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Seamless Discharge: Understanding the Challenges of Hospital Discharge and
Development of a Web-Based Solution

By

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Abstract

Rationale: Forty-nine percent of patients experience at least one medical error following hospital discharge. One third of these errors are associated with gaps in communication between hospital and community care providers. Electronic discharge summaries may improve the content, format, and delivery of this communication and potentially improve patient safety.

Objectives: To understand discharge communication needs and challenges, to examine the efficacy of computer-enabled discharge communications, to develop the Web-Based Seamless Discharge Communication Tool, and to integrate this tool into Alberta Health Services Information Technology infrastructure.

Methods: Qualitative and formal systematic review methodologies were employed.

Results: Two viable electronic discharge solutions, a set of recommendations to improve discharge communication and documentation, and synthesis of evidence regarding the efficacy of computerized interventions were developed.

Conclusions: Electronic discharge summaries can be a viable option to bridge the discharge communication gap between care providers although further study is needed.

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List of Symbols, Abbreviations and Nomenclature

Symbol	Definition
AHS	Alberta Health Services
CHR	Calgary Health Region
CIHR	Canadian Institutes of Health Research
DS	Discharge Summary
ED	Emergency Department
IG	Intervention Group
PCP	Primary Care Physician
SCM	Sunrise Clinical Manager
U of C	University of Calgary

CHAPTER 1: RATIONAL AND OVERVIEW OF THESIS

1.1 Introduction

This chapter is a global introduction to this thesis that examines the challenges of assuring continuity of care following patient discharge from hospital. In this section, concepts central to this document are reviewed including: vulnerability of patients at time of discharge, traditional discharge summaries, and electronic/computer-enabled discharge summaries. This is followed by a discussion of current discharge practices within the Alberta Health Services Calgary Zone, a description of the Medical Ward of the 21st Century initiative, as well as thesis objectives.

1.2 Patient Vulnerability at Hospital Discharge

The transition between acute care and community care represents one of the most vulnerable periods in health care delivery, particularly as the acuity and complexity of inpatient populations increase. Forty-nine percent of patients experience at least one medical error during this transition related to medication errors, diagnostic tests, or to appropriate follow up (1, 2). Two recent North American studies reported an incidence of post-discharge adverse events between 19-23%, with medication related errors responsible for 66-72% of these (3-5). Of note is that two thirds of these adverse events were judged to be either preventable or ameliorable in severity (3, 4). A third study indicates that more than 30% of adverse events are attributable to gaps in information transfer (6). In addition to the risks to patient safety (7-9), these medical errors result in a significant burden on healthcare costs and resource use. Twenty-one percent of patients required additional physician visits, 17% required hospital readmission, and 12% presented to the emergency department (3-5). Discontinuity of care specifically related to diagnostic evaluations resulted in significantly higher risk of readmission as well (2).

The vulnerability of patients following hospital discharge has been attributed to several key factors (1). First, the process of discharge planning often occurs in a disorganized and variable manner (10-12). Second, changes to the medication regimen during hospitalization

are numerous, yet failure to reconcile discrepancies between admission and discharge is frequent (1). Third, the patient/family is required to take over care responsibilities at discharge and must often relay important information to the primary care physician (1). This can be particularly challenging if discharge information is complex and poorly communicated, or if the patient has low literacy or low health literacy (1, 13, 14). Finally, and perhaps most importantly, crucial information is often poorly transferred from the acute care physician to the primary care physician and to other community health professionals (1, 15).

1.3 Traditional Discharge Summaries

Information about a patient's hospitalization is commonly transferred to the primary care physician via a discharge summary (1, 15). This may be in a narrative or semi-structured format and include information such as diagnoses, medical history, brief hospital course, treatment provided, diagnostic/laboratory results, discharge medications, and follow up needs (1, 15). Physicians and residents may handwrite this document or dictate the information and have it later transcribed by administrative personnel. The discharge summary is then faxed, mailed, or given to the patient to hand deliver to their primary care physician.

1.4 Problems Associated with Traditional Discharge Summaries

The problems associated with traditional discharge summaries have been well documented over recent years (6, 7, 15-19). Lack of a standardized structure has resulted in either too little documentation or excessive and irrelevant documentation. Inaccurate, inconsistent, and misleading content is also often included. Hospital physicians most often neglect to include diagnostic findings (omitted from 33-63%), treatment/hospital course (7-22%), discharge medications (2-40%), tests results pending (65%), follow-up plans (2-43%), and whether the patient and family received counselling on the target condition (90-92%) (15). Handwritten notes are frequently illegible and may be lost or forgotten by the patient. Transmitting discharge summaries via fax or mail are problematic as well with timeliness being the primary concern. As few as 12-34% of summaries are received by the primary

care physician in time for the patient's first post-discharge appointment and in many cases, the discharge summary is never received (1, 7, 8, 15, 20, 21). This lack of access to information at the community level is a barrier to appropriate care for approximately 25% of patients (1, 15).

A recent systematic review examined the efficacy of a broad range of interventions to improve communication and information at time of hospital discharge (15). The cumulative effect size of many outcomes is not reported given substantial variability. For example, the findings from the one study that examined format reported that the standard discharge summary format compared to a narrative format resulted in improved quality and efficacy (15). Multiple studies from this review suggested that the use of computer generated summaries resulted in improved completion rates, and inclusion of more important, relevant, and clear information when compared to manually generated summaries (15). Timeliness was also significantly improved by allowing the patient to hand deliver the discharge summary to their primary care physician (15). It is important to note that while 7 of the interventions in this review were termed "computer-generated," only 2 of these involved substantial engagement of computer technology aside from basic word processing.

1.5 Electronic/Computer-Enabled Discharge Summaries

The concept of "electronic" or "computer-enabled" has been understood in its most broad sense by previous studies (15). This has included simple typed/word processed documents, documents generated by manually merging data from existing databases, and simple electronic transmission of text data.

In this thesis, a more focused definition of computer-enabled discharge communication was employed. Simple word processed documents were not included. Discharge summaries had to be either automatically populated using computer databases or transmitted via computer technology (e.g., text message, email, or through the world wide web/internet). Computer technologies providing a platform for bidirectional discharge communication

were also acceptable. Interventions had to be available to the primary care physician or directly to the patient/family.

A number of authors have suggested that computer-enabled discharge communications may avert the problems faced by traditional summaries and improve communication by improving content, format, and delivery (22). Electronic discharge summaries represent an advancement because they improve legibility and overall quality (7), and can also be structured to ensure consistent critical data about the hospitalization is documented for each patient (1, 23). Additional content such as laboratory and diagnostic findings, allergies, and medication lists can be uploaded in seconds from hospital databases and physician order entry systems (1). Information can be transmitted almost instantly via the internet or by automatic fax. Significant improvements in timeliness (sending/receiving) are the most commonly reported benefit compared to traditional summaries (6, 7, 18, 22, 24-26). Storing data electronically or in internet data repositories is secure, practical, and often does not require the user to have any special training or to acquire additional software. There is also mounting evidence that physicians in both acute and community settings prefer electronic discharge documents over hand written/dictated summaries with respect to clarity, comprehensiveness, and positive impacts on continuity of care (7, 24, 27-29).

1.6 Problems Associated with Electronic/Computer-Enabled Discharge Summaries

Implementation of electronic discharge summaries has not been entirely smooth to date (7, 29-31). Clinicians have an expectation that content will improve with the implementation of an electronic discharge summary, yet inadequacies in documentation continue to be reported (29-31). In one study, the frequency of errors and omissions identified in the electronic documentation was as high, or even higher than the frequency of errors found in manually generated documents (29). Many of these errors have been attributed to clinicians „cutting and pasting’ information from various sources into the electronic discharge summary in order to save time (31). Blending large volumes of irrelevant and out-dated information can result in information overload, can contribute to the recipient losing the

ability to extract meaningful information, and can ultimately lead to the recipient losing trust in the computer system (31).

The mixed results of previous research into electronic discharge summaries suggest that:

1. More definitive research is needed to clarify the efficacy of these emerging systems.
2. Greater attention must be placed on creating smarter electronic discharge summaries (for example, shifting away from the user having to duplicate data entry).
3. Simply implementing a computerized system is likely not sufficient to guarantee improvements in discharge communication and information transfer, but must also involve a change in accepted system wide attitudes and processes that result in current deficiencies (22). Ideally, development of electronic discharge summaries should include a thorough understanding of (local) information needs and existing challenges, should involve stakeholder input, and should also incorporate an understanding of factors related to computer-human interaction.

1.7 Alberta Health Services (AHS), Calgary Zone Practices in Discharge Communication

Over the course of this MSc work, all of the provincial health regions within Alberta became amalgamated under a central board, Albert Health Services (AHS). Provincial policies regarding patient discharge and preparation of the discharge summary came under review and the policies presented here are those previously used in Calgary (formerly the Calgary Health Region). In Calgary, the majority of discharge summaries are prepared through a dictation and transcription service, and delivery is done via fax or mail. As of 2007, there has been no computerized platform for discharge summaries although there was organizational interest in developing a solution. **Table 1.1** cites the former Calgary Health Region's (CHR) Patient Discharge Policy (Policy Number 1426, Updated November 3, 1997) (32).

Table 1.1: Calgary Health Region (CHR) Patient Discharge Policy

“Effective discharge planning involves a collaborative approach between hospital staff, community agencies, and the patient and their families, to ensure that the gains achieved through active hospital treatment are maintained and the likelihood of recurrence of illness or disability and possible readmission is reduced.

The discharge policy should ensure a planned efficient and effective discharge with minimal anxiety to patient and family; assist in the assignment of patients to the appropriate area and minimize the number of inter-nursing unit transfers; and support the effective utilization of beds and services within the Calgary Health Region while managing health care costs effectively.”

This document then specifies how discharge planning is to be done:

1. The patient may be discharged only on the order of the responsible physician or designate, or the order of the Medical Director, except in instances of patient separation "against medical advice."
2. The physician will write the discharge order and specify the expected date of discharge within 48 hours after admission for all patients designated as emergency. The discharge plan will be reviewed and revised as needed.
3. The physician will specify the expected date of discharge at the time of admission for all patients designated as urgent and elective categories.
4. The plans for discharge are developed by the team as follows:
 - 4.1 Patient and family understanding of the diagnosis, anticipated level of functioning, discharge medications, and anticipated medical follow-up;
 - 4.2 Specialized instruction or training so the patient and/or family can provide post-hospital care;
 - 4.3 Coordination of community support systems which enable the patient to return home;
 - 4.4 Relocation of the patient as appropriate.
5. Discharge time is on or before 1100 hours. Whenever possible, patients are expected to release the room before 1100 hours and to utilize the lounge areas while waiting to be picked up by friends/relatives.
6. Patients who are under 18 years of age must be discharged in the care of a parent, legal guardian, or if they are a Ward of the Crown, in the care of a Social Worker employed by Alberta Family and Social Services (A.F.S.S.). If release to a third party (e.g. foster parent) is requested, there must be written authority from a parent, legal guardian, or A.F.S.S. social worker. Telephone permission obtained by a registered nurse and monitored by one other member of the nursing staff, may be acted upon only when written permission cannot be obtained.

7. Patients who have been living independently of parents for six (6) months (emancipated minor) or who are under the age of 18, married and living independently of parents, do not require to be discharged into the care of a legal guardian.

8. If a patient wishes to leave hospital against medical advice, the patient shall sign a "Release of Responsibility" form absolving the hospital of any responsibility.

8.1 The responsible physician is to be notified when a patient leaves hospital against medical advice.

9. The Social Work Department will initiate, with the Patient Care Unit staff, high risk screening criteria for all patients over 70 years of age, in order for the diagnostic and support departments (i.e. Social Work, Diabetic Education, Rehabilitation, Home Care, Carewest Placement Service) to complete their assessments for discharge planning prior to the expected date of discharge.”

With respect to the former Calgary Health Region’s policy on discharge summaries, **Table 1.2** presents the policy on discharge summary completion and is cited from the Physician Responsibility for Completion of Health Records Policy (Policy Number 1424, Updated October 16, 2002) (32).

Table 1.2: CHR Physician Responsibility for Completion of Health Records Policy

“The Responsible Physician is responsible to summarize and record the entire hospital admission of a patient in the Health Record as soon as possible (no later than 28 days) following discharge from hospital. The Discharge Summary may be hand written using the "Short Discharge Summary Form" or documented in accordance with Health Records Services standards, and shall contain the following information:

- admitting and discharge dates
- primary and secondary diagnoses
- a summary of significant findings, treatments and events, including surgical, diagnostic procedures and receipt of blood or blood products
- full description of major complications or untoward events
- the condition of the patient on discharge
- all discharge prescriptions including dosages
- plans for future care including follow-up procedures or appointments”

A discharge summary template was available between 1992 and 2007 through the hospital communication and records system [Technicon Data Systems (TDS7000) OSCAR program]. This system required residents to enter approximately 70% of all required documentation and was associated with a myriad of problems (33, 34). **Figure 1.1** presents the discharge summary template that was available in the OSCAR system. In February 2007, the Eclipsys Sunrise Clinical Manager (SCM) replaced the TDS7000 system and a discharge summary template was no longer available. The manual process of dictating and transcribing discharge information was in use during the time of OSCAR and continues to be the choice method of preparing discharge summaries currently.

Figure 1.1: Discharge Summary Template Available in the TDS OSCAR Computer System Prior to 2007

This was the main discharge summary available to clinicians prior to 2007 in the former Calgary Health Region (CHR). Following introduction of Sunrise Clinical Manager in 2007, there has been no widely supported electronic discharge summary.

2006/12/20	CALGARY HEALTH REGION
FOOTHILLS MEDICAL CENTRE	*****
PT LOCATION: 36	

*****DISCHARGE SUMMARY*****	
ADMISSION DATE: 06/12/19	PLANNED DISCHARGE DATE:
DIAGNOSIS MOST RESPONSIBLE FOR HOSPITAL STAY:	
PRIMARY DIAGNOSIS:	
SECONDARY DIAGNOSIS:	
COMPLICATIONS:	
OPERATIONS/PROCEDURES:	
SIGNIFICANT FINDINGS:	
DISCHARGE MEDICATIONS / FOLLOW-UP:	
RECOMMENDATIONS/CONDITION ON DISCHARGE:	
A FINAL NARRATIVE SUMMARY WILL BE DICTATED:	
DATE DICTATED:	BY WHOM:
SEND COPIES TO:	
NO DISCHARGE SUMMARY INFORMATION WAS ENTERED FOR THIS PATIENT	
	_____ PHYSICIAN SIGNATURE
LAST PAGE	_____ PHYSICIAN SIGNATURE
=====	
DISCHARGE SUMMARY	

Several other discharge related initiatives had been identified within Alberta health Services and described below. In February 2009, a „Standardized Work plan for Discharge (Transition of Care)’ was prepared and published on an internal web site which highlighted the activities/tasks to be completed according to the clinical role at various stages of the hospitalization. In September 2009, several new patient discharge initiatives were also in planning stages:

- *A service specific discharge checklist* for the healthcare team which aimed to continually move the care plan forward
- *The „passport to home’* concept was to be provided to patients/families thus allowing them to be prepared for discharge and to have all needs anticipated
- *An alert available 72 hours prior to discharge* (to be built into Sunrise Clinical Manager or alternatively, staff will need to develop a process to communicate notification for discharge 72 hours out)
- *Guidelines for inter/intra unit and site transfers* (recognizing that all handovers increase risk to continuity of care and are potential safety risks)

1.8 The Medical Ward of the 21st Century (W21C) Initiative

The widely-acknowledged challenges of suboptimal health system safety and quality have inspired the development of a multi-disciplinary research and innovation initiative known as the Medical Ward of the 21st Century Initiative (W21C – see www.w21c.org). This initiative represents a partnership between Alberta Health Services and the University of Calgary and is an umbrella program within which a community of researchers from the faculties of medicine, nursing, allied health disciplines, engineering, computer science, psychology, sociology, anthropology, epidemiology, and other areas undertake interdisciplinary research. The work of this thesis was carried out under the auspices of the W21C from 2007-2010.

1.9 Thesis Objectives

This thesis has the following objectives:

- 1) The objective of Chapter 1 is to provide an overview of the state of research on traditional and electronic summaries, to present Alberta Health Services Calgary Zone practices in discharge communication, and to provide context on the environment in which this research was conducted.
- 2) The objective of Chapter 2 is to provide an examination of care provider and patient perspectives on communication needs and challenges at time of hospital discharge, particularly related to the discharge summary.
- 3) The objective of Chapter 3 is to provide the results of a systematic review of the efficacy of computer-enabled discharge communication compared to traditional communication for patients discharged from acute care hospitals.
- 4) The objective of Chapter 4 is to provide a detailed narrative about how the Web-Based Seamless Discharge Communication Tool was developed to meet the needs and challenges of hospital discharge with respect to content, format, and delivery mechanism.
- 5) The objective of Chapters 5 is to provide a detailed narrative about how the Alberta Health Services Seamless Discharge Summary was re-developed and integrated into Sunrise Clinical Manager (SCM) 5.0.

CHAPTER 2: THE CHALLENGE OF HOSPITAL DISCHARGE: PERSPECTIVES FROM PATIENTS, ACUTE CARE PROVIDERS, AND COMMUNITY CARE PROVIDERS

2.1 Introduction

To ensure patient safety and continuity of care following hospital discharge, relevant information must be documented and effectively communicated during and immediately following the discharge planning process. Discontinuity can occur when the discharge planning process is disorganized and variable (10, 11), when there is a failure to take a „whole systems’ approach (10, 35), when time constraints result in poor documentation (10), when clinician roles and responsibilities are vague (10, 12), and when there is a presence of ineffective teamwork (10, 11). Another key factor is poor communication within the hospital, between hospital and community health professionals, (1, 10, 15, 36, 37) and with patients/families (36, 38-40).

This chapter details a qualitative study designed to better understand the issues that care providers face in the areas of discharge planning and communication. The results of this study suggest recommendations to assist in developing more strategic and effective approaches.

2.2 Study Objectives

The primary objective of this qualitative study was to conduct a series of focus groups with the many stakeholders involved in the patient discharge process in order to better understand perspectives, experiences, and communication needs at the time of hospital discharge. We also wanted to understand perspectives on the ideal content of discharge summaries, as well as methods for enhancing the transmission and uptake of these summaries among stakeholders.

2.3 Methods

Research Design

The specific method used in this study was qualitative descriptive analysis. The data collection technique of semi-structured focus groups interviews was employed. Focus groups that include between 4-12 individuals typically allows suitable time for each participant to share their behaviours/perceptions while allowing for an adequate diversity of responses to be gathered (41) . Focus groups interviews were determined to be more useful than individual interviews in this study for several reasons. The first reason is that the natural process of patient discharge is not done in a solitary manner by a single clinician, but rather involves interaction between many groups. We anticipated that the dynamic information exchange that occurs during group dialogue would allow us to compare and contrast viewpoints from these many groups (42). This type of rich data is often not available from individual interviews (43). The second reason is that focus group interviews provide a systematic mechanism that is useful when answers to a specific question are desired. The third reason was tied to practical considerations with respect to efficient use of clinician time/resources. Finally, this data collection strategy has a high degree of face validity “because what participants say can be confirmed, reinforced or contradicted within the group discussion” (42) (pg. 800).

Qualitative Descriptive Studies

Qualitative research methods provide a tool for eliciting first-person narratives on the experience of individuals. Such descriptions then form a foundation upon which solutions to sub-optimal communication scenarios can be developed. In contrast to phenomenology, ethnography, or grounded theory that require either abstract interpretations of the data or development of theories from the data, qualitative descriptive studies allow researchers to collect rich information from multiple stakeholders and to generate a “straight descriptive summary of the informational contents of data organized in a way that best fits the data” (44) (pg. 338-339).

Qualitative Content Analysis

Qualitative content analysis is considered “the analysis strategy of choice” when conducting a qualitative descriptive study (44) (pg. 338). The objective of this technique is to strictly summarize the data collected (44) by systematically applying codes/categories that have been derived directly from the data (rather than applying pre-determined codes) (44). A sound analysis therefore is one in which the feedback from participants has been comprehensively and accurately represented (44).

Participants and Sampling Strategy

Care providers and in-patients were sought from a 1200 bed, University of Calgary affiliated tertiary care centre that is a referral centre for all of Southern Alberta (population of over 1.5 million residents). Clinical and administrative stakeholders with varied experience in the discharge process and individuals who we believed held rich information about our subject of inquiry were sought. Names of participants were initially obtained through a complete Alberta Health Services staff directory. The Calgary Physician Directory was also used to identify relevant individuals. Participants were selected from these lists by the research team (S.M. Motamedi and Dr. W. Ghali), contacted by telephone and followed up with by email.

