	What is one thing that could be done to improve the care delivered in General Internal Medicine (GIM)?	teach health providers more about pain and symptoms
physician	What is one thing that could be done to improve the General Internal Medicine (GIM) ward?	more kiosks
nurse	What is one thing that could be done to improve the General Internal Medicine (GIM) ward?	less patient-nurse ratio. more equipments that works, less time for patient stay,
hospital	What is one thing that could be done to improve the care delivered in General Internal Medicine (GIM)?	family needs to be more patient with hospital staff
other	What is one thing that could be done to improve the General Internal Medicine (GIM) ward?	nurse manager and nurses ward clerk should ensure names are properly placed in slots and meals are ordered for the next meal also hallway should be cleared
other	Would you recommend this hospital to your loved ones? Why?	yes. the staff was very courteous and all were extremely attractive young ladies
patient	What is one element that would make a patient's stay more comfortable in General Internal Medicine (GIM)?	availability of more pvt rooms
hospital	What is one thing that could be done to improve a patient's experience in General Internal Medicine (GIM)?	assigning specific house staff to patients. clear signover when this isnt possible
patient	What is one thing that could be done to improve a patient's experience in General Internal Medicine (GIM)?	create a social room for patients to interact with others and get support when family and friends are not around. change color of walls to something more eye pleasing. improve the smell and build more of a homey enviornment so its not claaustrophobic for patients who have been here for a long time.
patient	What is one thing that could be done to improve the care delivered in General Internal Medicine (GIM)?	I can not think of anything in particular at this time
patient	Would you recommend this hospital to your loved ones? Why?	The staff here has been exceptional and we really appreciate what you have done for /name/ and us. Your work ethics are only overcome by your compassion. /fisrt name1/ and /first name2/ /second name/

Finally, Table 4.5 shows the different recognition messages that users sent and that were posted on the screens on the board. The author and the receiver of each of these messages are not included in this table; however, the REB allowed us to post their first names on the screen when publishing the messages. In addition to the messages presented in this table, there was another message from a nurse who did not include any text in the message textbox, but he/she provided names of people. Notice that it was unnecessary to veto any message before publishing it, since users were very respectful and never used inappropriate language in the messages.

Table 4.5. Recognition messages

Role	Recognition message
hospital	We really appreciate you as a member of our team. We work with many different services and residents, however you have demonstrated outstanding professionalism, team work, and genuine regard for patient care.
patient	I am totally impressed by the professionalism and dedication of all the team. always smiling and reassuring in spite of the long hours...People need to come and spend a few days here to appreciate all the work you do. THANK YOU!!!
physician	/First and Second name/ is doing a bang up job!
physician	Hola
patient	Many thanks to everyone on Dr /last name/ team, the great nursing staff and all the support staff. I appreciate the care and kindness shown to me over the last few days. You\'re doing a wonderful job!!!
Patient	/name and last name/ family wish to thank everyone here for their fantastic support and care, in particular nurse /name/ and nurse /name/ Dr /last name/ and her team and d /last name/

Chapter 5

Conclusions

The objective of this chapter is to present an evaluation of the results of the kiosk project. This includes a review of how the project met its initial objectives, based on the literature and previous experience with the first kiosk iteration. The design and physical aspects of the kiosk will be evaluated as well as the overall system feedback. Some suggestions on future improvements will be made based on these evaluations. Since this is the first time that a feedback kiosk has been used in the health care domain, there was no literature about requirements for its design and physical aspects, so these came mainly from the first kiosk iteration.

5.1 Contributions to Theory

Although the core of this thesis is on applied research, it is possible to make some suggestions on a theoretical level based on the literature review and experience acquired during the *feedback kiosk* project.

The impact of communication barriers on feedback interventions (FIs) has not, to my knowledge, previously been addressed by any research study. However, this impact is likely to be important because the literature on FIs often mentions the importance of communication. Hence, there is a need for research to better understand the role of communication in feedback processes. Such research should focus on developing a general theory for feedback processes. It is still unclear how feedback works and what the different steps of feedback processes are. The only recent contribution to the feedback theory comes

from Mugford (1991), who describes feedback as a loop that needs to be closed in order for the process to be functional.

Even though there is a lack of a formal theory for feedback, it is possible to determine important elements that affect FIs. Having a psychologically safe environment where people can behave naturally and reflect their own ideas and opinions is pointed out by Edmondson (1999) as one of the most important factors contributing to fluid communication in teams. Hence, this feeling of comfort in a team is critical for FIs to succeed, since communication is a key factor in enabling feedback.

Another important element that affects the success of feedback is the amount of time required for closing the feedback loop, with shorter being better. Importantly, closing the feedback loop within short periods of time affects the credibility of the data distributed. It is very important that staff perceives the feedback as something valuable and reliable. This not only depends on features of the data presented but also on the level of engagement that staff has with the FIs. The literature describes situations where employees see FIs in a negative way. If this happens, it is difficult for them to think that the data provided is valuable. Hence, engaging staff in the FIs before deployment is very important and it can avoid the sometimes negative perception of feedback.

Finally, reducing the impact on employee workflow is very important, particularly in the health care domain. This also helps to avoid a negative perception of FIs.

A theory that explains how feedback works would help to better design interventions to enhance feedback impact within teams. In the meantime, the use of a kiosk that is accessible, works on real time, allows anonymity, and has a low impact on staff workflows seems to be an interesting and effective solution. With the use of a kiosk solution, for the first time something different than surveys or face to face interviews has been used to gather feedback.