Maximum variation sampling (a type of purposive sampling) was used to select stakeholders from many disciplines so that the diversity of experiences and responses about discharge communication could be fully understood. Efforts were made to sample diversely within each stakeholder group as well. For example, pharmacists from a variety of settings (hospital, community, and chronic care) were recruited to two focus groups as their specific discharge communication needs were found to vary. While we expected the majority focus groups to involve one category of stakeholder (for example, pharmacists only in one session, internal medicine physicians in another session), we were open to the possibility of mixed stakeholder groups as well. In circumstances where the minimum number of participants would not be met, we also planned to use the techniques of snowball sampling and convenience sampling to identify additional appropriate stakeholders.

Patients that were hospitalized during the course of this study (on an internal medicine ward, Unit 36) were also recruited. Patients were eligible to participate if they could converse in English, had previous experience with hospital discharge, and who were able to provide informed consent. These individuals were initially identified by the patient care manager on the ward. Researchers who were not directly involved in care (Dr. W.Ghali, S.M. Motamedi) then approached these patients to determine willingness to participate.

This study was approved by the University of Calgary Conjoint Health Research Ethics Board. Written informed consent was provided by all participants. As a measure of privacy protection, participants were asked to keep the discussion of the group confidential, and a pseudonym was assigned to each participant at time of transcription (*e.g.* Physcian1, Nurse2).

Data Collection

Semi-structured focus group interviews were used to collect data. Each session was conducted over approximately 1.5 hours. One researcher who was experienced in focus group research (S.M. Motamedi) facilitated each group session to ensure the semi-structured interview guide was followed. Another researcher (Dr. W. Ghali) was assigned to taking notes in order to summarize key points and identify topics to be explored in future group sessions. Focus group interviews were semi-structured in that pre-determined areas of inquiry were explored however participants were encouraged to converse freely, discuss issues of importance to them, and to use specific examples (42).

The interview guide was developed to provide sufficient structure to focus the conversation to the topic of discharge communication while allowing some flexibility for stakeholders to discuss related issues of importance to them. Several iterations of the interview guides for care providers and patients were created based on feedback from the research team (S.M. Motamedi, Dr. W. Ghali, Unit 36 physicians, nurses, and researchers). These guides were then pilot tested with a larger group of clinicians from Unit 36 and slight revisions to the

probing questions were made. The final version of the interview guide for care providers and staff is described in **Table 2.1**. The final version of the interview guide for patients is described in **Table 2.2**.

Table 2.1: Focus Group Interview Schedule, Care Providers and Staff

<p><i>What are current needs and challenges with respect to discharge communication?</i></p> <p><i>What are the most important issues that need to be addressed with respect to discharge communication?</i></p> <p><i>What is most effective?</i></p> <p><i>How do you use a discharge summary?</i></p> <p><i>What information is essential for decision making?</i></p> <p><i>What information would you like on follow up appointment?</i></p>

Table 2.2: Focus Group Interview Schedule, Patients

<p><i>How do patients currently access their hospital discharge information?</i></p> <p><i>What information should be made available to patients?</i></p> <p><i>Should patients be able to assign access to personal health information to their care providers and family members? Why?</i></p>
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Data Analysis: Qualitative Content Analysis

Focus groups were audio-recorded, transcribed in a verbatim manner, and manually summarized using content analysis by one researcher (S.M. Motamedi). Data analysis occurred simultaneously with data collection. Data was initially categorized under general headings as determined by the interview guide and revised over time as additional data was collected. New categories were explicitly defined to enable consistent application, and constant comparison was performed between transcripts to ensure consistency and continued relevance.

Following this, three other researchers with qualitative research experience (Dr. W. Ghali, S. Kimpton, Dr. Kathryn King) then independently reviewed each transcript using content analysis (without viewing the themes identified by S.M. Motamedi) and also examined the previously completed summaries. The four researchers then came together and through discussion and unanimous agreement, were able to generate the final set of data derived

categories and larger themes. Final themes, sub-themes, and representative quotes were organized into tables to provide context for our findings.

The decision was made to manually complete the analysis of data rather than use qualitative software (such as NVivo). An algorithm developed by Auld and colleagues (45) to determine the appropriateness of using as NVivo software determined that while the software allows the user to search, sort, and rearrange large quantities of data, it can come at the cost of losing some „whole-picture’ information that would have been gained by reading each transcript and manually coding the information. These researchers concluded that qualitative analysis software is not required for “valid and reliable research” (45) (pg. 47).

2.4 Results

A total of 9 focus groups were conducted and included all available internal medicine physicians from the AHS division of internal medicine, residents at various levels of training, all available nurses from a medical ward (Unit 36, Foothills Medical Centre, Calgary, Canada), a nurse discharge coordinator (Unit 36), unit clerks (Unit 36), hospital administrators, patient care managers from a range of in-patient wards within AHS Calgary Zone, transition services staff (who liaise with hospital and community services to promote timely discharges), acute/community/chronic care pharmacists, AHS IT staff, as well as patients. With respect to demographic information, only the (professional) role of each participant was collected. Six focus groups were homogenous (participants were from the same stakeholder group) and three were heterogeneous (multiple stakeholder groups participated in a given session). Most focus groups were arranged specifically for the purpose of this study and the number of participants was known. However, two sessions were held as part of larger regularly scheduled meetings due to practical considerations (it was not possible to gather sufficient numbers of these stakeholders outside these settings for the purpose of this study). As a result of conducting the session in this manner, an undetermined number of individuals were noted to enter and leave the room during the session and the exact number of participants could not be determined. This occurred with

the Calgary Foothills Primary Care Network (20+ physicians) and with a Discharge Improvement Task Force meeting of patient care managers and hospital administrators (30+). A summary of each focus group including participants and date of each session is provided in **Table 2.3**.

Table 2.3: Summary of Focus Groups

Focus Group	Participants/Context	Date	N
1	Physicians and Staff (Unit 36)	2007/12/19	8
2	Nursing Staff (Unit 36)	2008/03/12	7
3	Patients	2008/05/24	2
4/5	Pharmacists: Hospital/Community	2008/05/26/2008/05/28	7
6	Internal Medicine Physicians	2008/06/11	7
7	Residents, Internal Medicine Physicians, Primary Care Physician	2008/08/06	6
8	Primary Care Physicians	2008/10/07	20+
9	Patient Care Managers, Hospital Administrators	2010/01/21	30+

Key Themes

A total of 5 themes were identified. These included:

1. Communication Gaps (with 3 sub-themes)
2. Lack of Role Clarity
3. Lack of Standardization in Current Processes (Discharge Process and Discharge Summary)
4. Medication Related Hazards
5. Patient Engagement

A summary of themes is provided in **Table 2.4**, along with a listing of the stakeholder groups who were prominent in endorsing each theme.

Table 2.4: Key Themes and Sub-Themes by Participant Endorsement

Key Theme	Sub-Theme	Endorsement
Communication Gaps	Communication Gaps within Hospital	Ward Nurses, Patient Care Managers, Hospital Pharmacists, Residents, Transition Services, Nurse Discharge Coordinator
	Communication Gaps Outside Hospital	Primary Care Physicians, Community Pharmacists
	From Community to Hospital (Feedback Loop)	Discharging Physicians, Primary Care Physicians
Lack of Role Clarity	-	Hospital Administrators, Ward Nurses, Nursing Assistants
Lack of Standardization in Current Processes (Discharge Process and Discharge Summary)	-	Hospital Pharmacists, Transition Services, Residents, Discharge Coordinator, Patient Care Managers, Nurses
Medication Related Hazards	-	Community Pharmacists, Hospital Pharmacists, Pharmacy Manager
Patient Engagement	-	Nurse Discharge Coordinator, Patients

Theme 1: Communication Gaps

Communication gaps have been divided into 3 sub-themes to correspond with the challenges experienced by the multitude of care providers working within the hospital as well as those attempting to communicate between the hospital and community.

Sub-Theme 1a: Communication Gaps within Hospital

Stakeholders perceived there to be a lack of multidisciplinary discussion and very limited collaboration among physicians, nurses, residents, pharmacists, allied health, transition services, and unit clerks with respect to anticipating needs at discharge, making discharge decisions, carrying out the discharge, and preparing the relevant documents. Nurses felt particularly out of the communication loop, frequently noting lack of timely communication with physicians as a primary concern. The responsible ward nurse may not know the decision has been made to discharge his/her patient until 10-30 minutes prior to

the time the discharge is to occur. Real-time planning involving all nursing shifts (including evening and night shifts) was also desired. In many cases, the discharge coordinator or even unit clerk may have relevant information several hours ahead of time, however they are not able to transfer this information in a timely manner (by entering it into the computerized physician order entry system/or electronic health record) due to access restrictions imposed by hospital IT departments. In relation to this latter point, some participants perceived that IT departments do not necessarily understand or agree with their access requirement needs.

Finally, special follow up needs tailored to the patient are presently not well addressed. Examples of this are: homecare needs, special medication authorization requirements (i.e. Alberta Blue Cross special authorization forms), and determining whether certain medications were in stock at the community pharmacy. Representative quotes relating to this sub-theme are shown in **Table 2.5**.

Table 2.5: Participant Quotes for Sub-Theme, Communication Gaps Within Hospital

“There is no communication.” Nurse

“With respect to discharge teaching, we can’t tell who started it, who is in the middle, and who has finished-both who and how much teaching they have done.”

Patient Care Manager

“The greatest disconnect is with the physician—they want to discharge patients today, but we [the nursing staff] have been discussing discharge all week long (and discussing at discharge rounds) and they have not been part of those conversations.”

Patient Care Manager

I think the biggest problem as well is lack of a plan and communication with everyone in the loop.”

Hospital Pharmacist

“There is great variation between clinicians and provider practices—some physicians in cardiac sciences do a half day of rounding in critical care first, and then tell the unit about a discharge. It would expedite the unit’s work if the physician wasn’t taking all day to tell the unit about their intention to discharge.”

Patient Care Manager

“We can round with everybody and with the physicians, the clerks, the nurse clinicians and there are changes being made, and they note the patient is going to be in for another 3-4 days, and you come in the next day and the patient is gone home. So it can be a lack of planning that way, which down the road, affects many people-the primary care physician, the community pharmacy, transition services, if they are getting occupations/physiotherapy as well. So I think the biggest problem is lack of a plan and communication with everyone in the loop.”

Hospital Pharmacist

Sub-Theme 1b: Communication Gaps Outside Hospital

There was considerable frustration from both primary care physicians (PCP’s) and community pharmacists with the lack of direct communication at time of patient discharge.

Communication with Primary Care Physicians (PCP’s)

Primary care providers emphasized the importance of standardizing the process of discharge, the importance of starting this process on the day of admission (rather than on the day of discharge), and the importance of ensuring clear communication so patients know what services they are to follow up with and when. The PCP often has no awareness

that their patient was in hospital or has recently been discharged. Patients are particularly vulnerable when they are without a permanent PCP. Physicians complained about timeliness of discharge communications (long delays or not receiving a discharge communication at all). Currently, summaries are dictated, transcribed, and then mailed or faxed. This process can take days or weeks, and the patient often has a scheduled visit with their PCP before this document has been received. Issues were raised by primary care physicians regarding lack of appropriate content and clarity, non-standardized content between hospital physicians, and irrelevant content. Handwritten notes (containing illegible and variable content) were not perceived to be optimal for discharge summaries. The ongoing need and value of “old fashioned communication methods” (via phone, fax) was emphasized. A representative quote relating to this sub-theme is shown in **Table 2.6**.

Table 2.6: Participant Quotes for Sub-Theme, Communication with Primary Care Physicians

“Appropriate content in terms of volume of content being excessive or being too little. Irrelevant content. Timeliness of information. And basically it’s just a great spectrum of efficiency where the top performers are really the Alberta Children’s Hospital Emergency where [the discharge summary] comes through, it’s legible, we know what’s happened down to some of the bottom performers. And the impact that has actually had on our ability to provide care.... We have a requirement as a family doctor to have really basic sets of information. We want to know why the patient was admitted, what happened, what went wrong, what went right, if they saw any specialists, what was changed, and what is planned.”
Primary Care Physician

Sub-Theme 1b: Community Pharmacists

Community pharmacists expressed frustration with not knowing who to call within the hospital for information (i.e. they cannot identify or locate the discharging physician) when discrepancies needed to be resolved. They also faced challenges with correctly identifying the primary care physician. Pharmacists noted that while their interaction with the patient post-discharge was significant, as a group they did not have access to any documentation aside from the prescription. This resulted in having to rely on the patient’s memory for a detailed description of the events in hospital. Pharmacists indicated that they would like access to the discharge summary, an accurate list of medications, as well as recent

laboratory results. Finally, a number of participants were concerned by the lack of communication between community and hospital pharmacies. Representative quotes relating to this sub-theme are shown in **Table 2.7**.

Table 2.7: Participant Quotes for Sub-Theme, Communication with Community Pharmacists

“There were 3 incidences where the discharged patient-a kidney transplant patient-was getting blister packing by us for the past 4 months, and her dose had been decreasing along the way. The problem is, we would wait for the patient to come and tell us that „the doctor says to change this, this, and that’. For the past 2 months, there has been some miscommunication because the patient didn’t remember what the doctor told her to change and we were just going blindly...Two weeks ago, we had the hospital pharmacy calling us angry saying, „Why didn’t you contact us?’ We have never been provided with information regarding who to contact [within the hospital] or exchange information with...and that’s where the big problem happened because there was a gap between hospital and community pharmacy and we were just relying on the patient guessing...”
Community Pharmacist

“I am currently in the outpatient sector at an outpatient clinic and so the biggest thing would be discharge lack of planning. They [hospital care providers] will refer to us at the last minute and expect us to drop everything and go and admit them to our clinic. We do have patients that go home on low molecular weight Heparin and sometimes that requires a lot of planning for us by getting people into the clinic for injections if they don’t feel comfortable doing it themselves....and plus phoning a community pharmacy to make sure they have it in, and if they don’t, what do we do?”
Community Pharmacist

Sub-Theme 1c: Communication Back from the Community (Feedback Loop)

Discharging physicians described uneasiness because they were never sure that the discharge summary they had dictated/faxed had been received and reviewed by the PCP (i.e. there was no feedback loop). Representative quotes relating to this sub-theme are shown in **Table 2.8**.

Table 2.8: Participant Quotes for Sub-Theme, Communication Back From the Community (Feedback Loop)

“As someone involved in discharging a patient, you worry about them being caught at the other end, or you worry about primary care actually getting the information you want them to get. Whether I do the discharge or one of the residents, again worrying about whether the primary care physician gets the information. We never get feedback unless the patient comes back to emergency that it didn’t work.”

Discharging Physician

“One of the things from the community side is that primary care physician faxes are quite busy, so failed faxes are not identified. You are actually relying on the fax to go through but you don’t know what happened on the other end. And the faxes that come through from acute care are not distinguished in any way in the pile of papers from any other fax that come through whether it be junk or someone sending an update from a year ago-there is no differentiation at the office level and no way to flag it.”

Primary Care Physician

“If there was a tool where we actually believed-where you could log in and see everything you needed. I think that would make me much more comfortable...there is a gap in trusting someone is actually going to see the information. We know that if we do dictations, it takes a while for it to be transcribed and sent out. We know that if we send a paper with the patient they are going to lose it or forget it. And we seem to discharge a lot of people on Friday night, Saturday, or Sunday so I can’t even call the family doctor and have the satisfaction of trying.”

Discharging Physician

“I like your [discharging physician’s] idea about the feedback loop because we have the same problem when we send referrals out. We don’t know if the referral has been received unless we get confirmation, ‘,thankyou for the referral, your referral has been received, we will deal with it.’ So the feedback is actually closing that continuity loop. This is a real gap.”

Primary Care Physician

Theme 2: Lack of Role Clarity

A variety of medical professionals play a role in hospital discharge, yet there is a general lack of awareness about the role of each specialty in the process. Physicians, residents, nurses, allied health (physiotherapists and occupational therapists), nursing assistants, discharge coordinators, ward pharmacists, transition services, and unit clerks all have various roles in hospital discharge. Some activities, such as documenting medication history, doing medication reconciliation and preparing a 24-hour supply of medications,

speaking with family members, booking transportation, and packing the patient's belongings should be assigned to specific team members in an explicit way, determined by protocol. It is unclear who is responsible for other activities, such as contacting community resources on behalf of the patient (anti-coagulation services), or identifying whether a patient is currently receiving home care services and what monitoring should be taken on by home care. Discharge coordinators and unit clerks also reported sometimes sharing the load of gathering information for discharge, making follow-up appointments, and faxing discharge summaries and other information to primary care physicians. Attending physicians were surprised to learn that in addition to getting their own phone calls, ward nurses also often received calls from patients who were confused about discharge instructions. Representative quotes relating to this sub-theme are shown in **Table 2.9**.

Table 2.9: Participant Quotes for Theme, Lack of Role Clarity

<p><i>"There is a lack of systems thinking in acute care that the role of nurse extends beyond unit. They do have a role in setting up care in the community. We have lost that now. New grads can articulate that but our culture shapes them away from these activities within months."</i></p> <p><i>Hospital Administrator</i></p>
<p><i>"There is no organization to what we do with every discharge unfortunately."</i></p> <p><i>Nurse</i></p>
<p><i>"Nurses-we chart everything on our patients-none of it gets transferred to the discharge summary. We chart, doctors don't even read our charting."</i></p> <p><i>Nurse</i></p>
<p><i>"The nursing assistants do a lot of that packing up of belongings...helping with transfers, getting the patient cleaned up...especially if someone is going to a nursing home, another facility or if they are a total care patient...if they are going to be on a 5-hour ambulance ride back to British Columbia then there is a lot that nursing assistants have to do as well."</i></p> <p><i>Nursing Assistant</i></p>

Theme 3: Lack of Standardization in Current Processes (Discharge Process and Discharge Summary)

It was generally agreed among most participants that there was currently no standard process for discharging a patient. Nurses stated that the discharge process could take anywhere from one hour to two days and could involve a good deal of duplication of tasks and documentation (specifically related to medication reconciliation). Many perceived there to be a general failure to document consistent timeframes, and issues of social/functional status are erratically documented as „tid bits’ in various locations in the patient chart. Another factor contributing to delays was that care providers have to use multiple data entry systems (i.e., Sunrise Clinical Manager [the hospital’s information system] as well as patient scheduling software and other computer systems) that generally do not “speak with one another.” Lack of access to computer systems was also noted as a concern as the discharge coordinator and unit clerks often booked follow-up appointments by telephone, however were not able to input these appointments into clinical databases. Representative quotes relating to this theme are shown in **Table 2.10**.

Table 2.10: Participant Quotes for Theme, Lack of Standardization in Current Processes (Discharge Process and Discharge Summary) 1

“Myself, I have a discharge fax that I use with what medication has been changed and if we are setting up for blister packing...and I always have a contact number and my pager number on there and I find that people will call quite often [following discharge].”
Hospital Pharmacist

“There are different processes for every location that someone is discharged to.”
Transition Services

Residents indicated that discharging a patient involves heavy reliance on person-to-person communication with specialist consultants including occupational therapists and physiotherapists as well as social workers, noting they would often wait hours/days to hear back from these individuals which caused a bottleneck of days in the process. Residents stated they often cannot find specialist notes in the chart or find only illegible notes. With respect to the standardized discharge documentation, residents expressed confusion about

the purpose of the discharge summary and about what content community physicians actually want in the discharge summary. Residents said they needed clarification about whether the discharge summary was a medical-legal document or a communication document as these were viewed as distinct types of communication and would therefore require different documentation. Representative quotes relating to this theme are shown in **Table 2.11**.

Table 2.11: Participant Quotes for Theme, Lack of Standardization in Current Processes (Discharge Process and Discharge Summary) 2

“Distinguishing what is a care summary versus what is a communication summary is key. And maybe we haven’t got our heads around what we are actually writing when we write.”
Resident

“The variety of discharge summaries and how they are done by individuals is so huge that I personally feel a template-we have a template-but it’s anywhere from one paragraph to seven pages. So it would be important for us to know exactly what is the purpose of our discharge summaries.”
Resident

“It can take an hour up to two and a half days for some [residents] to get [the discharge summary] together because of being interrupted, and having to see other patients, to just sit down and focus, going through the chart, following up by actually phoning specialists and making sure they are all happy.”
Discharge Coordinator

“I can’t believe we are in the 21st century and still bound by hand written notes. And I find it so incredibly inefficient, absolutely a horrendous waste of time when we can’t read the consultants notes, especially when we consult and it totally holds up the entire process in the hospital I feel. And I just wonder how many medical mistakes are done as a result of- „Oh, is that Septa, or was it Cefataxim, or it kind of looks like it starts with a ‘C’. The other thing I find incredibly inefficient is to hand write all our discharge summaries and then dictate them and then find out that neither copy got to where it was supposed to be and it takes up to three months for the discharge summary to get to the primary care physician and our patient needs to be seen on Monday. I think that’s ridiculous.”
Resident

“The one thing we talked about doing on the team is having a sheet at the front of the chart summarizing where we are off the bat, what’s happened in the past, the past medical history and presentation. And as things become clarified and issues and plans become formed, they are laid out. So if it’s a work in progress and includes differentials, if it’s a solidified plan that includes not only the inpatient plan but also a discharge plan...we go through past medical history, admission issues, current issues, inactive issues that were in hospital, and then our discharge plan and necessary follow up and the importance of that. Something like that we start from day one so the discharge summary becomes easier, a lot more concise and you don’t get irrelevant detail.”
Resident

Other care providers also reported that there was currently no standardized means to communicate information. As a result, participants reported having to generate their own customized documents or „work-arounds’ that served as discharge communication documents. This was particularly important for nurses and pharmacists who were not directly involved with existing discharge summary completion. Consistent timelines for discharging patients, including documentation of expected date of discharge was also desired. One physician wondered why nurses were not able to estimate the date of discharge on their own. Additional representative quotes relating to this theme are shown in **Table 2.12**.

Table 2.12: Participant Quotes for Theme, Lack of Standardization in Current Processes (Discharge Process and Discharge Summary) 3

“It would be great to have consistent standards around when to discharge patients- not Friday afternoon at 4pm, last minute.”

Patient Care Manager

“Each of my colleagues sends a different amount of information [to home care]. There is no regular...I might photocopy certain report and certain consults and then another person doesn’t send out anything but their own hand-written summary of the entire admission.”

Nurse

“Home care needs almost as much information as the family doctor.....particularly as high turnover is a problem in home care nursing.”

Transition Services

Theme 4: Medication Related Hazards

Medication related hazards were identified at several important junctures. On numerous occasions during hospitalization, a variety of care providers stated that they attempted to generate an accurate list of “at home medications.” This list is documented in different locations in the chart as well as on private lists that are not included with the chart or within Alberta Netcare (an electronic data repository). This ultimately results in dissimilar lists among providers and no central source of information. Another important juncture is the process of medication reconciliation at time of discharge. Ideally, the discharging physician should go back through the computerized order entry system and restart medications that

were held on admission, cancel „PRN’ drugs (medications that are to be administered on an „as needed’ basis such as laxatives and sedatives), prescribe new medications, and explain changes. Presently there is no single location where the at home medications and discharge medications can be viewed together, and reasons for changes are generally not documented in the chart. This results in community pharmacists having to do some “guesswork around medication decisions.” Representative quotes relating to this theme are shown in **Table 2.13**.

Table 2.13: Participant Quotes for Theme, Medication Related Hazards 1

<p><i>“We have no idea what to do. Do we cancel everything the patient had before and continue with the new discharge sheet medications, or do we co-merge whatever the patient had before with what’s new?”</i></p> <p><i>Community Pharmacist</i></p>
<p><i>“A lot of physicians change things just on the discharge prescriptions, and then we don’t have any record of that. We try hard to keep a copy of the discharge prescriptions when they leave, but that’s the kind of stuff that gets missed and we have no recourse.”</i></p> <p><i>Hospital Pharmacist</i></p>

It was noted that patients in special programs (such as patients that received an organ transplant, those with cancer, human immunodeficiency virus, tuberculosis, or multiple sclerosis) have certain medications that are not commonly listed with other medication histories. Care providers must be aware of where to find this specific information. There must also be awareness that certain medications require non-routine measures. For example, special circumstances arise for patients in methadone programs, clinical trials, those requiring special compounds or blister packing, low molecular weight heparin (not normally stocked) or narcotics requiring a triplicate prescription. Similarly, certain drugs require special authorizations that can take up to 10 days for patients using social assistance programs. Additional representative quotes relating to this theme are shown in **Table 2.14**.

Table 2.14: Participant Quotes for Theme, Medication Related Hazards 2

<p><i>“When people go home and you don’t have the correct history, then you can have people taking 2 classes of the same medications-like 2 ace-inhibitors, or 2 beta-blockers-and that’s is a re-admission if they come in with renal failure, bradycardia, and low blood pressure.”</i> Hospital Pharmacist</p> <p><i>“It’s really hard sometimes to put all the pieces together with what other people have done [with respect to medication reconciliation]. And some people are totally frustrated when you go back in and say, „Can I talk to you about this?’ and they say, „Well, I have told the last 3 people’, but it’s still not documented though.”</i> Hospital Pharmacist</p> <p><i>“There is an automatic substitution that occurs when the patient is admitted, the physician will inadvertently forget to go back and revert it back to what the patient was on it the community. That is where you sometimes have therapeutic duplications.”</i> Pharmacy Manager</p>
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Theme 5: Patient Engagement

The key message from clinicians with respect to patient engagement was that the process, the communication, and the expectation of communication should be clear so that everyone understands their respective roles and accountabilities. Hospital administrators and clinicians also agreed that patients should play a key role in their own discharge, but felt it was generally not clear to the patient what that role should be. Patients indicated they could not adequately convey the information that was verbally provided to them during hospitalization back to their primary care physicians. They also indicated that their primary care physicians were often not able to obtain pertinent discharge information. In addition, patients felt that the discharge summary should have a specific section providing instructions to them as it would be helpful in understanding what he/she was accountable for.

Nurses felt that patients at high risk for readmission should be identified early in the hospitalization and brought into daily conversations (documenting each interaction using computer software) in order to increase patient/family engagement. Representative quotes relating to this theme are shown in **Table 2.15**.

Table 2.15: Participant Quotes for Theme, Patient Engagement 1

“I have changed family doctors three times-and the newest doctor generally does not get that [discharge] information...and sometimes when he requests it, [hospital staff] won't give it out even if he is on your consent form.”

Patient

“As it stands right now, I have to take my wife with me to all my appointments-she has the list [of medications] and all that stuff because I can't remember. My memory is not very good.”

Patient

“Communication with family and patients because often they get really anxious if all of a sudden, the patient has been in hospital for 4 weeks and then we say, ‘oh, you are going home in 2 hours’ and the family is like, ‘What! We don't have anything ready!’ Meanwhile we have maybe been working on stuff every day towards discharge...Maybe occupational therapy is involved and they have already assessed this and sometimes families are not aware of that so they get really anxious all of a sudden....then somebody has to sit down and go through all of it with them, whereas if we communicated with them along the way there is less anxiety as well.”

Nurse Discharge Coordinator

Patient indicated their desire for access to their own health information/records electronically. Patients who participated in our focus group had a high speed internet connection, indicating they were on the internet “all the time,” and felt it would be useful to have access via a secure password protected website. Representative quotes relating to this theme are shown in **Table 2.16**.

Table 2.16: Participant Quotes for Theme, Patient Engagement 3

“There are instances where [patients] should be able to access [their medical history] themselves...just to refresh their memory”

Patient

Patients also indicated they would like to have the ability to assign access to their records (to both care providers and family members) by giving out their password rather than have access being automatically available to others. Patients suggested this password should be on the documents released with them at time of discharge, as well as on a portable card they could carry. Patients had mixed feelings and understanding about the importance a

providing information access to a wide group of care providers. For example, one patient recognized the critical role of his community pharmacist and home care nurse while another patient did not see the need for his surgeon who had removed a cancerous prostate and did follow up care for 6 months to communicate with his primary care physician. Representative quotes relating to this theme are shown in **Table 2.17**.

Table 2.17: Participant Quotes for Theme, Patient Engagement 4

“I think pharmacists these days want to feel they are more part of the team and not just someone shoving out pills.”

Patient

“I think [the discharge summary] should also go to the community nurse—home care. I think it should be in there and she should have access instead of her carrying this thick book...and every day she has got to update this thing.”

Patient

“I can’t see why there would be any need why or where there would be any necessity to check up on what happened...”he [primary care physician] never said anything to me about it. As far as I know, it was a smooth process-I didn’t ask him [primary care physician] any details, right?”

Patient

2.5 Discussion

This study was carried out in order to understand care provider and patient perspectives on the ongoing challenges of discharge planning as well as the communication gap between acute and community care. We also wanted to better understand what content was desired in discharge summaries.

This study is unique in that feedback was gathered from a wide variety of participants (physicians, residents, nurses, nurse discharge coordinators, unit clerks, hospital administrators, patient care managers, transition services, acute/community/chronic care pharmacists, as well as patients). Five relevant themes were identified: communication gaps both internally and externally, lack of role clarity, lack of standardization in current processes, medication related hazards, and patient engagement.

Inherent to the provider and patient perspectives compiled through the extensive qualitative research that we have conducted are 11 recommendations that we have extracted from the thematic discussions and participant transcripts.

With respect to improving the discharge process:

1. Clarification of the roles and responsibilities of each care provider in the discharge process is desired.
2. A direct connection should be established between community pharmacists and acute care centers as well as with primary care physicians (including communication of the discharge summary to all parties).
3. The primary care physician plays a key role and must be included in any structured discharge planning.
4. The patient/family role should be explicitly defined as part of the discharge process.

With respect to improving the discharge summary:

5. A standardized discharge summary template (based on primary care needs) is required.
6. Clarification about the purpose of a discharge summary is required (a communication document rather than a legal document).
7. Patient special needs should be anticipated before discharge (medication related and special forms).
8. Contact details of the acute care physician, ward pharmacist, ward nurse, primary care physician, and others should potentially be included on the discharge summary.
9. Primary care physicians want the discharge summary to be distinct from other documents so that it can be readily identified when faxed.
10. The discharge summary should ensure that a current list of 'at home medications' and 'discharge medications' are available so that any discrepancies can be resolved. Reasons for medication changes should also be provided on this page.

11. Patients should have access to their own medical information, preferably in an electronic format, and the discharge summary can potentially include a section detailing specific instructions to the patient regarding follow up.

A number of other studies have used qualitative research methods to understand health professional concerns at time of hospital discharge. The content of themes identified through these studies overlap with some of the themes identified in this work. For example, Connolly and Grimshaw (10) conducted focus groups with a slightly less diverse group of care providers (11 nurses, 5 allied health professionals, 5 social workers, 1 physician), and identified the following themes: conflicting pressures (keeping patients in versus getting them out, striving for flexibility within a system, staff having to deal with social issues well beyond the scope of their professional practice), and casualties arising from conflicting pressures (practitioners' sense of professionalism, patients being „systematised,' and communication challenges).

Brand (46) used an ethnographic approach to gather data on nurse concerns about the discharge process through ten episodes of observation, two interviews, and three focus groups. The four themes identified in this work included: tension between nurses and medical staff (including taking on a submissive role to avoid conflict with physicians), the unique value of the nurse, the significant administrative workload of nurses, and decision making (the lack of acknowledgment of nurses as decision makers).

Bull and Roberts (37) interviewed a participant mix somewhat more similar to this study that included twenty four individuals (community health professionals, social services staff, nurses/ward sisters, two patients, a family carer, and one physician). The objective was to understand factors which both enable and impede effective patient discharge. Several critical circles of communication at four stages of the discharge process were identified. The themes of effective teamwork with a holistic approach including a level of trust between members of a multi-disciplinary team was also important, as were impediments to a „proper' discharge.

The perception that patient/family engagement is a crucial element to successful discharge planning is well documented (1, 15, 47), however poor communication between hospital staff and patients/relatives is commonly reported (10, 36). Generally, very few studies have considered patient perspectives. In this study, patient participation was initially considered an area of key focus. It became clear early on however that given the various obstacles related to patient privacy and access to health information, Alberta Health Services would not have the ability to incorporate patient perspectives into a potential discharge communication solution. As a result, we conducted one focus group (with two elderly male patients) and then focused our efforts on obtaining input from other stakeholders. We do not disregard the importance of the patient viewpoint however and plan to further explore this in future studies.

A number of randomized clinical trials have also been done with respect to analyzing the role of structured discharge planning. A 2009 Cochrane review of 21 trials (48) found that when discharge planning was done, hospital length of stay and readmissions to hospital were significantly reduced (mean difference length of stay -0.91, 95% CI -1.55 to -0.27, 10 trials; readmission rates RR 0.85, 95% CI 0.74 to 0.97, 11 trials). Discharge planning also resulted in increased patient satisfaction in three trials. Interestingly, none of these trials assessed communication with primary care physicians following hospital discharge.

In summary, there does appear to be significant value in re-examining the discharge communication requirements for a safe and effective transition from hospital. Gains in this area will require organizations to take a „whole systems’ approach (10, 35) to discharge planning, including potentially providing formal training for staff and clarifying roles/responsibilities. It also requires the need to improve and standardize the overall quality of the discharge summary.

2.6 Conclusions

In conclusion, this study indicates that a variety of individuals, health professionals and patients, continue to feel the impact of haphazard discharge planning and coordination of care once discharge has occurred. These concerns must be fully understood and taken into account when planning solutions and large scale patient safety initiatives.

CHAPTER 3: A SYSTEMATIC REVIEW OF THE EFFICACY OF COMPUTER-ENABLED DISCHARGE COMMUNICATION INTERVENTIONS

3.1 Introduction

Computer-enabled discharge summaries have been introduced in recent years in response to the well documented problems faced by traditional handwritten and dictated summaries (1, 15). Concerns about inadequate and incorrect content, lack of standardized structure, and untimely information transfer are the most commonly cited.

Despite their growing popularity, there has been no comprehensive systematic review examining the efficacy of these new computerized systems. In 2007, Kripalani and colleagues (15) investigated the prevalence of discharge communication deficits and looked broadly at all types of interventions that target those deficits. Of the 18 interventions identified, 16 of these were implemented prior to 2000 and therefore examined older tools/mechanisms. None involved significant contributions of computer technology in discharge summary construction [data had to be manually entered from handwritten documents in one intervention (23)], and none used the World Wide Web to transmit the information. A literature review on the current state of electronic discharge summaries also published in 2007 (22) reported that electronic discharge summaries did appear beneficial with respect to improving communication timeliness, and satisfaction, and on reducing medical error rates. Much of the literature cited however did not include controlled studies, was not peer-reviewed, or was identified from grey non-indexed literature (such as technical reports from government bodies, websites, newsletters, etc.).

This systematic review was done therefore, in response to a significant gap in the literature. The objective was to evaluate the efficacy of computer-enabled discharge communication interventions for patients discharged from acute care hospitals.

3.2 Methods

Search Strategy

Two authors independently conducted a search of the literature (initially conducted September 13, 2007, with the most recent update occurring on March 1, 2010) using MEDLINE, EMBASE, the Cochrane CENTRAL Register of Controlled Trials, and MEDLINE In-Process and Other Non-Index. The Cochrane Database of Systematic Reviews was searched to identify existing systematic reviews. We applied a detailed search strategy combining terms/keywords from the following three themes: 1) Discharge Communication; 2) Electronic/Online/Web-based Communication; and 3) Controlled Interventional Studies.

For theme 3, the study design search filter described by Egger *et al* (49) was amended to include both randomized clinical trials and other prospective interventional studies with control groups (i.e., quasi-experimental studies with concurrent controls, or controlled before-after studies). The initial search strategy was developed for use in MEDLINE, but was adapted for use in other databases. We considered both adult and paediatric populations, as well as studies in all languages. Hand searching of reference lists was also performed. The full search strategy for both the original MEDLINE search and the adapted/combined search strategy is provided in APPENDIX A and APPENDIX B.

Study Selection

Titles and abstracts of all studies retrieved from the search were reviewed independently by two investigators (S.M. Motamedi, Dr. J. Posadas). Studies that were obviously unrelated and studies containing non-primary data were excluded in this first step. A full text review was then independently conducted by the same two reviewers for studies that were retained to determine if they met the inclusion criteria outlined below. Agreement among reviewers was quantified using Kappa statistics.

Inclusion and Exclusion Criteria

Interventions that focused on computer-enabled discharge communication, specifically for patients discharged from acute care to community care were included. Also considered were computer-enabled discharge communications available directly to the patient. In order to be judged a „computer-enabled discharge communication’, the intervention had to contain one or more of the following features: 1) Automatic population of the discharge document by a computer database; 2) Transmission of discharge information via computer technology (for example, text message, email, or world wide web/internet); or 3) Computer technology providing a platform for dynamic bidirectional discharge communication to occur between parties. Studies had to include a comparison group that received either no intervention or a traditional handwritten/dictated discharge summary. Studies included were therefore clinical trials, quasi-experimental studies with concurrent controls, or controlled before-after studies.

Primary outcomes of interest were (post discharge) mortality, readmission/emergency department visits, and adverse events (including adverse drug events). Secondary outcomes included timeliness (time to complete, time to receive, or time to read), accuracy of discharge information, quality/completeness, and physician/patient satisfaction (including patient understanding of medical condition). Study specific definitions for the various outcomes were compared and contrasted to determine the appropriateness of combining results across studies.

Studies with no comparison group were excluded as were those without primary data, those with no reported outcomes, and those not meeting our definition of a computer-enabled discharge communication (e.g., non-electronic transmission, manually created documents or simple word processing). Additional exclusions applied to tele-health interventions that did not specifically relay discharge communication and to web-portals that contained only non-patient specific information (e.g., only clinical practice guidelines, education materials, drug prescriptions and cost information, or referral information).

Data Extraction and Quality Assessment

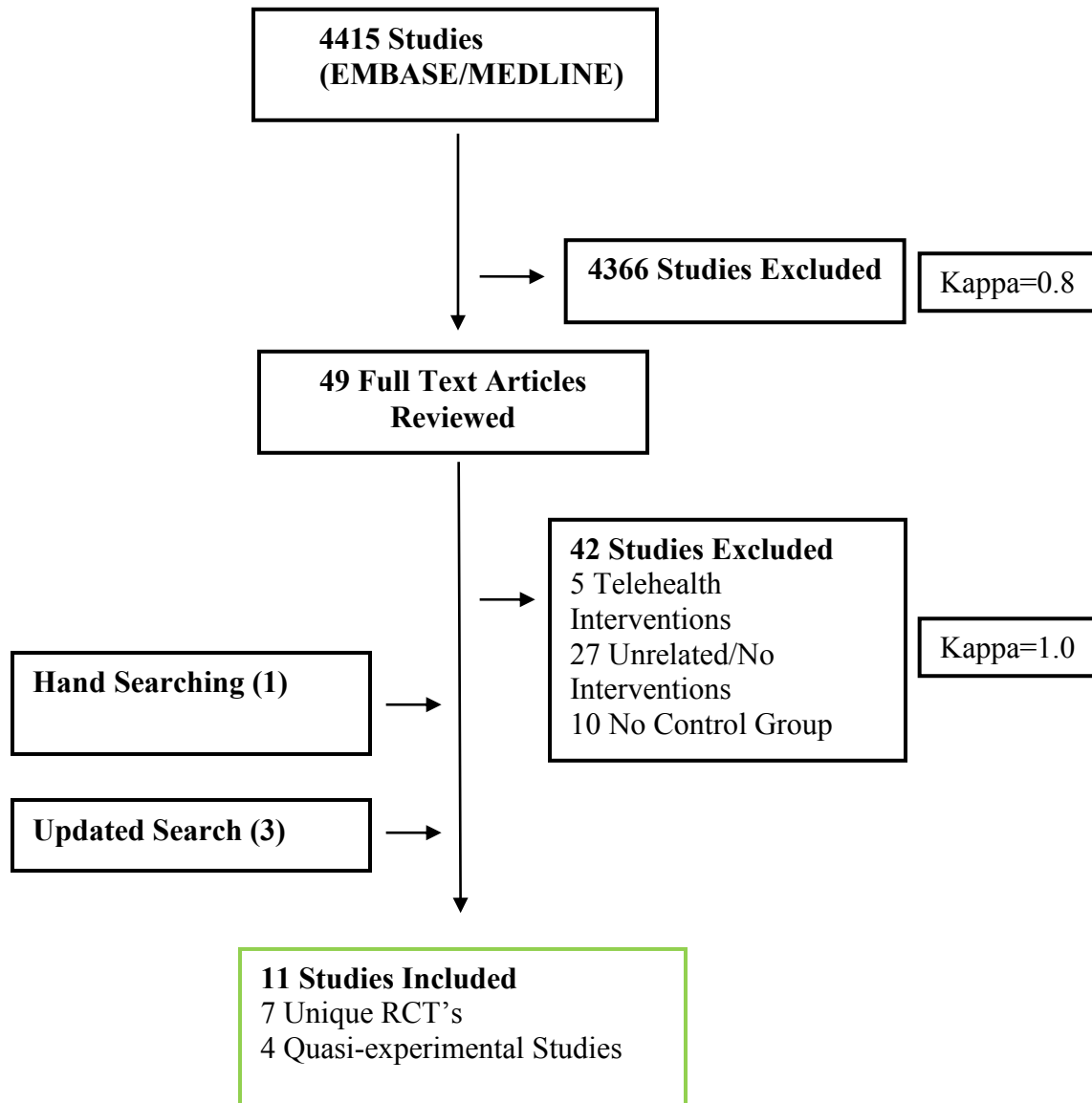
The data were independently extracted by two authors (S.M. Motamedi, Dr. J. Posadas) and entered directly into data tables. Differences in data extraction decisions were resolved through discussion and review of source documents. Study quality for identified randomized controlled trials (RCTs) was assessed using criteria described by Jadad (50). Allocation concealment was also assessed although this study quality criterion is not part of the Jadad score. For non-RCTs, the inferior study design was considered to be the main indicator of evidence quality.