5.2 Contributions to Practice

In this section, the technical requirements initially decided for the project are reviewed to evaluate their level of success.

A key objective of the *feedback kiosk* was that the kiosk had to be differentiated from other medical devices and systems present in the ward. To achieve this, a poster was placed on top of the kiosk inviting people to use it. Also, following Maguire's (1999) recommendation, the main kiosk screen was designed using saturated and bright colours with 3D elements to make it as different as possible from medical interfaces. Despite these efforts, there was one patient who, in the evaluation survey, said: "Its purpose is not clearly advertised. Seems like a medical computer that is for staff". Additionally, when introducing the kiosk to nurses, one nurse mentioned that more differentiation from medical devices was needed for patients to feel invited to use it. Note that 33% of people who completed a task on the kiosk were patients, which represents only 1.5% of the patients discharged from the GIM unit during the study period. Since patient feedback is considered by Brooker (1998) more valuable and adjusted to reality than staff feedback, it is very important to create an awareness system that is specific to patients [Brooker, 1998].

There was a need to block the use of the kiosk for other purposes than providing feedback. This was successfully accomplished with the use of two free applications. Commercial software was used to make a computer behave as a kiosk but this cost about \$250. If a network of kiosks is ever planned, the use of free software would contribute to the economic sustainability of the system.

The keyboard was an element that helped to prevent users from accidentally exiting the main application because it did not have any extra system keys such as function keys or windows specific keys. In addition, the keyboard was designed to be vandal-proof and washable with a wet cloth or tissue. However, the keyboard was highly criticized on the evaluation, as 50% of users disliked some of its features. For example, several users said that the keyboard was strange or not easy to use. It is true that the keyboard is not as comfortable as desktop keyboards for two main reasons. First, the keys are further apart from each other, so people accustomed to standard desktop computer keyboards could not

easily hit the keys they wanted without looking. And second, the keys on the kiosk keyboard need to be pressed harder than those on desktop computer keyboards. These two elements and the fact that kiosk users had to type in a standing position, explain why users did not like the kiosk keyboard. It is very difficult to know if the level of disappointment with the keyboard prevented people from using it. However, the evaluation survey indicates that users strongly agreed that the kiosk was self explanatory and easy to use; hence, the keyboard is not a complete barrier.

The option of using the touch screen was mentioned by several users in a positive way. In addition, the track ball incorporated on the kiosk keyboard was never negatively mentioned despite not being easy to use, which may indicate that most people used the touch screen to navigate through the application. Thus, the touch screen interface design was adequate.

Another requirement was that the kiosk has to be easy to set up. Ideally, the device would only need to be plugged in and it would be ready to run. This was not possible because the wireless network to which the kiosk was connected required security certification each time it was moved to a different location. Moreover, during the time of the study the kiosk needed to be restarted on some occasions for maintenance purposes or wireless disconnections, due to problems in the network. Three different team members were trained to be able to restart the kiosk and they all agreed that it was easy to do.

The main reason why the kiosk needed to be restarted frequently was to restart the wireless connection. The 5 days in total that the kiosk was not in service was a limitation for the evaluation of the pilot test. It is difficult to assess the impact that this off-line time had on the number of users. In order to improve the connection, the kiosk could be designed to work locally when wireless is not available so that the server could be updated as soon as the connection was re-established. A better option would be to use a more stable wireless network.

Based on the literature and our experience with the first kiosk, providing feedback is often perceived as a negative task. However, this was not the case in this kiosk study. In fact, two users evaluated the feedback functionality as something positive to have and a third one said the same for the recognition functionality it offered. In addition, in the evaluation

surveys, users considered having the feedback and recognition functionalities as being very valuable, and also expressed their desire to continue having the kiosk after the period of evaluation.

It is known that the more engaged professionals are with the study, the less negative perceptions they will have of feedback tasks and the better they will accept feedback comments. Unfortunately, the level of engagement of those who received the data could not be assessed with precision in this pilot test. The Head of Nursing was probably one of the persons more involved; she helped to decide the kiosk location and also to create some feedback questions. All the staff from GIM who attended CICC rounds were aware of the kiosk project and had some level of engagement. Finally, the awareness strategies, including the distribution of brochures, that were followed during the initial weeks had the double objective of informing and creating engagement.

In this pilot study, it was not possible to close the feedback loop. In other words, the feedback acquired through the kiosk was not presented to attending physicians or to the Head of Nursing at GIM due to schedule constraints. However, this kiosk system allows feedback that is gathered to be available for distribution immediately after users give it. This is an important advantage over the current NRC Picker surveys, which provide feedback with a six month delay. In order to facilitate the distribution of feedback to interested personal, one could consider integrating the display of feedback into already existing information systems, such as the internal secure communication system used by physicians and nurses.

In contrast to feedback functionality, the distribution of recognition messages was accomplished when displaying the messages on the TV screens on the ward. However, it was found that not everyone saw the recognition messages posted on the screen, since these were displayed for a short period of time. To increase this time would require negotiation with the Nursing Informatics department. It might also be helpful to integrate the dissemination of recognition messages into an existing system that GIM staff frequently use.