Data Synthesis

We compiled a detailed description of the selected studies with tabular presentation of the study design, intervention, outcomes of interest, results, and study quality. A statistical meta-analysis was planned *a priori*, but was not performed due to heterogeneity of measures across studies.

3.3 Results

The search identified 4415 articles that were initially assessed by review of titles and abstracts. Forty-nine of these were included for full text review. One additional study was identified through hand-searching of references, and another three identified on an updated verification search. A total of 11 studies published between 1992 and 2009 were considered unique and appropriate for final inclusion (**Figure 3.1**). Study publications by Afilalo *et al* (24) and Lang *et al* (28) reported overlapping results from a single study. Callen *et al* (29) and Callen *et al* (30) also reported results from the same study.

Figure 3.1: Selection Process for Study Inclusion into Systematic Review

Description of Studies and Interventions

The identified studies consisted of 7 RCT's and 4 quasi-experimental studies (among the latter: 1 prospective cohort study with concurrent controls, and 3 before-after studies). In total, six interventions employed computer database(s) to automatically populate the discharge document (6, 7, 18, 26, 29, 30, 51). Four studies used computer technology to transmit discharge information via text messaging, email, or the World Wide Web (6, 23-25, 28). Two studies were classified as a computer technology providing a platform for dynamic discharge communication where bi-directional information flow could occur (including a web-based call center) (52, 53). One intervention combined all three features (54). Descriptions of each intervention are provided in **Table 3.1**.

Study Quality

Each randomized clinical trial was assigned a Jadad Score (50) of 3 or 4 out of 5 which is indicative of moderate study quality. Each appropriately described the procedure of randomization as well as withdrawals/dropouts. No study explicitly indicated double blinding. Allocation was concealed in all studies, except for 2 studies, where this methodological element was unclear. **Table 3.2** provides a summary of study quality.

Table 3.1: Characteristics of Studies Included in Review by Study Design

Study	Design	Setting/Patients	Intervention Group	Control Group
Afilalo M Canada (2007)(24) Lang E Canada (2006)(28)	RCT (4-Period Cluster Cross Over)	Emergency Department (ED)	<ul style="list-style-type: none"> • n = 23 (PCP's) • 1048 patient visits to the emergency department (ED) • Two 10-week periods • PCP's received a secure, web-based communication system including ED notes, consultant notes, laboratory results, electrocardiograms, imaging reports, discharge planning, medication changes • Daily/immediate advisory emails alerting PCP of ED visit 	<ul style="list-style-type: none"> • n = Same 23 (PCP's) • 974 patient visits to ED • Two 10-week periods • PCP's received usual mailed copies of the ED notes (1-2 weeks post discharge)
García-Aymerich J Spain (2007)(53)	RCT	COPD Patients: Respiratory and Environmental Health Research Unit	<ul style="list-style-type: none"> • n = 44 4 key features: <ul style="list-style-type: none"> • Comprehensive assessment of the patient at discharge • Educational programme on self-management • Individually tailored care plan shared across the system via interaction between nurse care manager and the primary care team • Information and communication technologies (ICT) platform including web-based call centre containing discharge information • 	<ul style="list-style-type: none"> • n = 69 • Patients received pharmacologic prescriptions and in-hospital treatment • Standard protocols of centres involved (no help from specialised nurse, no educational programme, no access to the call centre)

Study	Design	Setting/Patients	Intervention Group	Control Group
Casas A Spain, Belgium (2006)(52)	RCT	COPD Patients: Respiratory and Environmental Health Research Unit	<ul style="list-style-type: none"> • n = 65 4 key features: <ul style="list-style-type: none"> • Comprehensive assessment of the patient at discharge • Educational programme on self-management • Individually tailored care plan shared across the system via interaction between nurse care manager and the primary care team • ICT platform including web-based call centre containing discharge information 	<ul style="list-style-type: none"> • n = 90 • Patients received pharmacologic prescriptions and in-hospital treatment • Followed standard protocols of centres involved (no help from specialised nurse, no educational programme, no access to the call centre)
Gray J USA (2000)(54)	RCT	Infants in NICU	<ul style="list-style-type: none"> • n = 26 <ul style="list-style-type: none"> • Families accessed Baby CareLink, a multifaceted telemedicine program (videoconferencing and internet technology) • Six areas of clinical content were available: a daily clinical report, message centre, infant photos, family room, clinical information, individualized preparation for discharge 	<ul style="list-style-type: none"> • n = 30 • Usual Care (no access to Baby CareLink)
van Walraven Canada (1999)(18) Canada	RCT	General Internal Medicine Patients	<ul style="list-style-type: none"> • n = 184 • Database created DS, mailed/faxed 	<ul style="list-style-type: none"> • n = 187 • Dictated DS, mailed/faxed

Study	Design	Setting/Patients	Intervention Group	Control Group
Maslove Canada (2009)(7)	RCT (Cluster)	General Internal Medicine Service, 513-bed Tertiary Care Hospital	<ul style="list-style-type: none"> • n = 56 surveys, 46 DS, 50 patient phone interviews • EDS created by fee-entry text, pasting from hospital IT system, pick lists 	<ul style="list-style-type: none"> • n = 63 surveys 48 DS, 54 patient phone interviews • Traditional dictated DS (mailed/faxed to outpatient physicians)
Graumlich USA (2009)(51)	RCT (Cluster)	Tertiary Care Hospital, 730-bed	<ul style="list-style-type: none"> • n = 34 physician clusters, 316 patients • Computerized physician order entry system/EDS including decision support. Output of 4 documents: personalized PCP letter, prescription list, patient instructions, discharge orders 	<ul style="list-style-type: none"> • n = 35 physician clusters, 315 patients • Traditional handwritten DS
Kirby J UK (2006)(26)	Prospective Intervention (Concurrent Control)	Department of Diabetes and Endocrinology	<ul style="list-style-type: none"> • n = 50 • New EDS integrated with electronic discharge prescriptions 	<ul style="list-style-type: none"> • n = 52 • Conventional discharge system (conventional discharge prescriptions and dictated discharge summaries, mailed/faxed)
Branger P Netherlands (1992)(25)	Before-After	Unspecified Services, 27 Primary Care Physicians, 2 Regional Hospitals	<ul style="list-style-type: none"> • n = 27 PCP's, 1388 (admission-discharge reports, 1396 laboratory results) • Electronically transmitted messages (admission and discharge reports, laboratory reports, free-text) 	<ul style="list-style-type: none"> • n = NA • Traditional paper based communication, mailed/faxed

Study	Design	Setting/Patients	Intervention Group (IG)	Control Group
Callen JL Australia (2008)(29); Callen JL Australia (2010)(30)	Before-After	Medical and Rehabilitation Patients, Public Hospital, 78-bed	<ul style="list-style-type: none"> • n = 151 • EDS integrated with electronic discharge prescriptions, mailed to PCP 	<ul style="list-style-type: none"> • n = 94 • Handwritten DS mailed
O'Leary USA (2009)(6)	Before-After	General Medical Patients, 753-bed Hospital	<ul style="list-style-type: none"> • n = 95 • EDS generated by electronic medical record (EMR) • Automatic insertion of data, automatic fax to outpatient physicians 	<ul style="list-style-type: none"> • n = 101 • Traditional dictated DS (mailed/faxed to outpatient physicians)

DS: Discharge Summary

EDS: Electronic Discharge Summary

PCP: Primary Care Physician/Outpatient Physician

Table 3.2: Study Quality Criteria That Constitute the Jadad Study Quality Score

Jadad Quality Criteria	Afilalo; Lang(24, 28)	García- Aymerich(53)	Casas(52)	Gray(54)	van Walraven(18)	Maslove (7)	Graumlich(51)
Was the study described as randomized? (0,1 point)	1	1	1	1	1	1	1
Was the method used to generate the sequence of randomization described and appropriate? If yes and appropriate, add 1 point. If yes and not appropriate, deduct 1 point.	1	1	1	1	1	1	1
Was the study described as double blind? (0,1 point)	0	1	0	0	0	0	0
Was the method of double blinding described and appropriate? If yes and appropriate, add 1 point. If yes and not appropriate, deduct 1 point.	0	0	0	0	0	0	0
Was there a description of withdrawals and dropouts? (0,1 point)	1	1	1	1	1	1	1
Total Jadad Score (out of 5)	3	4	3	3	3	3	3
Allocation Concealment*	Yes	Yes	Yes	Not Explicit	Yes	Not Explicit	Yes

Primary Outcomes: Mortality, Readmission/ED Visits, Adverse Events

Studies were quite variable with respect to outcomes reported (**Table 3.3**). Only four studies reported on primary outcomes: 3 reported on both readmission and mortality (7, 51, 52), 1 reported on re-admission only (24, 28), and 2 reported on actual or PCP perceived reductions in adverse events/near misses (6, 7). No significant differences in mortality were reported between groups at 30 days, 6 months, or 12 months (7, 51, 52).

Readmission/Emergency Department visits were similar between groups at 14 days, 28 days, and 6 months, (24, 28) and were significantly lower in the intervention group at 12 months (52). O'Leary *et al* (6) reported a significant reduction in PCP perceived preventable adverse events (40.7% vs. 30.2%, $p = 0.02$) and near misses (65.7% vs. 52.9%, $p = 0.008$) over 6 months following deployment of an electronic discharge summary.

Graumlich *et al* (51) employed a more rigorous process of determining adverse events developed by Forster *et al* (3, 4) and reported no differences between groups in adverse events over 1 month.

Secondary Outcomes: Timeliness, Accuracy, Quality/Completeness, Satisfaction

The majority of studies reported on at least one secondary outcome. Surveys/questionnaires were the most common means of data collection (6, 7, 18, 24, 25, 28, 53, 54).

Timeliness

Five of six studies showed that intervention discharge summaries were generated significantly more efficiently than traditional summaries and were transmitted to the PCP more quickly (7, 23-26, 28, 51). The majority of intervention summaries were available within 48 hours, while the control summaries were received 1 to 106 days post-discharge (23, 25, 26). It was not possible to pool these data because each study measured time in different units (hours/days [including mean of 0 days]/or as a proportion of discharge summaries generated by a specified time).

Accuracy, Quality/Completeness

Accuracy and quality/completeness of discharge summaries was assessed using study-specific rating scales or by the number/percentage of omitted data elements. Only two studies examined accuracy in relation to transcription errors and reported that intervention summaries were more accurate or contained a similar number of errors (25, 29, 30). Three of 5 studies assessing completeness demonstrated significant improvements in the intervention group, specifically with respect to legibility (24, 28), comprehensiveness (24, 28), brevity (23), and more frequently included information on diagnosis (23), medications (23), planned follow up, (6, 23) tests pending, (6) and information provided to the patient (6). One study found no differences in discharge summary quality (7). Callen *et al* (29, 30) had mixed findings and noted that intervention summaries contained significantly more errors/omissions regarding discharge date, additional/other diagnoses, follow-up requirements, and discharge medications. A small number of physicians were responsible for 76% of all errors/omissions reported in this study.

Satisfaction

Seven studies reported on either the satisfaction of the physician (PCP, residents) with the discharge intervention, or of the patient/family (7, 23, 24, 28, 51, 53, 54). Among all populations studied, satisfaction with intervention summaries was similar to or greater than with traditional summaries. Each study employed unique definitions for satisfaction, and with two exceptions, (7, 54) used non-standardized/custom questionnaires.

Primary care physicians reported that intervention summaries were very useful and more comprehensive, (24, 25, 28) providing them with better knowledge of their patients hospital visits (24, 28) and the ability to ultimately better manage their patients (24, 28). PCP's also generated significantly more follow-up actions upon receiving these summaries (24, 28). In contrast, Maslove *et al* (7) reported no significant differences in satisfaction between groups.

Residents expressed preference for the intervention over traditional dictated summaries (7, 23). One study found intervention summaries were prepared significantly more quickly and easily, and reduced the burden on workload (23). Another study reported that while intervention summaries were significantly easier to complete, there were no differences in preparation time (7).

Patient/family preference varied by specific intervention. Patients with access to web-based resources in addition to personalized online discharge information (52), or with access to Baby CareLink (a tele-medicine initiative providing daily clinical reports) (54) had significantly improved knowledge of disease and self-management techniques and were more satisfied with overall quality of care and the care environment. In the study from Maslove *et al*, (7) computer-enabled discharge documents were provided directly to the patient, although attendance at follow-up visits/appointments and CTM-3 satisfaction scores were similar to patients whose discharge summaries were dictated (and these dictations were not necessarily provided to the patient).

Meta-analysis and Visual Summary of Results

A priori, our study protocol anticipated possible meta-analytic pooling of outcomes. This was, however, not possible given the heterogeneity of measures and outcomes reported across studies. **Table 3.4** provides a semi-quantitative summary of our review's findings. While no one study reports on all outcomes of interest, the body of literature as a whole points to some beneficial effects of computer-enabled discharge communication interventions, particularly for the secondary outcomes that we assessed.

Table 3.3: Description of Study Outcomes and Corresponding Results

Study	Outcomes of Interest	Results
Afilalo M Canada (2007)(24); Lang E Canada (2006)(28)	<u>Readmission, Timeliness, PCP Satisfaction, Quality/Completeness</u> 1. Re-admission to emergency department within 14 days; 28 days.	1. NS Difference in 14 day re-admission (OR 1.10, 95% CI 0.8-1.51); NS Difference in 28 day re-admission (OR 1.01, 95% CI 0.8-1.27).
	2. Duplication of diagnostic tests and speciality consultations (2022 questionnaires to PCP's).	2. NS Difference in duplication of tests (24 vs. 22, p=0.93).
	<u>PCP Satisfaction:</u> A Web-based Questionnaire was emailed to PCP's 21 days post discharge [Responses dichotomized from original 5-point Likert scale: strongly disagree (0), neutral (3), to strongly agree (5)]. Responses 1-3=Negative; Responses 4, 5=Affirmative. Applicable to Outcomes 4-9.	
	4. Timeliness.	4. IG PCP's received information more often (73% vs. 49%, OR 3.14, 95% CI 2.6-3.79). Also received information more often in 48 hours (66% vs. 0.5%, p<0.001 ⁺).
	5. Usefulness of information, Completeness.	5. IG PCP's found information more useful (59% vs. 29%, OR 5.1, 95% CI 3.49-7.46), and more comprehensive (72% vs. 14%, p<0.001).
	6. Knowledge of patients ED visit.	6. IG PCP's had better knowledge of patient ED visit (62% vs. 21%, OR 6.28, 95% CI 5.12-7.71).
	7. Patient management.	7. IG PCP's felt they could better manage patients (45% vs. 25% OR 2.46, 95% CI 2.02-2.99).
	8. Actions initiated by PCP.	8. IG PCP's initiated more follow-up actions upon information receipt.

	9. Higher rate of follow-up visits to PCP's office (ED advised, PCP-initiated, or patient-initiated).	9. NS increase in patient follow-up visits after ED care (17% vs. 14%, OR 1.25, 95% CI 0.97-1.61).
Study	Outcomes of Interest	Results
García-Aymerich J Spain (2007)(53)	<u>Patient Satisfaction (Self-Management/Understanding)</u> 1. Patient Satisfaction: self-management/knowledge (name of disease, identification of exacerbation, early treatment of COPD exacerbation), adherence to oral treatment (MAS Scale), adherence to inhaled treatment (IAS Scale), correct inhaler manoeuvre, long term oxygen therapy.	1. IG patients significantly improved knowledge of disease including: name, exacerbation, adherence to inhaled treatment, inhaler manoeuvres. Other outcomes in this category NS.
Casas A Spain, Belgium (2006)(52)	<u>Mortality, Readmission, Resource Use</u> 1. Mortality: mortality at 12 months (from hospital records, family interviews).	1. NS Difference [12 deaths (19%) IG vs. 14(16%) usual care]. Survival without re-admission [32(49%) vs. 28(31%), p=0.03].
	2. Readmission/ED Visits: Re-admission to hospital during 12 month follow-up.	2. IG Lower rate of re-hospitalisation at 12 months (1.5±2.6 vs. 2.1±3.1, p=0.033).
	3. Assessment of resource use by nurse at 1, 3, 6, 9, and 12 months.	3. NS Difference.
Gray J USA (2000)(54)	<u>Patient/Family Satisfaction (Quality of Care), LOS, Discharge Location</u> 1. Patient/Family Satisfaction: quality of care assessed by Picker Institutes Neonatal Intensive Care Family Satisfaction Survey (1-4 months post discharge).	1. IG patients/families reported significantly higher satisfaction with overall quality of care and environmental/visitation dimensions. IG did not report higher satisfaction with coordination of care. IG reported fewer problems with quality of care (mean problem score 3% and vs. 13%)

Study	Outcomes of Interest	Results
Van Walraven C Canada (1999)(23)	<u>Timeliness, Quality/Completeness, PCP and House Staff Satisfaction</u>	
	1. Timeliness: proportion of admissions for which a discharge summary was created by 4 weeks post discharge.	1. IG significantly faster generation at 4 weeks post discharge (79.6% vs. 57%, $p<0.001$). This difference persisted post 4 weeks.
	2. Timeliness: number of days from patient discharge to summary generation.	2. More IG summaries generated within 1 week post discharge (94.7%, vs. 80.2%, $p<0.001$).
	3. Quality/Completeness: organization (of 14 items, proportion of content items from chart review reported with a heading or cited in first sentence of paragraph).	3. NS Difference. IG summaries significantly shorter with headings
	4. Quality/Completeness: overall quality (100 mm VAS; 0 indicating worst to 100 indicating best). Stratification by physician type.	4. NS Difference. Stratification by speciality: PCP's rated IG summaries higher on timeliness (ratings 72.2 vs. 62.6, $p=0.04$). Consultants gave lower ratings to IG summaries for quality (64.6 vs. 76.2, $p=0.02$) and completeness. (68.2 vs 79.5, $p=0.01$).
	5. Quality/Completeness: Completeness (21 items, by chart review).	5. NS Difference (mixed results). 15/21 items cited with significantly different frequency between groups. 10 items (discharge diagnosis, medications, follow up) more common in IG. Five items (social history, admission diagnosis, hospital consultations, and functional status at discharge) more common in control summaries.

	6. Resident/House Staff Questionnaire. Time and burden to complete, rated 0 (worst) to 100 (best). Preference for each method (100 mm VAS, ratings >50 indicated preference for database/IG system).	6. IG summaries significantly faster to complete (65.3 vs. 46.3, $p=0.007$), less of a burden (65.2 vs. 43, $p=0.002$) and preferred over the dictated summaries ($p=0.004$).
Study	Outcomes of Interest	Results
Kirby J UK (2006)(26)	<u>Timeliness</u> 1. Timeliness: time between patient discharge and posting of discharge summary on to PCP accessible computer system.	1. IG summaries significantly less time to produce and post. (mean 0 days vs. 80 days, range 55-106, $p<0.0001$).
Branger Netherlands (1992)(25)	<u>Timeliness and PCP Satisfaction</u> 1. [Before] Timeliness: time to receive paper based mailed reports (PCP estimate).	1. Between 1-10 days by mail.
	2. [After] Timeliness: time between generation and delivery to PCP of electronically generated messages.	2. 91% of reports available at 1 hour, remainder at 3 hours post generation.
	3. [After] Timeliness: time for PCP to read messages (measured only over 3 of 10 weeks).	3. PCP's read messages between 0-48 hours after receipt.
	4. [Before/After] Other: percentage of laboratory results stored by PCP, Number of transcription errors.	4. More IG summaries were stored than control/paper reports, more errors were found in transcribed paper reports (19 compared to 0).
	5. [After] PCP Satisfaction: satisfaction with intervention 3 months post receiving electronic messages regarding accuracy, burden to process, speed of reporting, integration into existing computer based patient record, [5-Point Likert Scale: useless (0) to very useful (5)].	5. 20/23 PCP's rated electronic communication of admission-discharge report as $\geq 4/5$ with respect to the benefit of this type of communication. 15/23 reported electronic communication has provided more accurate knowledge of the care being delivered to patients. 10/23 PCP's reported less burden to process electronic communications.

Study	Outcomes of Interest	Results
Callen JL Australia (2008)(29); Callen JL Australia (2010)(30)	<u>Quality/Completeness</u> 1. Quality/Completeness: presence of data items in appropriate locations (discharge date, additional/other diagnoses, summary of patient progress including treatment, investigations and results, follow-up requirements, discharge medications).	1. IG summaries contained more omissions/errors regarding discharge date (OR 0.17,95%CI 0.09-0.31,p<0.05), additional/other diagnoses (OR 0.33,95%CI 0.15-0.89,p<0.05), follow-up requirements (OR 0.96,95%CI 0.42-2.16,p<0.05), discharge medications (OR 0.5,95%CI 0.20-1.26, p<0.05). IG summaries more commonly reported progress including treatment. (OR 18.3,95%CI 3.33-100, p<0.05), investigations and results (OR 3.18,95%CI 0.84-12.0,p<0.05).
	2. Quality/Completeness: comparison of medication transcription error rate between electronic summaries and traditional handwritten summaries.	2. NS Difference. Medication omission the most common error type in both summaries.
	3. Quality/Completeness: comparison of medication documentation quality by level of physician medical training.	3. NS Difference in error rates by physician medical training level (intern, resident, and registrar).
Graumlich USA (2009)(51)	<u>Readmission, Emergency Dept Visits, Adverse Events</u> 1. Readmission/ED Visits: proportion of patients readmitted at 6 months.	1. NS Difference in hospital readmission at 6 months.
	2. Readmission/ED Visits: Proportion of patients visiting emergency departments at 6 months.	2. NS Difference in emergency department visits at 6 months.

	3. Adverse Events: Proportion of patients experiencing an adverse event related to medical management within 1 month after discharge.	3. NS Difference in proportion of patients experience adverse events.
Study	Outcomes of Interest	Results
Maslove Canada (2009)(7)	<u>Mortality/ED Visits/Readmissions, Timeliness, Quality/Completeness, PCP, Resident/House Staff and Patient Satisfaction</u> 1. Composite Outcome: Emergency department visits, Readmissions, Death at 30 days.	1. NS Differences between groups.
	2. PCP Satisfaction: overall satisfaction (100 point VAS), quality, completeness, organization, timeliness.	2. NS Differences between groups on quality, completeness, organization, timeliness.
	3. Resident/House Staff Satisfaction (100 point VAS): overall satisfaction, ease of use, preparation time	3. NS Difference in overall satisfaction -House staff found the IG summaries easier to use (mean rating 86.5 vs. 49.2; $p=0.03$); No difference in time burden (mean rating 36.8 vs. 55.2; $p=0.23$).
	4. Patient Satisfaction: Patient Understanding. Rates of attendance at outpatient follow-up tests and appointments Patient Satisfaction (Care Transitions Model (CTM-3) score (ranging from 0 to 100)	4. NS Difference in rates of attendance at outpatient follow-up tests and appointments. No difference in CTM-3 scores (patient satisfaction) between groups (80.3 vs. 81.2, $p=0.81$).

Study	Outcomes of Interest	Results
O’Leary USA (2009)(6)	<u>Adverse Events/Near Misses, Timeliness, Quality/Completeness</u> 1. Adverse Events/Near Misses: PCP perceived.	1. IG PCP’s perceived that 1 or more of their patients hospitalized in the preceding 6 months sustained a near miss (65.7% vs. 52.9%, $p = 0.008$) or a preventable adverse event (40.7% vs. 30.2%, $p = 0.02$) due to poor information transfer before implementing IG summaries.
	2. Timeliness: proportion of summaries completed within 3 days post discharge.	2. Greater proportion of IG summaries completed within 3 days (72.6% vs. 59.4%, $p=0.05$).
	3. Timeliness: PCP rating [5-Point Likert Scale: very dissatisfied (1) to very satisfied (5)].	3. Greater physician satisfaction with timeliness of IG summaries 3.34±1.09 vs. control summaries 2.59±1.02 ($p<0.001$).
	4. Quality/Completeness: Proportion of summary elements present (16 elements using custom “Discharge Summary Completeness Score”).	4. 3/16 elements more common in IG summaries: discussion of follow-up issues (52.0% vs. 75.8%; $p=0.001$), pending test results (13.9% vs. 46.3%; $p < 0.001$), and information provided to the patient and/or family (85.1% vs. 95.8%; $p = 0.01$).
	5. Quality/Completeness: clarity/readability of summary [5-Point Likert Scale: unintelligible (1) to lucid (5)].	5. Authors indicate that „quality’ (clarity/readability) improved significantly with IG summaries (3.64±0.99 vs. 3.04±0.93, $p<0.001$).

Abbreviations: IG: Intervention Group, PCP: Primary Care Physician, ED: Emergency Department, VAS: Visual Analogue Scale

Table 3.4: Semi-Quantitative Visual Assessment of Study Results

Authors	Mortality	Readmission	Adverse Events/Near Misses	Timeliness	Accuracy	Quality/Completeness	Physician Satisfaction	Patient Satisfaction/Knowledge
Afilalo/ Lang(24, 28)	NR	↔	NR	+	NR	+	+	NR/NR
García- Aymerich(53)	NR	NR	NR	NR	NR	NR	NR	↔/+
Casas(52)	↔	+	NR	NR	NR	NR	NR	NR/ NR
Gray(54)	NR	NR	NR	NR	NR	NR	NR	+/ NR
van Walraven(23)	NR	NR	NR	+	NR	↔	+	NR/ NR
Kirby(26)	NR	NR	NR	+	NR	NR	NR	NR/ NR
Branger(25)	NR	NR	NR	+	+	NR	+	NR/ NR
Callen(29, 30)	NR	NR	NR	NR	NR	-/+*	NR	NR/ NR
O’Leary(6)	NR	NR	+	+	NR	+**	+	NR/ NR
Maslove(7)	↔	↔	NR	↔	NR	+	↔/+	↔
Graumlich (51)	↔	↔	↔	NR	NR	NR	NR	NR/ NR

NR: Not Reported

+: Significantly improvement(s) in the intervention group; -: Significantly poorer in the intervention group; ↔: No Significant difference between groups

*: The Callen *et al* study focuses on completeness of information. Electronic summaries were poorer on some items, but better on other items.

**The O’Leary *et al* study revealed improved completeness in some, but not all of the domains that were assessed.

3.4 Discussion

To our knowledge this is the first systematic review to assess the efficacy of computer-enabled discharge communication. With the exception of 2 studies, the 11 interventions we identified generally did not overlap with those described by two reviews done in 2007 (15, 22). Mortality and readmission to hospital/emergency departments within 6 months appear to be similar for patients regardless of type of discharge summary, although one study found a significant reduction for patients in the intervention group at 12 months. There is limited information about impact on post-discharge adverse events as only two studies reported this outcome; one study relied on physician recall of events after 6 months, and the second more rigorously identified events, albeit at only 1 month. More definitive benefits of computer-enabled summaries were identified with respect to improved quality and completeness, timeliness of delivery to care providers, as well as satisfaction among physicians and patients/families.

Computer-enabled discharge summaries could be particularly advantageous over traditional paper-based summaries when they are used as part of a larger electronic medical record system and/or with integration of a medication reconciliation component. Patient data elements can be automatically imported reducing the need for transcription or „copying/pasting’, and the integration of forcing functions, error checking of discharge orders, and automatic generation of tests pending at discharge are all means of improving patient safety during this vulnerable period (6, 7, 51). Finally, files can be more easily stored and searched/data-mined than their paper counterparts (6, 7, 51).

Our review has caveats and limitations. First, we identified only a limited number of clinical trials and controlled studies evaluating such information system tools. Second, the studies identified were of modest reported methodological quality and are quite heterogeneous in the patient populations studied, measures used, and outcomes reported, so it was not possible to pool results in a meaningful way. Third, readers need to recognize that electronic health records and discharge tools are complex interventions that require

interplay between information technologies and human factors in a local context. For example, issues related to handwritten summaries (for example, high rates of medication transcription errors) can easily be carried over to electronic summaries if systems are not designed to automatically populate this information (30). Fourth, efficacy in one setting or context does not guarantee similar benefit in other hospitals or jurisdictions. A final point to mention is that a number of computer-based interventions were excluded from our review because they were only descriptions of the technology or because only uncontrolled evaluations of the interventions had been reported (47, 55-62). While outside the scope of this review, it would also be pertinent to examine communication of medication information at time of discharge between inpatient and outpatient pharmacies, (5, 63, 64) given that information transfer relating to medications is also a particularly vulnerable handoff (5).

Should health care organizations now move to invest in the establishment of computer-based discharge communication tools based on the evidence that we have reviewed? Or should they dogmatically wait for more definitive research to be published on hard clinical outcomes of interest before investing in such systems? Such questions are challenging ones to answer, because they weigh the realization that the status quo for discharge communication under usual care conditions is not tenable. Yet, from the standpoint of scientific inquiry, rigorous studies comparing various communication tools vs. usual care are still needed to better characterize the efficacy of such tools. A reasonable balance to addressing the tension of scientific inquiry vs. the need for immediate health system improvement is for us to unequivocally state that there is (in this review) certainly evidence to support the implementation of such systems now. However, we encourage organizations that move now to implement such systems to also incorporate formal evaluation protocols to expand collective knowledge on their efficacy, and perhaps also their cost-effectiveness. Such an approach would allow health systems to address both the clear need for immediate system enhancements, while also potentially contributing new information to the evidence-base on such computer-based communication interventions.

3.5 Conclusions

In conclusion, our findings globally support the notion that computer-enabled discharge communication tools are beneficial and worth implementing now. However, the evidence in support of their widespread implementation is still relatively limited in scope. Given the rapid uptake and continuing evolution of electronic patient information systems in acute and primary care settings, it is important to continue to scientifically study the extent to which such systems affect patient outcomes.

CHAPTER 4: EVOLUTION OF THE WEB-BASED SEAMLESS DISCHARGE COMMUNICATION TOOL

4.1 Introduction

In this phase of research, an electronic discharge summary, the “Web-Based Seamless Discharge Communication Tool” was developed. This was done based on an understanding of the communication gaps that occur between acute care and community care providers (Chapters 1 and 2), an examination of the efficacy of these interventions (Chapter 3), and a recognition that an electronic discharge summary was desired in Alberta Health Services. Contextual information describing the evolution of the prototypes is provided below.

4.2 Development of Vaporware Prototypes

The partnership between our research team (S.M. Motamedi, Dr. W. Ghali), the Ward of the 21st Century (W21C), and a Calgary based industry partner (Clarity Inc.), was established in 2007. Since that time we have worked as a collective to build the Web-Based Seamless Discharge Communication Tool in a virtual development environment. My role was to design the studies described in this thesis, as well as to collect and synthesize data from stakeholders in order to inform the content of the software tool. Our collective goal was to facilitate uptake within Alberta Health Services (AHS), though there was uncertainty from the outset as to whether this would ever be possible given external challenges. One key challenge was integration of this newly developed stand-alone software with existing computer systems (including some out-dated computer infrastructure) so that discharge fields could be automatically populated. There were also differences in which data fields were deemed to be important to include, as well as dissimilar views on which stakeholders should have access to the discharge summary once it was completed and available.

Rather than focus on barriers at an early stage, our research collective developed this tool as conceptual software, termed ‘vaporware’. Five design cycles were required before a

mature prototype that contained optimal content and a user friendly format was obtained. In order to move to a real world evaluation of the prototype, we realized that integration with several other existing databases would be a critical next step. Our research team considered two options. The first option was to package the mature prototype as a stand-alone web system that could communicate with a variety of hospital information systems via an HL-7 interface. High Level 7 (HL-7) is “an international set of open standards for communication that allows health information systems developed independently to automatically „talk’ with one another (65). The second option was to re-build the electronic discharge summary content into the computerized physician order entry system currently in use by AHS (Sunrise Clinical Manager 5.0, SCM) to allow for straightforward uptake and integration.

4.3 Objectives

Our objective was to develop an electronic discharge summary for use in an acute hospital that would: 1) provide a standardized template for a multi-disciplinary group of care providers to communicate relevant clinical information; 2) be immediately available at time of discharge; and 3) be web accessible to community-based providers (primary care physicians, specialist consultants, home care nurses, community pharmacists), and patients/families.

4.4 Methods

Research Design

This research component can be considered a sub-study of the main study detailed in Chapter 2 because data was collected during the course of the same focus group sessions. As previously mentioned, practical considerations related to efficient use of clinician time/resources was a key consideration in conducting sessions in this manner. Feedback about discharge needs/challenges was collected during the first 45 minutes of each focus group interview, and this was followed by approximately 45 additional minutes of

discussion about the vaporware tool(s). As a result, two distinct interview guides were used and a separate analysis was conducted for this phase of study.

In order to determine the nature of existing discharge communication tools, data from the systematic review (described in Chapter 3) was examined. It is important to note that because the systematic review was conducted to understand efficacy, interventions that lacked a control group would not have been included. Therefore, in addition to examining the literature excluded by this review, several other approaches were taken to identify existing products. We carried out broad web searches, targeted search of the websites of several known competitor companies, and had members of Clarity Inc. attend industry specific events such as the annual Healthcare Information and Management Systems Society (HIMS) conference. Following this, multiple rounds of iterative development of the “Web-Based Seamless Discharge Communication Tool” prototype began through stakeholder focus groups.

Participants and Sampling Strategy

The same participants (and therefore the same sampling strategy) that were engaged during the main study (Chapter 2) were also available for this sub-study, with the exception of the final focus group (Hospital Administrators, Patient Care Managers) who did not provide feedback on the prototype. Therefore a total of 8 separate focus groups were held with physicians, residents, nurses, nurse discharge coordinators, unit clerks, two patient care managers, transition services, acute/community/chronic care pharmacists, as well as patients.

Data Collection

As previously described (Chapter 2), a series of semi-structured focus group interviews were conducted over approximately 1.5 hours each over a 24 month period (2007-2009). As each new prototype became available, it was presented to stakeholders during scheduled focus groups. Each session was tape-recorded and transcribed in a verbatim manner. One

software programmer (R. Sykes) from Clarity Inc. was present for all focus groups, and was given meeting transcripts and summary data (stripped of information that could identify participants) to guide iterative development work. Several versions of the interview guides were developed and pilot tested. The final version of the interview guide for care providers and staff is described in **Table 4.1**. The final version of the interview guide for patients is described in **Table 4.2**.

Table 4.1: Focus Group Interview Schedule, Care Providers and Staff

Recommendations for Content, Functionality, and Usability of the Discharge Communication Tool

- 1) What are participant reactions to the prototype (what is positive, what should be changed, can the important information be easily found, what information is missing, what depth of information is required)?
- 2) What information should other care providers be able to access? Should there be restrictions due to privacy or ethical concerns?
- 3) What should a 30 second view contain/a 3 minute view/a 30 minute view?

Opportunities to Re-Engineer Existing Admission and Discharge Processes By Integrating the Discharge Tool

- 1) Where would a dynamic discharge communication tool (the document can be modified or updated with respect to new medications, interventions, etc.) fit in with current processes/protocols for patient care?

Table 4.2: Focus Group Interview Schedule, Patients*Recommendations for Content, Functionality, Usability of the Discharge Communication Tool*

- 1) What are reactions to the prototype (what is positive, what should be changed, can the important information be easily found, what information is missing, what depth of information is required)?
- 2) What information should other care providers access? Should there be restrictions due to privacy or ethical concerns?
- 3) What should a 30 second view contain/a 3 minute view/a 30 minute view?

Iterative Tool Development

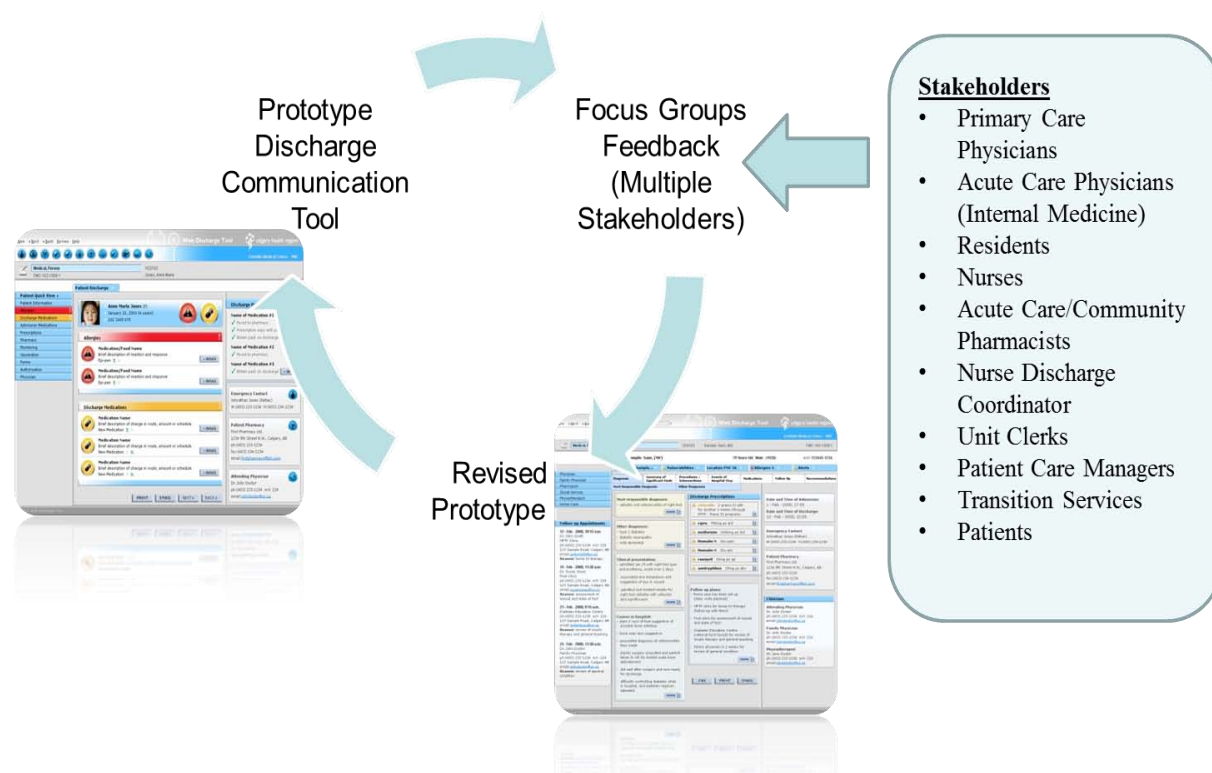
Following discussions about participant information needs at time of hospital discharge (Chapter 2), one researcher (S.M. Motamedi) in collaboration with R. Sykes presented the Web-Based Seamless Discharge Communication Tool prototype by showing screen shots on Microsoft PowerPoint software. R. Sykes was also available to answer any questions related to technical/software development aspects of the prototype. A description of each data field in the screen shots was provided and participants were encouraged to ask questions, provide comments, and to converse freely with one another during the presentation. Individual usability testing was not done at this stage (however will be undertaken during later evaluative stages of work, as described in Chapter 5).

At the time of the first focus group, only the basic requirements of an electronic discharge summary (collected from literature reviews and conversations with experts) were available and were built into a simple prototype. This tool was then very briefly pilot tested with several clinicians on a medical inpatient unit (Unit 36, Special Services Building, Foothills Medical Centre, Calgary) to determine how it might be used. Over time, multiple versions of the tool were developed and revised, and participants were able to view the evolution of the prototype and compare/contrast the most recent version with earlier versions.

The process of discharge tool development included a data collection phase followed by one/multiple design cycles, and then another round of data collection and re-design. This

process is presented in **Figure 4.1**. The feedback from these focus groups was summarized into general categories, and some „fact-distillation’ by a physician (WAG) was occasionally required to identify concrete suggestions from large blocks of text. A list of all potential changes was compiled and consensus was reached by the research team (S.M Motamedi, Dr. W. Ghali, R. Sykes) about which changes could be implemented on a short term and longer term basis. Changes that could not be implemented (largely for technical/data integration reasons) are noted in this chapter as suggestions to be considered in later releases of the software tool.