The average number of kiosk messages received each week was 3. This is a small number considering that approximately 300 different people passed by the GIM unit on the 13th

floor during a month. This means that approximately 4% of the total population left a message and about one third (109) interacted with the kiosk. Hence, strategies to invite more people to use the kiosk are needed. A factor that may have influenced the low participation rate is the low mobility of patients from the GIM unit, which could have prevented their access to the kiosk. The weekly distribution of events (Figure 4.2) shows that Tuesday is when more people used the kiosk. Interestingly, this is the day of the week that the CICC members, GIM staff and other professionals get together in the rounds session to discuss the status of ongoing research projects, including the kiosk. This suggests that word of mouth is probably a good strategy to generate awareness.

Overall, the results obtained in the pilot study suggest that the kiosk is a well-received, easy to use and effective system to gather feedback. The technologies used in its design and implementation make this project scalable and still economically sustainable.

5.3 Future Research

Based on the kiosk's performance and comments from users, future iterations of the *feedback kiosk* project would benefit from introducing the following adjustments.

- Improve the awareness and visibility of the kiosk. Since patient feedback is considered by Brooker (1998) more valuable and adjusted to reality than staff feedback, it is very important to create an awareness system specific to patients.
- Improve the keyboard input. A more user friendly keyboard should be the first priority when upgrading the kiosk.
- Improve the wireless network connection. It is not possible to know how wireless failures affected the use of the kiosk but they increased the time that the kiosk was not available for users.
- Test the kiosk in other locations. The demographics of both patients and staff change across hospital units and it would be useful to compare how location affects the results.

- Investigate different ways to close the feedback loop. One option could be to integrate the distribution of the feedback results into already existing information systems that staff normally work with.
- Create a plug and run system. Having the system set up in a plug and run mode would simplify maintenance work, and personal with no training would be able to restart the system.
- Develop a kiosk administration site. This would allow handling a network of several kiosks with different settings on each of them.

References

- Ammons, R. B. (1956). Effects of knowledge of performance: A survey and tentative theoretical formulation. *Journal of Applied Psychology*, 54, 279-299.
- Autohotkey. Download and information retrieved December, 2010 <<http://www.autohotkey.com>>.
- Bloom, B. S. (2002). Crossing the quality chasm: A new health system for the 21st century. *The Journal of the American Medical Association*, 287(5), 646-647.
- Bradley, E. H., Holmboe, E. S., Mattera, J. A., Roumanis, S. A., Radford, M. J. & Krumholz, H. M. (2004). Data feedback efforts in quality improvement: Lessons learned from US hospitals. *Quality & Safety in Health Care*, 13(1), 26-31.
- British Medical Association. The psychological and social needs of patients. Data retrieved July, 2011. <http://www.bma.org.uk/health_promotion_ethics/psychologicalandsocialneedsofpatients.jsp?page=4>.
- Brooker, D. J. & Dinshaw, C. J. (1998). Staff and patient feedback in mental health services for older people. *Quality in Health Care*, 7(2), 70-6.
- Centre for Innovation in Complex Care (CICC). Information retrieved June, 2011 <<http://www.thecicc.com/aboutus.html>>.
- Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly*, 44(2), 350-383.
- Edmondson, A., Bohmer, R. & Pisano, G. (2001). Speeding up team learning. *Harvard Business Review*, 125-132.
- Green, A. R., Carrillo, J. E. & Betancourt, J. R. (2002). Why the disease-based model of medicine fails our patients. *Western Journal of Medicine*, 176(2), 141-3.
- Gube, J. Web browser performance by Six Revisions. Information retrieved December, 2010 <<http://sixrevisions.com/infographs/browser-performance/>>.
- Heinaaro, K. R-kiosk 0.8.1 by Firefox add-ons. Download and information retrieved December, 2010 <<https://addons.mozilla.org/en-us/firefox/addon/r-kiosk/>>.
- Kahn, W. A. (1990). Psychological conditions of personal engagement and disengagement at work. *Academy of Management Journal*, 33(4), 692-724.
- King products. Information retrieved December, 2010 <<http://www.kingproducts.com/>>.
- Kluger, A. N. & Denisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin*, 119(2), 254-284.

- Kluger, A. N. & Denisi, A. (1998). Feedback interventions: Toward the understanding of a double-edged sword. *Current Directions in Psychological Science*, 7(3), 67-72.
- Kroll, L., Singleton, A., Collier, J. & Rees Jones, I. (2008). Learning not to take it seriously: Junior doctors' accounts of error. *Medical Education*, 42(10), 982-90.
- Maguire, M. C. (1999). A review of user-interface design guidelines for public information kiosk systems. *International Journal of Human-Computer Studies*, 50(3), 263-286.
- Mugford, M., Banfield, P. & O'hlanon, M. (1991). Effects of feedback of information on clinical practice: A review. *British Medical Journal*, 303(6799), 398-402.
- Nielsen, J. & Loranger, H. (2006). *Prioritizing web usability*. New Riders Press.
- Nipigon district memorial hospital. The link to performance-based compensation of our executives. Document retrieved June, 2011 <<http://www.ndmh.ca/upload/documents/ndmh-qip-2011-12-performance-based-compensation.pdf>>.
- Organisation for Economic Co-operation and Development (OECD). Health expenditure and financing. Data retrieved July, 2011 <<http://stats.oecd.org/index.aspx?datasetcode=sha>>.
- Parmelli E, Flodgren G, Schaafsma ME, Baillie N, Beyer FR, Eccles MP. The effectiveness of strategies to change organisational culture to improve healthcare performance. *Cochrane Database of Systematic Reviews* 2011, Issue 1. Art. No.: CD008315. DOI: 10.1002/14651858.CD008315.pub2
- Plaza, C., Beard, L., Fonzo, A. D., Tommaso, M. D., Mujawaz, Y., Serra-Julia, M. & Morra, D. (2011). Innovation in healthcare team feedback. *Healthcare Quarterly*, 14(2), 61-8.
- Raleigh, V. S., Hussey, D., Secombe, I. & Qi, R. (2009). Do associations between staff and inpatient feedback have the potential for improving patient experience? An analysis of surveys in nhs acute trusts in england. *Quality & Safety in Health Care*, 18(5), 347-54.
- Reeves, S. (2011) Oral presentation at the 3rd Annual GIM Amazing Symposium. Agenda of event at <http://www.thecicc.com/documents/symposium_agenda_02_23_11.pdf>
- Reichheld, F. *The ultimate question*. Bain & Company.
- Shaller, D. (2007). Patient-centered care: What does it take? *The Commonwealth Fund*, Pub. no. 1067.
- Statistics Canada. Body mass index, overweight or obese, self-reported, adult, by age group and sex. Data retrieved July, 2011 <<http://www40.statcan.gc.ca/l01/cst01/health81a-eng.htm>>.

- Statistics Canada. Diabetes, by age group and sex. Data retrieved July, 2011 <<http://www40.statcan.ca/101/cst01/health53a-eng.htm>>
- Stewart, M., Brown, J. B., Donner, A., Mcwhinney, I. R., Oates, J., Weston, W. W. & Jordan, J. (2000). The impact of patient-centered care on outcomes. *The Journal of Family Practice*, 49(9), 796-804.
- Sutcliffe, K. M., Lewton, E. & Rosenthal, M. M. (2004). Communication failures: An insidious contributor to medical mishaps. *Academic Medicine*, 79(2), 186-94.
- Ursprung, R., Gray, J. E., Edwards, W. H., Horbar, J. D., Nickerson, J., Plsek, P., Shiono, P. H., Suresh, G. K. & Goldmann, D. A. (2005). Real time patient safety audits: Improving safety every day. *Quality & Safety in Health Care*, 14(4), 284-9.
- Walton, M. M. (2006) Hierarchies: The berlin wall of patient safety. *Quality & Safety in Health Care*, 15(4), 229-30.



University Health Network

Toronto General Hospital | Toronto Western Hospital | Princess Margaret Hospital

Please use the enclosed postage-paid envelope and mail the completed survey to:

The NRC+Picker Group Canada
7100 Woodbine Ave Suite 411
Markham ON L3R 9Z9

MR CHRISTOPHER JOHNSON
1245 Q ST STE 400
LINCOLN NE 68508

Dear Mr. Johnson:

On behalf of the Board at University Health Network, I ask for your assistance in evaluating the care and service that you received during your stay at our hospital.

Your opinions are valuable to us. At University Health Network we want to provide the best possible service to our patients. In order to do so, we need to know what we are doing right and what may need improvement. **Your feedback will be used to improve how we provide care.**

Please complete the enclosed questionnaire and return it in the envelope provided as soon as possible. If you are unable to respond, a relative or friend may respond on your behalf, as long as the answers represent your own feelings. Only a limited number of our patients receive this questionnaire, so your participation is very important.

Completion of the survey is voluntary. Your responses will be kept confidential and will comply with University Health Network's Privacy Policy. Please feel free to express your opinions frankly and be assured that your future care at our hospital will not be negatively impacted.

If this questionnaire has reached you in error, please contact us to have your name removed. Every effort is made to ensure that this questionnaire is not sent to families of patients who have passed away. If a grieving family member receives this letter, please accept our heartfelt condolences and our sincere apology. If you would like to respond on behalf of your loved one, you may certainly do so, but it is not our intention to add pain to your sorrow and grief.

If you have any questions or concerns or wish to be removed from the survey, please contact Elizabeth Chiu at (416) 340-4800 Ext. 4329.

Thank you for your time and help. Your effort will help us provide better care to all our patients.

Sincerely,

Tom Closson
President & CEO



University Health Network

Toronto General Hospital | Toronto Western Hospital | Princess Margaret Hospital

Please use the enclosed postage-paid envelope and mail the completed survey to:
The NRC+Picker Group Canada
7100 Woodbine Ave Suite 411
Markham ON L3R 9Z9

MR CHRISTOPHER JOHNSON
1245 Q ST STE 400
LINCOLN NE 68508

Dear Mr. Johnson:

Recently you were mailed a questionnaire regarding the inpatient services you received at University Health Network. If you have already returned your questionnaire, thank you and please disregard this note. If you have not yet had a chance to complete the questionnaire, or if you no longer have the copy sent to you, please take a moment to complete the extra copy enclosed.

Your opinions are valuable to us. At University Health Network we want to provide the best possible service to our patients. In order to do so, we need to know what we are doing right and what may need improvement. **Your feedback will be used to improve how we provide care.**

Please complete the enclosed questionnaire and return it in the envelope provided as soon as possible. If you are unable to respond, a relative or friend may respond on your behalf, as long as the answers represent your own feelings. Only a limited number of patients receive this questionnaire, so your participation is very important.

Completion of the survey is voluntary. Your responses will be kept confidential and will comply with University Health Network's Privacy Policy. Please feel free to express your opinions frankly and be assured that your future care at our hospital will not be negatively impacted.