Figure 4.1: Iterative Process of Tool Development

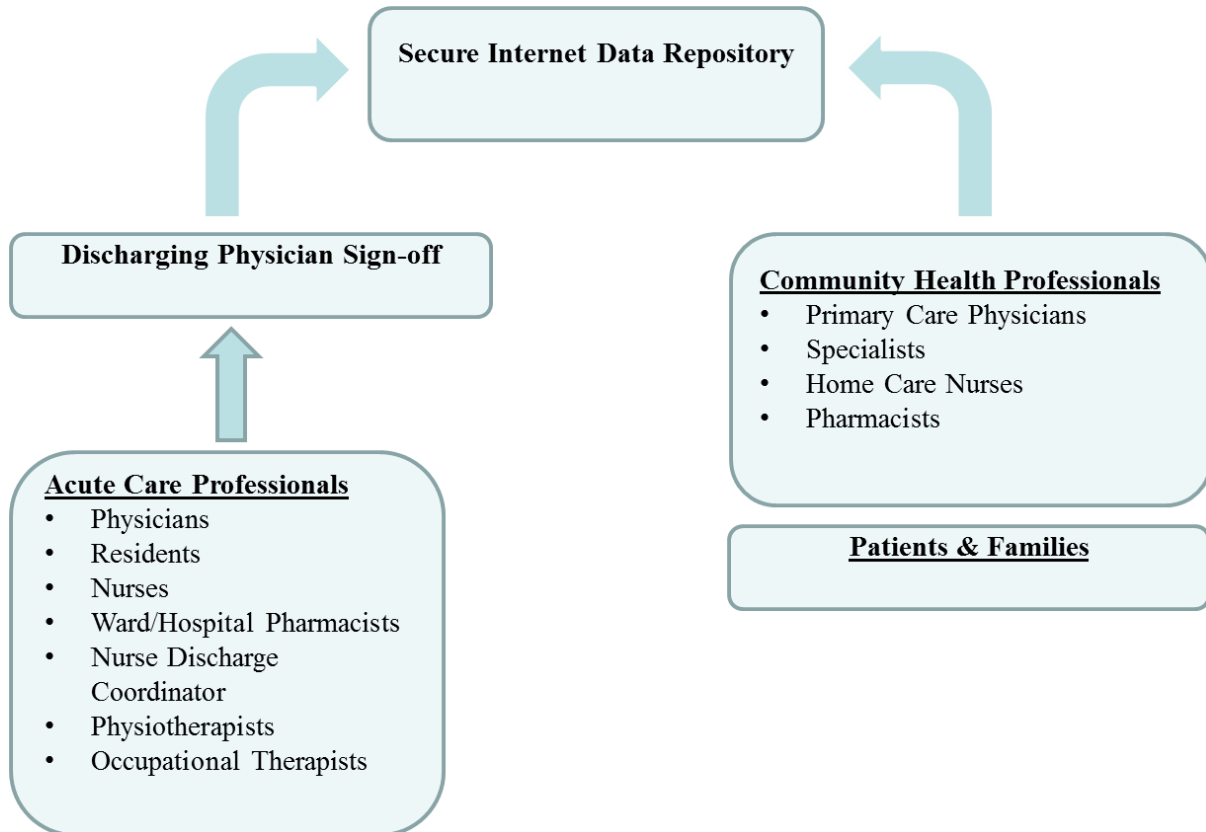


4.5 Results

A number of existing electronic discharge summaries were identified from our systematic review (Chapter 3), as well as from web searches and conference abstracts, however we could not locate detailed descriptions of the data fields (or more than 1 basic screen shot) of most of these summaries making it difficult to compare them to our work.

In our tool, a new discharge summary record for the patient would be created upon admission to hospital. This means that a patient with multiple hospital admissions would have multiple corresponding archived and accessible discharge summaries. This was done to ensure the discharge summary did not replace the electronic record for each patient, but was rather one distinct piece of a larger record. The workflow of the Web-Based Seamless Discharge Communication Tool is presented in **Figure 4.2**. At the point of patient admission, a variety of hospital care providers could potentially have access to this record and would be encouraged to input information relevant to discharge over the duration of hospitalization. Once the patient was ready for discharge, the responsible discharging physician would provide sign-off. The discharge summary would then be immediately available to community health professionals and patients/families via a secure web-based data repository that did not require additional software to be acquired by users. A description of the development process for each prototype along with screen shots are provided below.

Figure 4.2: Workflow of the Web-Based Seamless Discharge Communication Tool



Prototype 1

The first prototype of the Web-Based Seamless Discharge Communication Tool is presented in **Figure 4.3**. The discharge summary was visualized and completed by the user on a single screen. As previously mentioned, only data fields from a list of basic requirements were built into this simple prototype. This form provided a standardized template for the discharge summary that replaced free dictation; however feedback from focus groups as well as a brief pilot test centered on the poor usability of this prototype. Technical and patient privacy considerations prevented this version from being saved and completed over time by multiple individuals. This was consequently deemed to be an impractical approach. Participants provided considerable feedback about content and format. Some of these comments are summarized below:

- Rather than having to browse large blocks of text, a snapshot of the patient including changes to diagnoses and medication lists (possibly through coloured icons) was desired.
- Almost all data fields were free text boxes which required significant (error prone) data entry.
- Pharmacists wanted an indication of whether blister packing of medications or other special considerations were required for a given patient.
- More information was desired with respect to medications including start/stop/suspension dates and the name of the patient's community pharmacy.

Figure 4.3: The Web-Based Seamless Discharge Communication Tool, Prototype 1
 This was the very first prototype built by Clarity Inc. Feedback on this early prototype was used to build subsequent prototypes.

calgary health region

Discharge Summary **Foothills Medical Centre**

Patient Contact Information:

Patient Last Name: Alberta Health Care #:

Patient First Name: Hospital Card #:

Patient Phone: Patient Location Unit:

Patient Address: Form ID Number:

Admission Date: 2006 October 29

Discharge Date: 2007 January 21

Most Responsible Diagnosis (Diagnosis Most Responsible for Stay):

Attending Physician Contact Information:

Last Name:

First Name:

Phone:

Office Address:

Other Diagnosis or Co-morbidities:

Family Physician Contact Information:

Last Name:

First Name:

Phone:

Office Address:

Complications:

Procedures/Interventions:

Summary of Significant Findings:

Events of Hospital Stay:

Admission Medications:

Name: Route:

Dose: Schedule:

Discharge Medications:

Name: Route:

Dose: Schedule:

Explanation of Change in Medication:

Changes: ☐ Explanation:

New: ☐

Follow Up: PRIMARY CARE

Follow Up: OTHER/SPECIAL

Recommendations (Conditions on Discharge):

Discharge Summary Legal Disclaimer.

Prototype 2

Prototype 2 incorporated much of the feedback gathered from Prototype 1, and made efforts to provide a more visually effective design. This prototype contained 11 pages along with a “patient quick view” window (snap shot). A screen shot of the patient quick view window is provided in **Figure 4.4, Figure 4.5, and Figure 4.6**. Data fields could be exploded by clicking through the headings on the left hand navigation menu. Medication related information and other information thought to be of particular importance are highlighted on the right hand side. A summary of participant comments is listed below:

- This prototype resembled a web page, not a typical hospital document and/or form which caused confusion.
- There were too many unfamiliar and poorly explained icons, particularly along the top of the page which participants noted would necessitate perpetual staff training. Clinicians wanted a more information-rich document with the ability to “drill down” to get more detailed information from the quick view window if desired.
- Participants wanted to add the data field, “Patient Vulnerabilities” (including vulnerabilities of 4 types: financial, transportation, family/social issues, and behavioural/learning issues).
- Acute care nurses indicated that they often communicated with home care nurses and wanted to include a section specifically for this purpose.
- Nurses also requested a “Nurse Instructions to Patient” section.

Figure 4.4: The Web-Based Seamless Discharge Communication Tool, Prototype 2 (View 1)

This is the quick view window page of prototype 2. This was the first web-page prototype to be designed by Clarity Inc. Unfamiliar icons are ubiquitous. Participants wanted a more information rich document which precipitated the developed of subsequent prototypes.

The screenshot displays the 'Web Discharge Tool' interface for the 'calgary health region' and 'Foothills Medical Centre FMC'. The top navigation bar includes links for 'New', 'Next', 'Back', 'Review', and 'Help'. Below this is a toolbar with various icons. The main content area is titled 'Patient Discharge' and features a 'Patient Quick View' sidebar on the left with options like 'Patient Information', 'Allergies', 'Discharge Medications', 'Admission Medications', 'Prescriptions', 'Pharmacy', 'Monitoring', 'Vaccination', 'Forms', 'Authorization', and 'Physician'. The central panel shows patient details for 'Anne Marie Jones (F)', including her date of birth (January 31, 2003) and phone number (102 3345 678). It also lists 'Allergies' (Epi-pen) and 'Discharge Medications' (New Medication). The right sidebar contains 'Discharge Prescriptions' (Faxed to pharmacy, Prescription copy with patient, Blister pack on discharge), 'Emergency Contact' (Johnathan Jones), 'Patient Pharmacy' (First Pharmacy Ltd.), and 'Attending Physician' (Dr. John Doctor). At the bottom, there are buttons for 'PRINT', 'EMAIL', 'NEXT', and 'BACK'.

New Next Back Review Help

Web Discharge Tool calgary health region

Foothills Medical Centre FMC

Medical, Person 102/102 Jones, Anne Marie

FMC-102-1059-1

Patient Discharge

Patient Quick View

- Patient Information
- Allergies
- Discharge Medications
- Admission Medications
- Prescriptions
- Pharmacy
- Monitoring
- Vaccination
- Forms
- Authorization
- Physician

Discharge Prescriptions

Name of Medication #1

- ✓ Faxed to pharmacy
- ✓ Prescription copy with patient
- ✓ Blister pack on discharge

Name of Medication #2

- ✓ Faxed to pharmacy

Name of Medication #3

- ✓ Blister pack on discharge

Emergency Contact

Johnathan Jones (Father)

W:(403) 299-5234 H:(403) 299-5234

Patient Pharmacy

First Pharmacy Ltd.

1234 5th Street N.W., Calgary, AB

ph:(403) 299-5234

fax:(403) 299-5234

email: firstpharmacy@fph.com

Attending Physician

Dr. John Doctor

ph:(403) 299-5234 ext: 299

email: johndoctor@uc.ca

Allergies

Medication/Food Name

Brief description of reaction and response

Epi-pen Y N

Discharge Medications

Medication Name

Brief description of change in route, amount or schedule.

New Medication Y N

Medication Name

Brief description of change in route, amount or schedule.

New Medication Y N

Medication Name

Brief description of change in route, amount or schedule.

New Medication Y N

PRINT EMAIL NEXT BACK

W21C Web Discharge Tool

Figure 4.5: The Web-Based Seamless Discharge Communication Tool, Prototype 2 (View 2)

This is a view of the patient demographic page of prototype 2. To permit data entry, data fields could be exploded by clicking through headings on the left hand navigation menu. In this case, the Patient Information field was exploded.

The screenshot displays the 'Web Discharge Tool' interface for the 'calgary health region' and 'Foothills Medical Centre - FMC'. The main navigation bar includes links like 'New', 'Next', 'Back', 'Review', and 'Help'. A secondary bar shows 'Medical, Person' with patient details: '102/102', '56y Female', and 'Alsebeth, Gregory Allan'. Below this is a tabbed interface with categories: 'Patient Info', 'Allergies', 'Alerts', 'Discharge Meds', 'Admission Meds', 'Prescriptions', 'Pharmacy', 'Monitoring', 'Vaccination', 'Forms', 'Authorization', and 'Physician'. The 'Patient Info' tab is active, showing a list of fields on the left: 'Patient Name', 'Alberta Health Care #', 'Hospital Card #', 'Patient Location Unit', 'Birth Date', 'Gender', 'Day Time Phone', 'Alternate Phone', 'Address', 'Admission Date', 'Discharge Date', 'Emergency Contact Name', 'Relationship to Patient', 'Day Time Phone', 'Alternate Phone', and 'Contact Address'. The 'Patient Information' form is expanded, containing sections for 'Enter Patient Personal Information' and 'Emergency Contact Information'. The 'Enter Patient Personal Information' section includes fields for 'Patient Last Name', 'Patient First Name', 'Birth Date' (with a date picker set to 2006-10-28), 'Gender' (radio buttons for Female and Male), 'Patient Phone (H)', 'Patient Phone (W)', 'Patient Address', and 'Patient Location Unit' (set to Unit 36). The 'Emergency Contact Information' section includes fields for 'Contact Last Name', 'Contact First Name', 'Contact Phone (H)', 'Contact Phone (W)', 'Relationship to Patient', and 'Contact Address'. At the bottom of the form are buttons for 'OK', 'NEXT >', 'Cancel', and 'Help'. The status bar at the bottom left reads 'W21C Web Discharge Tool'.

Figure 4.6: The Web-Based Seamless Discharge Communication Tool, Prototype 2 (View 3)

This is another view of the patient demographic page of prototype 2. Once data was entered, the information would be presented in a “read only” format (as seen here).

The screenshot displays the 'Web Discharge Tool' interface for the 'calgary health region' and 'Foothills Medical Centre - FMC'. The top navigation bar includes links for 'New', 'Next', 'Back', 'Review', and 'Help', along with a series of icons representing various medical functions. The main content area is titled 'Medical, Person' and shows patient details for '102/102' and 'Alsebeth, Gregory Allan', a 56-year-old female. A tabbed interface at the top lists various categories: Patient Info, Allergies, Alerts, Discharge Meds, Admission Meds, Prescriptions, Pharmacy, Monitoring, Vaccination, Forms, Authorization, and Physician. The 'Patient Info' tab is active, showing two sections: 'Patient Information' and 'Emergency Contact Information'. Each section contains a table of demographic data. At the bottom right, there are buttons for 'PRINT', 'EMAIL', 'NEXT >', and 'BACK <'. The footer indicates 'W21C Web Discharge Tool'.

Patient Information	
Patient Name:	Smith, John James
Alberta Health Care #:	1028 5542 102
Hospital Card #:	567 822 031
Patient Location Unit:	Unit 36
Birth Date:	1978, January, 07
Gender:	Male
Day Time Phone #:	(403) [REDACTED]
Alternate Phone #:	(403) [REDACTED]
Address:	1023 54th Avenue S.W., Calgary, Alberta T4J 5V6
Admission Date:	2006, November, 21
Discharge Date:	2007, January, 30

Emergency Contact Information	
Contact Name:	Smith, Jane
Relationship to Patient:	Spouse
Day Time Phone #:	(403) [REDACTED]
Alternate Phone #:	(403) [REDACTED]
Contact Address:	1023 54th Avenue S.W., Calgary, Alberta T4J 5V6

Prototype 3

Prototype 3 attempted to incorporate all the feedback from focus groups to date and ultimately incorporated a wealth of information not previously available. This version is presented in **Figure 4.7**. The left hand navigation menu was shortened and tabs were added to make the document resemble a patient chart. Participants indicated that this version was too cluttered, lacked clear direction, and contained confusing terminology and nomenclature. A selection of participant comments is below:

- The large text boxes create a busy environment through which the clinician has to search through. The copy-and-paste function was appreciated but not optimal as participants preferred to have automatic population of data from existing databases.
- A list of “at home” and “new in hospital” medications was desired instead of “admission medications.”
- Participants wanted to include the use of the terms “continue,” “discontinue,” and “hold” in reference to medications.
- Names of individuals who completed medication reconciliation, reasons for medication changes, prescribed dosing, patient compliance, and flagging of patients who required blister packing, compliance aids, and/or special authorization forms was also desired.
- Electronic verification/sign-off of discharge summaries by the responsible attending physician was highlighted as an important safety step.
- A forcing function should be created to ensure the attending physician views all screens, particularly the medication reconciliation screen (as residents at varying levels of training were currently preparing discharge summaries).

Figure 4.7: The Web-Based Seamless Discharge Communication Tool, Prototype 3


This is the quick view window of prototype 3. This version was designed to resemble a patient chart however was ultimately viewed by participants as too cluttered, lacking clear direction, and confusing. Efforts were made to reduce large blocks of text in subsequent iterations.

New ▶ Next ◀ Back Review Help Log-out

Web Discharge Tool
calgary health region

Foothills Medical Centre - FMC

Medical, Person
102/102
Sample, Sam, (Mr)
FMC-102-1059-1


Sample, Sam, (Mr)
DOB 01-Jun-1947 (61 years) Gender Male AHC 123445-1234

Address 123 Sample...
Considerations 1
Location FMC 36
Allergies 2
Risks 1

Physician
Family Physician
Pharmacist
Social Service
Physiotherapist
Home Care

Follow-up Appointments

01 - Jan - 2008, 10:15 a.m.
Dr. John Doctor
ph:(403) 233-1234 ext: 224
123 Sample Road, Calgary AB
email: johndoctor@uc.ca
Reason: lorem ipsum dolor sit amet consectetur

15 - Jan - 2008, 11:30 a.m.
Dr. John Doctor
ph:(403) 233-1234 ext: 224
123 Sample Road, Calgary AB
email: johndoctor@uc.ca
Reason: lorem ipsum dolor sit amet consectetur

29 - Jan - 2008, 9:15 a.m.
Dr. John Doctor
ph:(403) 233-1234 ext: 224
123 Sample Road, Calgary AB
email: johndoctor@uc.ca
Reason: lorem ipsum dolor sit amet consectetur

29 - Jan - 2008, 9:15 a.m.
Dr. John Doctor
ph:(403) 233-1234 ext: 224
123 Sample Road, Calgary AB
email: johndoctor@uc.ca
Reason: lorem ipsum dolor

Diagnosis	Summary of Significant Finds	Procedures / Interventions	Events of Hospital Stay	Medications	Follow Up	Recommendations
Most Responsible Diagnosis Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque venenatis, nibh eget ultrices iaculis, ligula nulla viverra erat, nec luctus mauris elit at metus. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Vestibulum vulputate, massa quis interdum blandit, augue ipsum semper tortor, vitae semper arcu tellus nec velit.		Other Diagnosis or Co-morbidities Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque venenatis, nibh eget ultrices iaculis, ligula nulla viverra erat, nec luctus mauris elit at metus. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Vestibulum vulputate, massa quis interdum blandit, augue ipsum semper tortor, vitae semper arcu tellus nec velit.		Discharge Prescriptions <ul style="list-style-type: none"> digoxin 125 mg 1 6hr cyclizine 50 mg 3 D ranitidine 150 mg 2 D erythromycin 250 mg 2 D 		
Complications Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque venenatis, nibh eget ultrices iaculis, ligula nulla viverra erat, nec luctus mauris elit at metus.		Procedures / Interventions Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque venenatis, nibh eget ultrices iaculis, ligula nulla viverra erat, nec luctus mauris elit at metus. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Vestibulum vulputate, massa quis interdum blandit, augue ipsum semper tortor, vitae semper arcu tellus nec velit.		Emergency Contact Johnathan Jones (Father) W:(403) 233-1234 H:(403) 234-1234		
Recommendations Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque venenatis, nibh eget ultrices iaculis, ligula nulla viverra erat, nec luctus mauris elit at metus. Vestibulum ante ipsum primis in faucibus orci luctus et ultrices posuere cubilia Curae; Vestibulum vulputate, massa quis interdum blandit, augue ipsum semper.		Patient Pharmacy First Pharmacy Ltd. 1234 5th Street N.W., Calgary, AB ph:(403) 233-1234 fax:(403) 234-1234 email: firstpharmacy@fph.com		Clinicians <p>Attending Physician Dr. John Doctor ph:(403) 233-1234 ext: 224 email: johndoctor@uc.ca</p> <p>Family Physician Dr. John Doctor ph:(403) 233-1234 ext: 224 email: johndoctor@uc.ca</p> <p>Physiotherapist Dr. Jane Doctor ph:(403) 233-1234 ext: 224 email: janedoctor@uc.ca</p>		

FAX PRINT EMAIL

W21C Web Discharge Tool

Prototype 4

Prototype 4 was an attempt to simplify the user interface while retaining a fairly significant level of content. This version is presented in **Figure 4.8 and Figure 4.9**. Participants continued to view this iteration as too cluttered, and opted to remove the tabs in favour of a more detailed navigation menu. One key feature involved removing large blocks of text in favour of point form documentation. A summary of participant comments is below:

- Information should be presented in order of importance/clinical relevance, with key items being made mandatory before discharge can be done.
- A “self-management” section should be added for patients (detailing what the patient is expect to do, what the primary care physician’s role will be, the expected timeline for the patient’s condition to improve, what to watch out for in terms of worsening condition, and a plan of action if things do not go as expected including a contact number alternate to the emergency department).
- Potentially adding a “Patient Education” section.
- Potentially adding a link to BMJ best treatments and BMJ clinical evidence for physicians.
- Addition of data fields, “Source of Medication Information,” and “How long has the patient been on this medication (Start Date)?”
- Specification of whether follow up appointments have been made (use of the terms “done,” “not done,” and “in progress”) including reason for follow up and names of individuals who booked the follow up appointments.
- Making the heading “Primary Care Recommendations” or just “Recommendations” the most visually prominent piece.
- Most recent vitals could be added along with a list of vaccines the patient received during hospitalization.

Figure 4.8: The Web-Based Seamless Discharge Communication Tool, Prototype 4 (View 1)

This is the quick view window of prototype 4. This goal of this version was to simplify the user interface while retaining a significant level of content. This view shows the quick view window (snap shot) of this prototype.