If this questionnaire has reached you in error, please contact us to have your name removed. Every effort is made to ensure that this questionnaire is not sent to families of patients who have passed away. If a grieving family member receives this letter, please accept our heartfelt condolences and our sincere apology. It is certainly not our intention to add pain to your sorrow and grief. If you wish, you may respond to this questionnaire on behalf of your loved one. If your wish is not to respond, we will respect your wishes.

If you have any questions or concerns or wish to be removed from the survey, please contact Elizabeth Chiu at (416) 340-4800 Ext. 4329.

Thank you for your time and help. Your effort will help us provide better care to all our patients.

Sincerely,

Tom Closson
President & CEO



University Health Network

Toronto General Hospital Toronto Western Hospital Princess Margaret Hospital

Your Hospital/Facility Stay...

Please fill in the circle that best describes your experience during your hospital/facility stay ending on March 3, 2003. Thank You!

ADMISSION...

1. Were you:

- Admitted through the Emergency Department
 Admitted through a planned admission by your doctor
 Admitted unexpectedly after a day procedure or test
 Transferred from another facility
 Other

2. How organized was the admission process?

- Not at all organized Somewhat organized Very organized

3. Do you feel you had to wait an unnecessarily long time to go to your room?

- Yes, definitely Yes, somewhat No

4. If you had to wait to go to your room, did someone from the hospital explain the reason for the delay?

- Yes No Didn't have to wait

5. How would you rate the courtesy of the staff who admitted you?

- Poor Fair Good Very Good Excellent

DOCTORS...

6. Was there one particular doctor in charge of your care in the hospital?

- Yes No Not sure

7. When you had important questions to ask a doctor, did you get answers you could understand?

- Yes, always Yes, sometimes No Didn't have questions

8. If you had any anxieties or fears about your condition or treatment, did a doctor discuss them with you?

- Yes, completely Yes, somewhat No Didn't have anxieties or fears

9. Did you have confidence and trust in the doctors treating you?

- Yes, always Yes, sometimes No

10. Did doctors talk in front of you as if you weren't there?

- Yes, often Yes, sometimes No

11. How would you rate the courtesy of your doctors?

- Poor Fair Good Very Good Excellent

12. How would you rate the availability of your doctors?

- Poor Fair Good Very Good Excellent

13. Overall, how would you rate the care you received from your doctors?

- Poor Fair Good Very Good Excellent



NURSES...

14. **When you had important questions to ask a nurse, did you get answers you could understand?**
 Yes, always Yes, sometimes No Didn't have questions
15. **If you had any anxieties or fears about your condition or treatment, did a nurse discuss them with you?**
 Yes, completely Yes, somewhat No Didn't have anxieties or fears
16. **Did you have confidence and trust in the nurses treating you?**
 Yes, always Yes, sometimes No
17. **Did nurses talk in front of you as if you weren't there?**
 Yes, often Yes, sometimes No
18. **How would you rate the courtesy of your nurses?**
 Poor Fair Good Very Good Excellent
19. **How would you rate the availability of your nurses?**
 Poor Fair Good Very Good Excellent

HOSPITAL STAFF...

20. **Sometimes in the hospital, one doctor or nurse will say one thing and another will say something quite different. Did this happen to you?**
 Yes, always Yes, sometimes No
21. **Did you have enough say about your treatment?**
 Yes, definitely Yes, somewhat No
22. **Did your family or someone close to you have enough opportunity to talk to your doctor?**
 Yes, definitely No Family didn't want or need to talk
 Yes, somewhat No family or friends were involved
23. **How much information about your condition or treatment was given to your family or someone close to you?**
 Not enough Too much Family didn't want or need information
 Right amount No family or friends involved
24. **Was it easy for you to find someone on the hospital staff to talk to about your concerns?**
 Yes, definitely Yes, somewhat No Didn't want to talk/no concerns
25. **When you needed help getting to the bathroom, did you get the help in time?**
 Yes, always Yes, sometimes No Didn't need help
26. **How many minutes after you used the call button did it usually take before you got the help you needed?**
 0 minutes/right away 6-10 minutes 16-30 minutes Never used call button
 1-5 minutes 11-15 minutes More than 30 minutes Never got help
27. **In general, after you used the call button, was the time you waited for help reasonable?**
 Yes, completely Yes, somewhat No Didn't use call button
28. **Did a doctor or nurse explain the results of tests in a way you could understand?**
 Yes, completely Yes, somewhat No No tests were done
29. **Were your scheduled tests and procedures performed on time?**
 Yes, always Yes, sometimes No No tests/procedures
30. **Did you feel like you were treated with respect and dignity while you were in the hospital?**
 Yes, always Yes, sometimes No

PAIN...

31. **Were you ever in any pain? If no, go to #37.**
 Yes No (Go to #37)



32. When you had pain, was it usually severe, moderate, or mild?

- Severe Moderate Mild

33. Did you ever request pain medicine? If no, go to #35.

- Yes No (Go to #35)

34. How many minutes after you requested pain medicine did it usually take before you got it?

- 0 minutes/right away 6-10 minutes 16-30 minutes Never got medicine
 1-5 minutes 11-15 minutes More than 30 minutes

35. Do you think that the hospital staff did everything they could to help control your pain?

- Yes, definitely Yes, somewhat No

36. Overall, how much pain medicine did you get?

- Not enough Right amount Too much

GOING HOME...