The screenshot displays the 'Web Discharge Tool' interface for the Calgary Health Region, specifically for the Foothills Medical Centre (FMC). The patient is identified as 'Sample, Sam, (Mr)', 79 Years Old Male (1928), with AHC 123445-1234. The interface is organized into several sections:

- Header:** Includes navigation links (New, Next, Back, Review, Help, Log-out), a search bar, and the tool's name and location.
- Patient Information:** Displays the patient's name, age, gender, and AHC number.
- Medical, Person:** A dropdown menu for patient type.
- Physician:** A list of roles including Family Physician, Pharmacist, Social Service, Physiotherapist, and Home Care.
- Follow-up Appointments:** A list of appointments with dates, times, and details for Dr. John Smith and Dr. Susan Jones.
- Diagnosis:** A section for 'Most responsible diagnosis' and 'Other diagnoses'.
- Discharge Prescriptions:** A list of medications including cefazolin, cipro, metformin, Humulin N, ramipril, and amitriptyline.
- Follow-up plans:** A list of plans including home care, HPTP clinic, foot clinic, diabetes education, and family physician review.
- Clinicians:** A list of clinicians including Dr. John Doctor, Dr. Jane Doctor, and Dr. Susan Jones.
- Course in hospital:** A list of events including plain X rays, bone scan, plastic surgery, and surgery.

The interface also includes a 'Vulnerabilities' section, a 'Location' dropdown, and an 'Allergies' dropdown. The bottom of the screen shows 'FAX', 'PRINT', and 'EMAIL' buttons.

Figure 4.9: The Web-Based Seamless Discharge Communication Tool, Prototype 4 (View 2)

This is the quick view window of prototype 4. Once a user clicked on a given data field (in this case most responsible diagnosis), a dedicated text box appeared. This allowed the user to “drill down” for more detailed content. The large blocks of Latin text were distracting and created confusion for some participants.

The screenshot displays the 'Web Discharge Tool' interface for the 'calgary health region'. The header shows the user is logged in as 'Dr. Jane Doctor' on '16 - April - 2008 13:21'. The patient record is for 'Sample, Sam, (Mr)', a 79-year-old male, with AHC number 123445-1234. The sidebar on the left lists various medical categories, with 'Most Responsible Diagnosis' selected. The main content area shows the diagnosis 'Cellulitis and osteomyelitis of the right foot.' followed by three paragraphs of placeholder Latin text.

Web Discharge Tool		calgary health region		EMAIL	PRINT	FAX	HELP	LOG OUT
Foothills Medical Centre FMC		Logged on as: Dr. Jane Doctor 16 - April - 2008 13:21						
Most Responsible Diagnosis Other Diagnosis Clinical Presentation Follow-up plans Course in Hospital Medications Procedures/Interventions Recommendations Follow-up Appointments Clinicians Emergency Contacts	<div> Sample, Sam, (Mr) 79 Years Old Male (1928) AHC 123445-1234 </div> <div> Address ▼ Vulnerabilities ▼ Location FMC 36 ▼ Allergies 2 ▼ Alerts ▼ </div> <div> <p>Cellulitis and osteomyelitis of the right foot.</p> <p>Lorem ipsum dolor sit amet, consectetur adipiscing elit. Pellentesque vehicula, nulla ac ornare sodales, ante ipsum tincidunt tellus, nec pharetra felis lacus at metus. Cras luctus dictum leo. Sed erat lacus, suscipit nec, convallis vitae, adipiscing quis, massa. Vivamus consequat, velit in luctus ornare, augue elit tristique est, sed posuere quam odio posuere risus. Pellentesque sit amet turpis vel ante rutrum ullamcorper. Fusce nibh enim, faucibus quis, vestibulum quis, vestibulum eu, augue. Pellentesque venenatis, sapien ut venenatis tempor, nulla neque posuere metus, ut vehicula dolor mi eget diam. Suspendisse auctor sagittis tortor. Nulla neque magna, bibendum in, sagittis sit amet, sagittis in, odio. In tristique leo id eros. Quisque quis justo eget lorem sodales cursus. Phasellus ut quam. Nunc eleifend rutrum diam. Praesent libero ligula, feugiat viverra, malesuada ac, sodales eu, leo. Integer justo. Pellentesque tincidunt tincidunt turpis.</p> <p>Suspendisse faucibus varius mi. Mauris justo leo, ornare at, scelerisque eu, feugiat a, tortor. Integer nisi diam, venenatis in, malesuada vel, eleifend eu, augue. Quisque id lacus a nunc volutpat vehicula. Phasellus sem lorem, cursus at, varius sed, eleifend et, purus. Sed congue, pede ut adipiscing bibendum, tortor diam fringilla velit, vitae lacinia est lorem vel ante. Sed ornare. In vitae lacus. Maecenas vehicula velit vel nibh. Aliquam eget justo ac metus dapibus elementum.</p> <p>Vivamus sit amet libero quis lacus porttitor cursus. Sed enim. Mauris ut purus at neque fermentum iaculis. Suspendisse quis est eu felis porttitor fermentum. Donec mauris risus, fermentum vitae, congue pellentesque, euismod at, sem. Nam vitae quam. Vivamus id quam ac erat euismod sodales. Aliquam sagittis accumsan metus. Ut ipsum nisl, eleifend euismod, eleifend sit amet, eleifend at, lorem. Aliquam porttitor, justo vulputate condimentum iaculis, erat quam rutrum nisl, eu ultricies purus neque quis turpis.</p> <p>Donec laoreet erat vel orci. Phasellus ullamcorper suscipit lorem. Suspendisse tellus. Aliquam erat volutpat. Proin odio. Quisque facilisis. Fusce non tortor et justo tristique porttitor. Nam arcu odio, feugiat iaculis, euismod quis, vulputate id, ligula. Etiam eros lectus, porttitor vel, pulvinar sit amet, placerat et, nisl. Integer ligula nunc, venenatis eu, blandit ut, adipiscing id, augue. Phasellus tincidunt vulputate ipsum. Vestibulum congue semper odio. Nunc id ipsum non libero blandit adipiscing. Maecenas faucibus.</p> </div>							

W21C Web Discharge Tool

Prototype 5, Mature Prototype, the Web-Based Seamless Discharge Communication Tool

The fifth and final prototype was developed by combining the learning from the previous 4 iterations. The quick view window of this mature version is presented in **Figures 4.10**. A selection of screen shots to guide the user through the system is presented in **Figures 4.11-4.20**. This version was customizable so that the snap shot/quick view window could be altered according to the “focus” of the care provider. A range of care providers were able to enter information, with sections specific to certain groups (for example nurses and pharmacists). Information would no longer be entered in block format, but rather in point form (bullets would be created each time the enter key was pressed on the user’s keyboard). Medication reconciliation could be done by viewing all medication related information on one screen. Select significant test results could be imported, and a list of care providers involved in a given patients care would be available. Finally, a condensed yet simple document would be generated and automatically faxed once the discharge had been completed (the “discharge” button had been pressed by the responsible discharging physician). This prototype contained most of the feedback from all previous focus groups. Selected comments regarding this version are presented below and could potentially be built into a future software release:

- The ability to obtain a “trend-view” of various items such as blood sugar would be important for patient education.
- Addition of data fields, “Date and Time of Last Dose,” and “Date(s) Medication History Was Taken.”
- Users must be able to override information and have these overrides tracked for audit purposes (there should be a means to identify which individuals altered the discharge summary).
- Provide an address or clue that the facility the patient has been discharge to (if not home) is either long term care, a lodge, private assisted living, or an otherwise designated facility as these different facilities have varying services and access to physicians/pharmacists.

- Do not allow care providers to delete medications that have been cancelled because formulary requirements sometimes stipulate that a patient must have tried a given drug and been intolerant to it before funding for alternatives will be provided.
- Retain a record of who the discharge summary was automatically faxed to.

Figure 4.10: The Web-Based Seamless Discharge Communication Tool, Prototype 5, Mature Prototype (View 1)

This is the quick view window (snap shot) of the mature electronic discharge summary. As in the previous version, the user has the ability to “drill down” for more detailed information. Feedback from focus groups did not require significant revision.

The screenshot displays the 'Web Discharge Tool' interface for the 'calgary health region'. The top navigation bar includes links for EMAIL, PRINT, FAX, HELP, and LOG OUT. The main header identifies the location as 'Foothills Medical Centre FMC'.

Patient List

- Patient Details
- Most Responsible Diagnosis
- Other Diagnosis
- Clinical Presentation
- Follow-up plans
- Course in Hospital
- Medications
- Recommendations
- Follow-up Appointments
- Clinicians
- Emergency Contacts

Patient Details:

- Date of Admission: 02-May-2008 15:06
- Date of Discharge: 13-May-2008 17:05
- Discharge From: FMC 36
- Discharging Physician:
- Attending Physician: DOCTOR, John (Dr.)

Patient Information:

SAMPLE, Sam (Title) Born 14-Jul-1928 (79y) Gender Male NHS No. [redacted]

Address: 123 Sample Road S
123 Sample Road SW
T1T 2T2

Phone and email: 403 555-1234
Home: 403 [redacted]
Work: 403 [redacted]
Mobile: 403 [redacted]
email: ssample@abc.xyz

Alerts:

- Need of assisted care

Known allergies:

- Dust 01-Feb-2008
- Smoke 01-Feb-2008

Most responsible diagnoses:

- cellulitis and osteomyelitis of right foot

Other diagnoses:

- type 2 diabetes
- diabetic neuropathy
- mild demential

Clinical presentation:

- admitted Jan -- with right foot pain and erythema, onset over 2 days
- associated skin breakdown and suggestion of pus in wound
- admitted and treated initially for right foot cellulitis with

Vulnerabilities:

- Need of assisted care
- Inexperienced Home Care Nurse

Follow Up Plans:

- Home care has been set up. (daily visits planned)
- HPTP clinic for home IV therapy (follow-up with them)
- Foot clinic for assessment of wound and state of foot
- Diabetes Education Centre (referral form faxed) for review of insulin
- family physician in 2 weeks for review of general condition

Course in hospital:

- plain X rays of foot suggestive of possible bone infection
- bone scan also suggestive
- associated diagnosis of osteomyelitis thus made
- plastic surgery consulted and patient taken to OR for limited scale
- did well after surgery and now ready for discharge
- difficulty controlling diabetes while in hospital, and diabetes

Discharge Prescriptions:

- cefazolin 2 grams
- cipro 750mg po bid
- metformin 1000mg po bid
- Humulin N 20u qam
- Humulin N 15u qhs
- ramipril 10mg po qd
- amitryptiline 25mg po qhs

Admission Medication:

Medication Reconciliation:

Recommendations:

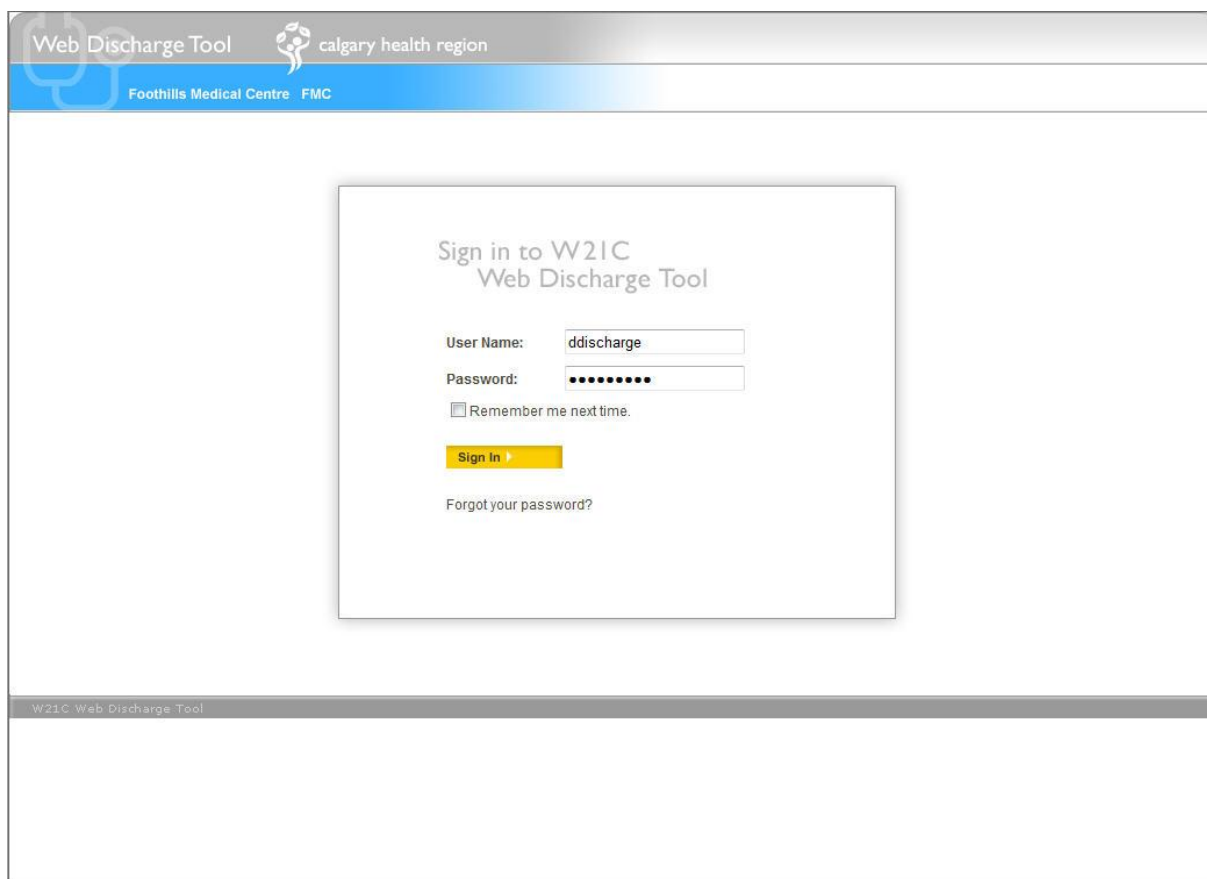
- Elevate foot as much as possible

W21C Web Discharge Tool

The following 10 screen shots are provided to guide the user through the Web-Based Seamless Discharge Communication Tool. These begin with the first page (the log in) presented in **Figure 4.11** and conclude with the final page (where an automatic fax would be generated) in **Figure 4.20**.

Figure 4.11: The Web-Based Seamless Discharge Communication Tool, Log-in (View 2)

The Log-in screen is the first page the user would view. Users would be required to register for a user name and password prior to obtaining access to the log-in screen. Patients would also be provided with log-in information that they could then provide to their community health professional. An automatic password reset function is also available.




The screenshot displays the login interface for the W21C Web Discharge Tool. At the top, a header bar contains the text "Web Discharge Tool" and the "calgary health region" logo. Below this, a blue banner identifies the "Foothills Medical Centre FMC". The main content area features a central white box with the heading "Sign in to W21C Web Discharge Tool". Inside this box, there are input fields for "User Name:" (containing "ddischarge") and "Password:" (masked with dots). A checkbox labeled "Remember me next time." is positioned below the password field. A yellow "Sign In" button is located at the bottom of the input section, with a "Forgot your password?" link underneath it. A footer bar at the bottom of the page reads "W21C Web Discharge Tool".

Once log-in has been successful, a user would be able to view a list of relevant patients and open specific records (**Figure 4.12**). Integration with existing hospital databases is required for this feature to function correctly.

Figure 4.12: The Web-Based Seamless Discharge Communication Tool, Sample Patient List (View 3)

This is the second page the user would view, a list of patients relevant to the health professional. This page requires integration with existing hospital databases in order to function correctly. Clicking on a patient name (or the “click to open” button) will take the user to the quick view window.

Web Discharge Tool

calgary health region

HELP

LOG OUT

Foothills Medical Centre FMC

Patient List

Patient Name	Date of Discharge	Alberta Health Care #	Status	
SAMPLE, Sam	05-Aug-2008 17:04	12345-0123	Opened	Click to Open
HENDERSON, Donald	08-Aug-2008 13:56	12345-1111	Opened	Click to Open
COOPER, Catherine	05-Aug-2008 12:26	12345-2222	Opened	Click to Open
DOE, John		12345-3333	Opened	Click to Open
EVANS, Jonathan		12345-4444	Not Opened	Click to Open
WORTH, Karen		12345-5555	Opened	Click to Open
SAMPLE, One		12345-6666	Opened	Click to Open
SAMPLE, Two	12-Aug-2008 12:39	12345-7777	Opened	Click to Open

1 2

W21C Web Discharge Tool

In order to enter data, the user will need to click on the data field of interest. **Figure 4.13** shows the data field for “Diagnosis.” The clinician would enter text and hit the return key on their keyboard (creating a bullet point) It is possible to provide a single line of summary text as well as to input additional detailed information in the “Content” data field. Users are able to upload relevant images, reports, or other files in the “Reference” data field.

Figure 4.13: The Web-Based Seamless Discharge Communication Tool, Diagnosis Data Fields (View 4)

This is a view of the Most Responsible Diagnosis page. Note that only the information contained in the summary line would be visible in the quick view window, therefore in order to view the more detailed information entered into specific data fields, the user would either click on the data field within the quick view window or on the associated link in the left hand navigation window.

The screenshot displays the 'Web Discharge Tool' interface for the 'calgary health region'. The top header includes links for EMAIL, PRINT, FAX, HELP, and LOG OUT. The left-hand navigation menu lists various patient-related sections, with 'Most Responsible Diagnosis' currently selected. The main content area is titled 'Most responsible Diagnosis' and includes a 'Back to Patient Details' link. The 'Summary' field contains the text 'cellulitis and osteomyelitis of right foot'. The 'Content' field also contains the same text. The 'References' field is empty, with a red 'X' and a green '+' icon indicating the ability to add or remove references. At the bottom of the main content area are buttons for 'Update', 'Delete', and 'Cancel'. The footer of the page reads 'W21C Web Discharge Tool'.

Figure 4.14 illustrates the medication related pages of the discharge summary which include “Admission Medication,” “Discharge Medication,” and “Medication Reconciliation.” Admission medications must be entered manually and must include information about start date, drug name, dose, frequency, route, and source of information.

Figure 4.14: The Web-Based Seamless Discharge Communication Tool, Admission Medications (View 5)

This is a view of the Medication Detail Page. Note that medication related information is located in one commonly accessible area. This is an important feature because many hospital health professionals duplicate the process of taking the patient’s medication history and attempt medication reconciliation. On this page, admission medications must be manually entered in a structured format.

Web Discharge Tool calgary health region PRINT FAX HELP LOG OUT

Foothills Medical Centre FMC

Patient List
Patient Details
Most Responsible Diagnosis
Other Diagnosis
Clinical Presentation
Follow-up plans
Course in Hospital
Medications
Significant Test Results
Recommendations
Follow-up Appointments
Clinicians
Emergency Contacts

Date of Admission:
01-Aug-2008 15:06 ▶

Date of Discharge:
05-Aug-2008 17:04 ▶

Discharge From:
FMC 36 ▶

Discharging Physician:
DISCHARGE, Dan (Dr) ▶

Attending Physician:
DOCTOR, John (Dr) ▶

Medication Detail [Back to Patient Details](#)

Admission Medication Discharge Medication Medication Reconciliation

Start Date	Drug	Dose	Frequency	Route	Source	
01-Aug-2008	coumadin (warfarin)	3mg	daily	oral	patient	Delete
01-Aug-2008	metformin	1,000mg po l	daily	oral	patient	Delete
01-Aug-2008	amitriptyline with chlordiazepoxide-	25mg qhs	every 2 nd de	oral	patient	Delete
05-Aug-2008	ramipril	10mg po qd	dail	oral	patient	Delete

Update Add New

W21C Web Discharge Tool

Figure 4.15 indicates that on the Discharge Medications page, medications can either be automatically pulled from existing hospital databases or manually entered.

Figure 4.15: The Web-Based Seamless Discharge Communication Tool, Discharge Medications (View 6)

This is the discharge medication page. Users are able to manually add new medications, or automatically import these medications through the existing computerized physician order entry system (SCM). This automatic population is a critical feature and is heavily dependent on successful integration.

Web Discharge Tool calgary health region PRINT FAX HELP LOG OUT

Foothills Medical Centre FMC

Patient List
Patient Details
Most Responsible Diagnosis
Other Diagnosis
Clinical Presentation
Follow-up plans
Course in Hospital
Medications
Significant Test Results
Recommendations
Follow-up Appointments
Clinicians
Emergency Contacts

Date of Admission:
01-Aug-2008 15:06

Date of Discharge:
05-Aug-2008 17:04

Discharge From:
FMC 36

Discharging Physician:
DISCHARGE, Dan (Dr)

Attending Physician:
DOCTOR, John (Dr.)