37. Did someone on the hospital staff explain the purpose of the medicines you were to take at home in a way you could understand?

- Yes, completely Yes, somewhat No Didn't need explanation No medicines at home

38. Did someone tell you about medication side effects to watch for when you went home?

- Yes, completely Yes, somewhat No Didn't need explanation No medicines at home

39. Did they tell you what danger signals about your illness or operation to watch for after you went home?

- Yes, completely Yes, somewhat No

40. Did they tell you when you could resume your usual activities, such as when to go back to work or drive a car?

- Yes, completely Yes, somewhat No

41. Did the doctors and nurses give your family or someone close to you all the information they needed to help you recover?

- Yes, definitely No Family didn't want or need information
 Yes, somewhat No family or friends involved

42. Did you know who to call if you needed help or had more questions after you left the hospital?

- Yes No Not sure

OVERALL IMPRESSION...

43. While you were in the hospital, were you able to get all the services you needed?

- Yes, completely Yes, somewhat No

44. Overall, how would you rate the care you received at the hospital?

- Poor Fair Good Very Good Excellent

45. How would you rate how well the doctors and nurses worked together?

- Poor Fair Good Very Good Excellent

46. Would you recommend this hospital to your friends and family?

- Yes, definitely Yes, probably No

AMENITIES...

47. How would you rate the quality of the food (how it tasted, serving temperature, variety)?

- Poor Fair Good Very Good Excellent

48. How would you rate the condition of your room and hospital environment (cleanliness, comfort, lighting, temperature)?

- Poor Fair Good Very Good Excellent



ADDITIONAL QUESTIONS...

49. Did nurses act on your suggestions about your care?

- Yes, definitely Yes, somewhat No

50. Were you able to find materials or programs while a patient at UHN?

- Yes, definitely Yes, somewhat No

51. Did you feel that someone was in charge of your care?

- Yes, definitely Yes, somewhat No

52. How much relief did you receive from pain medication?

- Complete Somewhat None at all Did not receive

53. How much relief did you receive from other therapies such as heat, cold, massage?

- Complete Somewhat None at all Did not receive

YOUR BACKGROUND...

In order to be sure we have survey responses from a variety of people, we are asking you to provide some information about your background. Remember, your individual responses will not be shared with anyone.

54. In general, how would you rate your health?

- Poor Fair Good Very Good Excellent

55. During the past month, how many days did illness or injury keep you in bed all or part of the day?

- None Two Days Four Days Eight-to-Ten Days
 One Day Three Days Five-to-Seven Days More than Ten Days

56. Including this hospital stay, how many times in the last six months have you been in a hospital overnight or longer?

- Only this time This time and one other time This time and more than one other time

57. What is the highest grade or level of school that you have completed?

- Public school College, trade, or technical school Post university/graduate education
 High school University undergraduate degree

58. Who completed this survey?

- Patient Someone else

59. Is there anything else you would like to tell us about your hospital stay?

Thank you for taking the time to complete this questionnaire! Your answers are greatly appreciated. When you are done, please use the enclosed pre-paid envelope to return this questionnaire to The NRC+Picker Group Canada, 7100 Woodbine Ave, Suite 411, Markham ON L3R 9Z9.



001AMD47

0060421



Appendix B

Protocol

Title

Design, implementation and usability evaluation of a kiosk-based system to enhance the use of reinforcement messages and feedback in a teaching hospital unit.

Setting

1. A kiosk will be placed in General Internal Medicine (GIM), the Emergency Room or other departments and units in University Health Network. The period of time the kiosk will be located in each unit will vary depending on the amount of data collected in each case. The location of the kiosk within one department may change during the study. For example, when locating the kiosk at GIM, the kiosk will may be moved from the 13th to the 14th floor (both GIM wards).
2. Posters will be posted around the kiosk's surrounding areas to invite people to use it. These posters will announce the main kiosk functionalities, feedback, recognition and Honour Your Hero. This poster is attached in the *Poster.ppt* file. We will also use informative brochures to inform potential kiosk users. See the brochure in the file *Brochure.ppt*.
3. The existing digital signage screens on the different units will display a message inviting people to use the kiosk. The design of this screen will match with the poster and brochure design.
4. We will generate awareness among the staff before the study begins on each unit. It may be done in the following ways. First, we may do brief presentations at rounds; second, we may distribute the information brochure; and third, we may email staff to announce the beginning of the study. On the presentations as well as on email, we will let staff know that they can say they do not want to see recognition messages sent to them posted on the screens. The awareness email can be seen in the file *AwarenessEmail_Feb5_2011.doc*.
5. The kiosk's main screen will provide access to different functionalities. When the user accesses these functionalities its first screen will be headed by a consent message informing the user that they are participating in a research project to evaluate the usability of the kiosk. This message is presented in the Kiosk User Inform Consent document in the file: *KioskUserInformConsent_Feb16_2011.doc*.

Kiosk, user interaction

6. Any person willing to use the kiosk, patient or care provider, will simply have to stand in front of the kiosk and use any of the functionalities accessible from the kiosk's main screen. As you can see on the file *KioskDiagram_Feb5_2011.doc*, the kiosk is

equipped with a touch screen and a keyboard to allow participants simple access to each of the following functionalities.

1. Provide feedback on specific questions. On the kiosk's main screen, there will be a feedback question section which will have two questions that will ask users for specific ways to improve patients' and providers experience while staying or working in the hospital. These questions may change or rotate over time and will focus on different aspects of care depending on the kiosk's location and feedback already provided by users. An initial list of feedback question is provided in the Feedback Questions document. There will be a text area where users will enter their answers to each feedback question.
 2. Send positive reinforcement messages. The kiosk main screen will have a second panel with direct access to a system to send a positive message to staff working in the unit. We will ask for the name of the person sending the message, the name of the receiver and there will be a text area where users will type their message. When a message will be sent, it will be reviewed and vetted by a member of the research team to eliminate any inappropriate or offensive content and any personal information other than names. Spelling errors in messages will be corrected. Grammar will not be corrected since this could change the meaning of the message. Then this message will be posted on the screens already existing in the units. The messages will be headed by the sender name and the receiver name; in any case we will not disseminate users' last name or any other piece of personal information. If the message is directed to a person who previously has said that does not want to receive messages, we will never post this message.
 3. Access to the Honour Your Hero program. This program allows people to send a recognition message and a donation to the hospital foundation in behalf of the recognized hospital staff member. This access will consist of a link to the Honour Your Hero Program's website, which already exists and is managed by the Toronto General and Western Hospital Foundation TGWHF. Our usability study does not include the evaluation of this website. We only will be counting the number of times people access it. However, we will ensure that the Honour Your Hero links are accessed using a secure internet connection.
 4. Suggestions to improve the kiosk. On the bottom part of the screen, there will be access to allow users to provide suggestions on the kiosk itself and its' usability.
7. The feedback functionality (1) the reinforcement message (2) and the suggestions to improve the kiosk (4) tasks will be performed on pop-up windows. These windows will be headed with a consent message, as previously mentioned. When users access the Honour Your Hero link (3), no consent will be presented since this functionality is not part of the study. It is an already ongoing initiative at UHN and our focus is feedback and positive recognition messages. The security of the Honour Your Hero functionality is ensured by the system already set up and running by the TGWHF.
8. In addition to the text boxes for the user to type the specific content of the task selected, we will ask them to indentify their role in the hospital among one of the following options:

1. Patient, family/friends of patient(s)
2. Nurse
3. Physicians, Residents or Medical Students
4. Other Hospital professionals
5. Other

Data Collection

9. From each task performed on the kiosk, the following data will be measured and recorded: what task is being performed, the date and time, the kiosk's specific location, the time when the task is completed and the message content. For the recognition message tool we will collect as well the names of the message sender and receiver.
10. We are considering recording the kiosk screen while users are performing their tasks. It would be done with specific software for this purpose. By doing so, we could study what are the specific barriers for users when using the kiosk.
11. After the user has performed a task and clicks the button to send the message, a new pop-up window will say thanks to the user for the message sent and will invite people to use the kiosk again in the future. In addition we will invite the user to answer a short survey to evaluate the kiosk. Questions for this survey are included in the Usability Evaluation Survey document.
12. All pop-up windows where users enter data will have an automatic system that will close few minutes after being opened. This has two purposes, to keep the kiosk in its main screen when it is not being used. Additionally, when a user leaves a task unfinished, the data already entered will not be displayed for a long time. This period of time may change for each task to ensure that enough time is given to finish the task before the windows is closed.

Information management and security

13. During the intervention, the feedback messages received will be reviewed and vetted by a member of the research team to eliminate any inappropriate or offensive content and any personal information. Based on the messages' content, this feedback may be shared with managers, teams or individuals for their review. This will be done in person by a research team member.
14. After revision, positive recognition messages will be posted on the digital signage screens already existing in the unit with the sender and receiver names. Users' last names will never be posted. The message will be always within quotation marks. To display the recognition messages we will create an image file that will contain the sender and receiver names as well as the recognition message to be displayed. This file will be send by email to the Nursing Informatics department who is in charge of the screens existing in the different hospital units. They will post the messages on the screens for a period of time that will vary depending on the number of messages received. Messages will be displayed on the screens from one week to one month.

15. As previously mentioned, the Honour Your Hero program is not being studied since it is already an ongoing initiative in the hospital. We only will record how many times this link has been accessed.
16. The kiosk will be connected to the internet through a secure UHN wireless network pending approval from SIMS. In case it is not possible to use the UHN wireless connection, we will connect the kiosk to a secure internet connection using Rogers Rocket Stick (mobile Internet access from Rogers).
17. Through our internet connection, the collected data from the kiosk will be sent to a server external to UHN. We will store the data on the server provided by Netfirms. This company ensures that all information will be always stored within the Canadian territory. Access to the server will be restricted to research team members. The login on the server will require a password only known by the research team. This server also provides a secure connection that will be used for personal information transmission. Our URL is: www.thecicc.com.
18. For data analysis purposes (generate graphics, summary tables...), all personal information in the database will be deleted including sender and receiver names as well as any personal information that may users have entered into the message. From this database we will generate summary tables that will be downloaded from the server into a file in Excel or similar program on a password-protected computer only accessible to team research members. It will be impossible to identify any person participating in the study from the data in these files.
19. After the data is transferred it will be deleted from the server. During the study we may do partial data analysis; this will be done following the same process. We will first remove any personal information, including sender and receiver names as well as any personal information that users may have entered into the message, from the server and then download the data into password-protected files to eliminate the risk of storing personal information into a non secure device.
20. After the data analysis and results publication the data will be stored during 5 years and deleted afterwards only storing summary results.
21. In case we record the kiosk screen, while users are performing on it this videos will be stored in the kiosk hard drive. When the study will be completed, they will be transferred to a UHN computer accessible only by members of the research team and protected under password. After 5 years these videos will be deleted.

Data Analysis

22. Different types of analysis will be performed on the collected data:
 1. Qualitative analysis will be done to determine the themes discussed on the feedback and recognition messages.
 2. Statistical analysis will be conducted to see if there is any correlation among the different parameters observed. Ex: The role of people using the kiosk may change depending on the kiosk's location; or the topics appearing on the feedback messages may depend as well on people's role or kiosk location.

3. We will be able to study as well the patterns of kiosk use along the day or depending on the kiosk location.
23. The videos recorded will be viewed by someone from the research team to inquire what specific steps generate more difficulties among users.

Data Distribution

24. The data collected during the intervention will be disseminated internally by the research team members. Users name will not be distributed among the research team. Data summaries, messages, graphics and general conclusions of the study, all without any personal identifier, may be included in research publications and academic presentations as well as disseminated to managers, teams and individuals who may have interest in our findings.
25. In case a video is considered to have interest to be shown to the research community all personal information appearing on it will be removed.



University Health Network

Toronto General Toronto Western Princess Margaret

University Health Network
Research Ethics Board
10th Floor, Room 1056
700 University Ave
Toronto, Ontario, M5G 1Z5
Phone: (416) 581-7849

Notification of REB Initial Approval

Date: March 21st, 2011

To: Dr. Dante Morra
Rm 14E218, 14th Floor, Eaton, Toronto General Hospital
200 Elizabeth St.
Toronto, Ontario, Canada
M5G 2C4

Re: 10-1003-AE
Design, Implementation and Usability Evaluation of a Kiosk-Based System to Enhance the Use of Reinforcement Messages and Feedback in a Teaching Hospital Unit

REB Review Type: Expedited
REB Initial Approval Date: March 21st, 2011
REB Expiry Date: March 21st, 2012

Documents Approved:

Protocol	Version date: March 8th, 2011
Brochure	Version date: March 8th, 2011
Feedback Question	Version date: March 8th, 2011
Kiosk User Inform Consent Screen	Version date: March 8th, 2011
Usability Evaluation Survey	Version date: March 8th, 2011
Poster	Version date: March 8th, 2011
Email - Awareness Email	Version date: March 21st, 2011

Documents Acknowledged:

Kiosk Diagram	Version date: March 8th, 2011
---------------	-------------------------------

The UHN Research Ethics Board operates in compliance with the Tri-Council Policy Statement, ICH Good Clinical Practice Guidelines, Ontario Personal Health Information Protection Act (2004), Part 4 of the Natural Health Product Regulations and Part C, Division 5 of the Food and Drug Regulations of Health Canada.

Best wishes on the successful completion of your project.

Sincerely,

Anna Gagliardi, PhD

Co-Chair, University Health Network Research Ethics Board

Appendix D

Table name: Evaluation		Description: This table stores the answers of the evaluation surveys. It also stores the time needed to complete the survey whether the survey was submitted or not.		
Field	Type	Null	Default	Description
evaluation_id	int(11)	No		Evaluation Identifier
question1	int(11)	No		Answer to question 1
question2	int(11)	No		Answer to question 2
question3	int(11)	No		Answer to question 3
question4	text	No		Answer to question 4
question5	text	No		Answer to question 5
evaluation_start_time	datetime	No		Time when the survey started
evaluation_final_time	datetime	No		Time when the survey is finished
evaluation_conclusion	varchar(20)	No		How the survey is closed, submitting, closing or timing out.

Table name: Feedback		Description: This table stores the feedback that users provide.		
Field	Type	Null	Default	Description
feedback_id	int(11)	No		Feedback Identifier
question_id	int(11)	No		Question Identifier
question	text	No		Question that users have answered
answer	text	No		Answer to the question

Table name: Kiosk_events		Description: This table stores any task that users perform on the kiosk. The time that takes users to perform it, how they finish this task, and the role of the user.		
Field	Type	Null	Default	Description
id	int(11)	No		Event Identifier
start_time	datetime	No		When the event starts
final_time	datetime	No		When the event finishes
task	varchar(20)	No		What task is performed on this event
conclusion	varchar(20)	No		How is the task performed finished
role	varchar(20)	No		The role of the person performing the task

Table name: Recognition		Description: This table stores the recognition messages that users send.		
Field	Type	Null	Default	Description
recognition_id	int(11)	No		Recognition message identifier
message	text	No		Message
message_from	varchar(100)	No		Persons name who sends the message
message_to	varchar(100)	No		Persons names who receives the message

Table name: Suggestions		Description: This table stores the feedback that users provide to help improve the kiosk.		
Field	Type	Null	Default	Description
suggestion_id	int(11)	No		Suggestion Identifier
suggestion	text	No		Suggestion text

Table name: Feedback_questions		Description: This table stores the list of questions to display on the feedback functionality		
Field	Type	Null	Default	Description
question_id	int(11)	No		Question Identifier
question	text	No		The text of the question
displayQ1	int(11)	No	0 or 1	It contains 1 if the question is displayed on first position or 0 if it is not displayed
displayQ2	int(11)	No	0 or 1	It contains 1 if the question is displayed on second position or 0 if it is not displayed
date	timestamp	No	CURRENT_TIMESTAMP	Time when the question was entered