Medication Detail Back to Patient Details

Admission Medication Discharge Medication Medication Reconciliation

Start Date	Drug	Dose	Frequency	Route
Add New				
Import				

W21C Web Discharge Tool

Figure 4.16 illustrates how the process of medication reconciliation could be simplified by having complete medication lists side by side so that discrepancies between the two lists can be easily identified and resolved in the data field “Explanation of any changes to pre-admission medications.”

Figure 4.16: The Web-Based Seamless Discharge Communication Tool, Side-By-Side Medication Reconciliation (View 7)

This is a view of the Medication Reconciliation page. The purpose of this page is to allow complete medication lists to be easily compared so that discrepancies can be identified and explained. Medication reconciliation is critical feature of this electronic discharge summary.

Web Discharge Tool calgary health region PRINT FAX HELP LOG OUT

Foothills Medical Centre FMC

Patient List
Patient Details
Most Responsible Diagnosis
Other Diagnosis
Clinical Presentation
Follow-up plans
Course in Hospital
Medications
Significant Test Results
Recommendations
Follow-up Appointments
Clinicians
Emergency Contacts

Date of Admission:
01-Aug-2008 15:06
Date of Discharge:
05-Aug-2008 17:04
Discharge From:
FMC 36
Discharging Physician:
DISCHARGE, Dan (Dr)
Attending Physician:
DOCTOR, John (Dr.)

Medication Detail Back to Patient Details

Admission Medication Discharge Medication Medication Reconciliation

Admission Medication	Discharge Medication
amitriptyline with chlorthalidone-oral 25mg qhs every 2nd day oral	amitriptyline 25mg po qhs every 2nd day oral
coumadin (warfarin) 3mg daily oral	cefazolin 2 grams IV q8h for another 3 weeks daily IV
metformin 1,000mg po bid daily oral	coumadin (warfarin) 3 mg daily oral
ramipril 10mg po qd daily oral	Humulin N 15u qhs weekly oral
	metformin 1000mg po bid daily oral
	ramipril 10mg po qd daily oral

Explanation of any changes to pre-admission medications

humulin - management of diabetes

cefazolin - antibiotic

Update

W21C Web Discharge Tool

Figure 4.17 shows that a list of significant test results can be selected for inclusion into the discharge summary. This is another instance where integration into existing hospital databases is required.

Figure 4.17: The Web-Based Seamless Discharge Communication Tool, Significant Test Results (View 8)

This is a view of the Significant Test Results page. Users are able to thoughtfully select which tests results would be relevant to community health professionals and import them on this page. This page requires integration with the computerized physician order entry system (SCM).

Web Discharge Tool calgary health region

PRINT | FAX | HELP | LOG OUT

Foothills Medical Centre FMC

Significant Test Results [Back to Patient Details](#)

Title	Date	Include
X-Rays	16-Sep-2008 13:45	<input type="checkbox"/>
CT-Scan	16-Sep-2008 15:00	<input type="checkbox"/>
Plural fluid Cytology	16-Sep-2008 20:15	<input type="checkbox"/>
Chest XRay	17-Sep-2008 08:30	<input type="checkbox"/>
Blood Cultures	17-Sep-2008 10:15	<input type="checkbox"/>
Laboratory results from final 48 hours	17-Sep-2008 10:27	<input type="checkbox"/>

[Update](#) [Import](#)

Navigation Links:

- Patient List
- Patient Details
- Most Responsible Diagnosis
- Other Diagnosis
- Clinical Presentation
- Follow-up plans
- Course in Hospital
- Medications
- Significant Test Results
- Recommendations
- Follow-up Appointments
- Clinicians
- Emergency Contacts

Patient Information:

- Date of Admission: 12-Sep-2008 15:06
- Date of Discharge: 17-Sep-2008 17:04
- Discharge From: FMC 36
- Discharging Physician: DISCHARGE, Dan (Dr)
- Attending Physician: DOCTOR, John (Dr.)

W21C Web Discharge Tool

Figure 4.18 displays the page where the contact information of clinicians involved in a given patient's care would be presented. All the fields in this section are not mandatory (for example, email information is not required as some clinicians may not like to include this).

Figure 4.18: The Web-Based Seamless Discharge Communication Tool, Clinician Contact Information (View 9)

This is a view of the Clinician Contact page. On this page, community health professionals can view the contact information of relevant care providers. This was noted to be a particularly useful feature for community pharmacists who periodically required access to care providers to resolve medication discrepancies.

The screenshot displays the 'Web Discharge Tool' interface for the 'calgary health region'. The header includes navigation links: EMAIL, PRINT, FAX, HELP, and LOG OUT. The main content area is titled 'Foothills Medical Centre FMC' and 'Clinicians'. A sidebar on the left lists various patient information sections, with 'Clinicians' currently selected. The main area shows three clinician profiles, each with a role, name, phone number, and email address, and an 'Edit' button. The footer indicates 'W210 Web Discharge Tool'.

Role	Name	Phone	Email
Attending Physician	DOCTOR, John (Dr.)	(403) 235-1234	johndactor@uc.ca
Family Physician	FAMILY, Frank (Dr)	403-234-2342	ffamily@email.com
Physiotherapist	DOCTOR, Jane (Dr.)	(403) 235-1234 ext. 1234	janedactor@uc.ca

Figure 4.19 displays the page where a responsible discharging physician would complete the discharge summary by clicking the “discharge” button. A time and date stamp is also generated for audit purposes.

Figure 4.19: The Web-Based Seamless Discharge Communication Tool, Discharge Time/Date Stamp (View 10)

This is a view of the Discharge Details page. The purpose of this page is to document the date and time the responsible discharging physician actually reviewed and signed off on the discharge summary.

The screenshot shows the 'Web Discharge Tool' interface for the 'calgary health region'. The top header includes links for EMAIL, PRINT, FAX, HELP, and LOG OUT. The sidebar on the left lists various patient information sections: Patient List, Patient Details, Most Responsible Diagnosis, Other Diagnosis, Clinical Presentation, Follow-up plans, Course in Hospital, Medications, Recommendations, Follow-up Appointments, Clinicians, and Emergency Contacts. Below these are summary fields for Date of Admission (02-May-2008 15:06), Date of Discharge (13-May-2008 17:05), Discharge From (FMC 36), Discharging Physician, and Attending Physician (DOCTOR, John (Dr.)). The main content area displays the 'Discharge Details' form, which includes a Status dropdown set to 'Opened', Date of Admission (02-May-2008 15:06), Date of Discharge (13-May-2008 17:05), and Discharge From (FMC 36). At the bottom of the form are 'Continue' and 'Discharge' buttons. The footer of the page reads 'W21C Web Discharge Tool'.

Once the discharge has been completed, a condensed document is generated (**Figure 4.20**) and automatically faxed to the care providers specified. Integration with an up-to-date database of community care providers (including fax numbers) is required for this feature to function correctly. This document can also be email or printed and provided to the patient/family.

Figure 4.20: The Web-Based Seamless Discharge Communication Tool, Automatic Fax Generated (View 11)

When the discharge summary receives sign-off by the responsible discharging physician, a condensed discharge summary is generated and automatically faxed to specified individuals. Integration with an existing database of community care providers (including fax numbers) is essential for this feature to function correctly.

The screenshot displays the 'Web Discharge Tool' interface for the 'calgary health region'. The top navigation bar includes links for EMAIL, PRINT, FAX, HELP, and LOG OUT. The left sidebar contains a menu with options like Patient List, Patient Details, Most Responsible Diagnosis, and others. The main content area is titled 'Send Fax' and includes a 'Back to Patient Details' link. The form contains fields for 'To (Fax Recipient):' (Name, Fax Number, Subject) and 'From (Sender):' (Name, Phone, Fax Number, Receipt Email Address). A 'Notes' text area and a 'Send' button are also present. Below the form is a preview of the 'Message Body' for 'Sample, Sam (Sam)', which includes patient details, contact information, and a section for 'Alerts'.

Web Discharge Tool calgary health region

EMAIL PRINT FAX HELP LOG OUT

Foothills Medical Centre FMC

Send Fax [Back to Patient Details](#)

To (Fax Recipient):

Name:

Fax Number:

Subject:

From (Sender):

Name: FAMILY, Frank (Dr)

Phone: 403-554-2242

Fax Number:

Receipt Email Address: ffamily@email.com

Notes:

Message Body:

Sample, Sam (Sam)

Born 14/07/1928 12:00:00 AM Gender Male NHS No. 12345-0123

Address 123 Sample Road SW
Calgary
Canada T1T 2T2

Phone and Email
Home: (403) 554-1234
Work: (403) 554-1234
Mobile:
Email:

Known Allergies
Dust
Smoke

Alerts

Summary:
Need of assisted care

Content:

References:

4.6 Discussion

The objective of this phase of research was to develop a highly functional and user friendly electronic discharge summary. This objective was accomplished following 8 focus groups with a variety of stakeholders involved in hospital discharge. The final Web-Based Seamless Discharge Communication Tool emerged following five design cycles. Key features of the discharge summary are that it provides a standard template to ensure consistent information is document for each patient, and it provides a venue for a multi-disciplinary group of care providers to input data over the course of hospitalization. Once the patient is discharged, the information is designed to be transmitted in a timely manner to a secure internet data repository that can be accessed by primary care physicians, community health professionals, as well as patients/families.

While a number of electronic discharge summaries have been discussed and/or studied in the international literature and grey literature, (22, 56-59, 62, 66) it was difficult to locate full descriptions of these summaries (including explanation of data fields and/or screen shots). This complicated the process of comparing the merits of each summary with our work.

Some of the issues related to the barriers in the development and uptake of electronic discharge systems were reviewed by Craig *et al* (22). The need to develop standardized content through use of templates, or at the very least, a set of minimum data elements was once such issue. Interestingly, the lack of access to computers or modern computer systems by hospital staff as well as by staff in the offices of primary care physicians was also a significant issue in this and other studies (22). Our research team heard similar sentiments by focus group participants as a reason why electronic transmission of information may not be a viable option at this time. Stand-alone software (that is not integrated into existing hospital databases) does not seem to be a viable option because care providers are required to duplicate their efforts to complete data fields. This has been reported to be barrier to uptake and physician satisfaction (22) and would result in a less effective discharge

summary in the case of our Seamless Discharge tool. Other less surprising barriers included concerns related to user acceptance and potentially heavy up-front training requirements. Our hope was that the added value of electronic discharge summaries would quickly become evident to clinicians and patients and that implementing this system would remove the need to continue with cumbersome dictations.

The next steps of this work are to identify a hospital environment where this prototype can be integrated with existing databases and evaluated. The purpose of this would be to identify any usability, functionality, or process concerns. Following any subsequent refinement of the software, a formal clinical trial should then be conducted to evaluate the efficacy of this tool using outcomes previously identified by our systematic review (Chapter 3). The next chapter will describe why it was not possible to integrate and evaluate this prototype within Alberta Health Services Calgary Zone and will describe the eventual re-build that our research collective was involved in.

4.7 Conclusions

In conclusion, this phase of research involved the development of an electronic discharge summary, the “Web-Based Seamless Discharge Communication Tool” through an iterative design process. This was accomplished through the successful partnership between our research team (S.M. Motamedi, Dr. W. Ghali), the Ward of the 21st Century (W21C), and a Calgary based industry partner (Clarity Inc.).

CHAPTER 5: MOVING TOWARDS IMPLEMENTATION AND EVALUATION OF SEAMLESS DISCHARGE IN ALBERTA HOSPITALS

5.1 Introduction

The academic research detailed in earlier sections of this thesis has precipitated a much larger initiative within Alberta Health Services (AHS). Significant financial and human resource commitments have been made to build the Seamless Discharge Summary into an existing computerized physician order entry system (Sunrise Clinical Manager 5.0). The funding for this build has been provided by an Alberta Ministry of Advanced Education and Technology Innovation Voucher (67) (\$12,500) as well as through the AHS Information Technology (IT) Department (\$250,000+).

Our research collective (S.M. Motamedi, Dr. W. Ghali, the Ward of the 21st Century, and Clarity Inc.) has been fully engaged in the process of integration with AHS which is led by Janice Mandolesi, Director of Clinical Practice and Informatics and Belinda Boleantu, Vice President, Clinical Transformation Services. In 2010, this build had largely been accomplished and the functional prototype was called the “AHS Seamless Discharge Summary.”

This chapter details the development of the AHS Seamless Discharge Summary, the associated workflow, as well as a series of images that illustrate the new tool. A discussion of an evaluation plan our research team has designed is also presented.

5.2 Development of the AHS Seamless Discharge Summary

Through the auspices of the Ward of the 21st Century (W21C), the original Web-Based Seamless Discharge Communication tool was presented to AHS executive leadership. These meetings led to subsequent collaboration with the Calgary Zone Professional Practice Informatics Council (PPIC) Calgary which is an inter-professional decision making body responsible for examining matters of professional practice that arise during

the development, planning, implementation and use of the electronic health record. The AHS IT Department also became involved and the decision was made to integrate the discharge summary concept into AHS IT infrastructure and to further grow the initiative.

As of 2009, the “Seamless Discharge Project” has involved a variety of AHS stakeholders, including a dedicated core design team and a multi-disciplinary group of care providers. These individuals work in activities related to development, implementation, and evaluation. An organizational chart of these AHS stakeholders is presented in **Figure 5.1**. An AHS project charter was constructed to define the work plan, individual responsibilities, performance criteria, budget, and communication plan.

The project charter identifies 4 phases of the Seamless Discharge Project that can be summarized as: Current State Analysis, Development of Content and Interface, Build Within SCM, and Evaluation. The first 3 phases are described in detail below. Phase 4 Evaluation, is based on a research protocol designed by Dr. W. Ghali, S.M. Motamedi, and others affiliated with the Ward of the 21st Century, and will be described later in this chapter.

Phase 1 Current State Analysis: The objective is to analyze the current discharge summary documentation practices in Calgary Zone hospitals and to determine regional, standardized content for a multidisciplinary discharge summary. Sub-phases include:

- a. Current state analysis, expanded validation of discharge summary content and linking with regional discharge initiatives and projects.
- b. Current discharge summary practice data collection and analysis.
- c. Collaboration and alignment with the Regional Capacity Committee’s Standardized Discharge Process initiative.
- d. Collaboration and alignment with discharge readiness initiative (Medworxx).

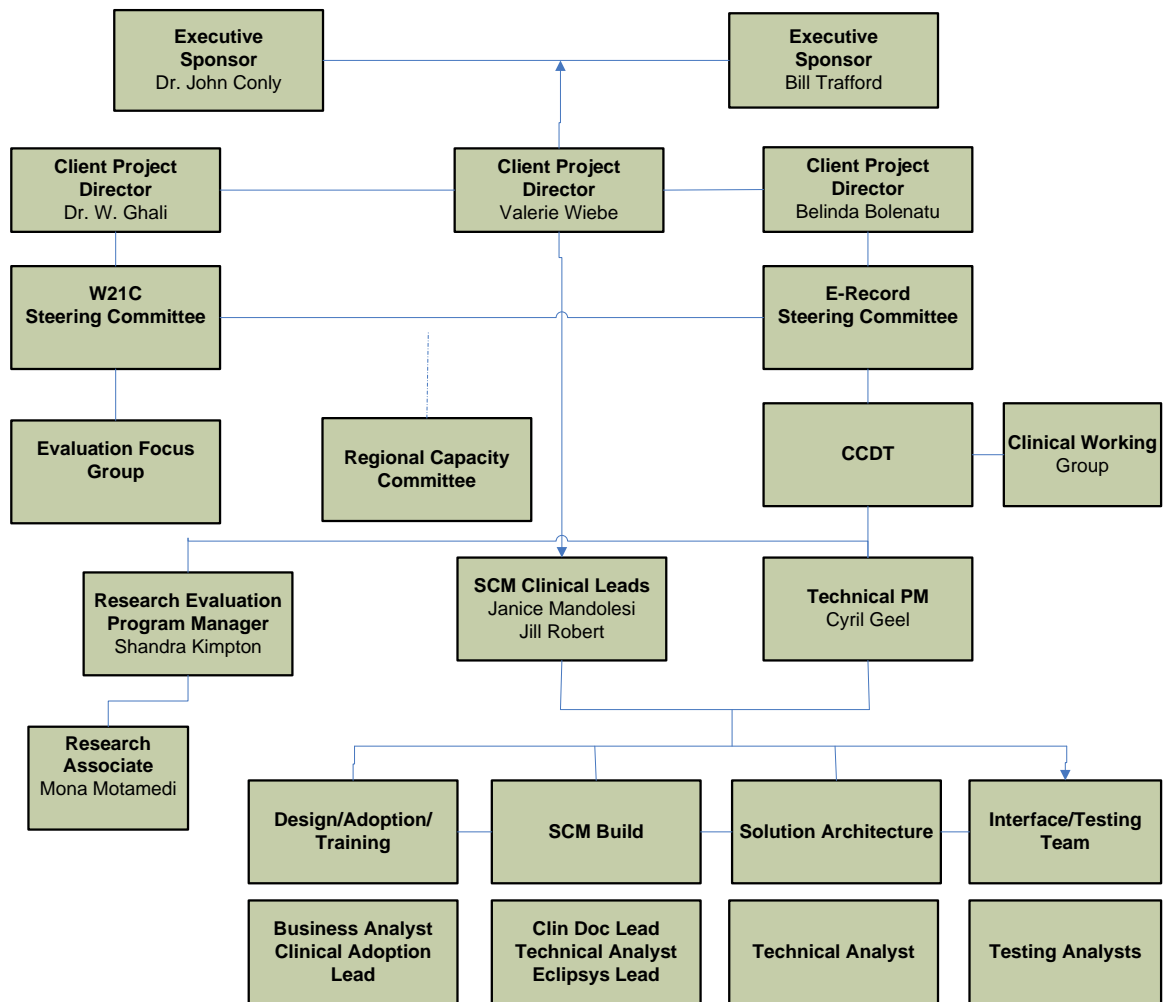
Phase 2 Development of Content and Interface: The objective is to design and configure the discharge summary in Sunrise Clinical Manager 5.0. Sub-phases include:

- e. Apply content and process learning's from Phase 1 to inform the design and build of a structured document in SCM for electronic documentation of the discharge summary.
- f. Expanded clinical program focus groups to validate content, workflow and usability of the discharge tool and iteratively inform the design and build of the SCM discharge summary (ongoing through design of tool).
- g. Develop and implement a viewing platform of the discharge summary to provide community and primary care physician access to this information.

Phase 3 Build within SCM: The objective is to implement the discharge summary in Sunrise Clinical Manager 5.0. Sub-phases include:

- h. Limited Production Roll out and pilot testing of the tool with at least 100 actual patient discharges (see pilot evaluation, section 5.6) Feedback between the research group and core design team will be an iterative process to inform final design.
- i. Regional transitioning to a standard discharge summary (paper format of the seamless discharge tool from Phase 2), by modifying the existing discharge report in SCM to mirror the content/design of the Seamless Discharge Summary in Phase 2.
- j. Roll out of the Seamless Discharge Summary in SCM. Implement the discharge summary in SCM including training and potential multidisciplinary adoption.

Figure 5.1: Key AHS Stakeholders Involved in the Seamless Discharge Project



5.3 Delivery of the AHS Seamless Discharge Summary via Alberta Netcare

It was necessary to adapt the delivery mechanism of the new tool from the original concept due to privacy concerns. The original concept included relatively simple yet secure web-based access to the discharge summary by health professionals as well as by patients/families. The new AHS Seamless Discharge Summary would be available only to health professionals through the Alberta Netcare Electronic Health Record Portal.

The Alberta Netcare Electronic Health Record Portal is an internet based data repository that contains all the electronic health records of individuals who reside in Alberta, Canada. The types of documents available to registered care providers include: “personal demographic information that helps to uniquely identify each patient, prescribed dispensed drugs, known allergies and intolerances, immunizations, laboratory test results, diagnostic imaging reports, [and] other medical reports” (68). Access would now be provided on a “need to know” basis (68) that is variable based on user role and profession. To obtain permissions and passwords, a five step process has to be completed by each health provider including initial registration/enrolment, a privacy impact assessment (requiring approval), an organization readiness assessment (requiring approval and potentially additional technical and network configuration to each user’s computer system), an information management agreement, and an information exchange protocol.

5.4 Iterative Development of the AHS Seamless Discharge Summary

The new Alberta Health Services (AHS) Seamless Discharge Summary was re-built into the Sunrise Clinical Manager Interface (SCM) in collaboration with the AHS Information Technology (IT) Department. **Figure 5.2** illustrates the new workflow concept of the AHS Seamless Discharge Summary. This workflow differs from the original concept in that only physicians and residents are provided with access to the discharge summary data fields (the original version involved multi-disciplinary access). If a resident enters data, a data box pops up on the left hand side that forces them to enter an “Authored By” physician so that sign off by an attending physician is assured before the discharge is finalized (**Figure 5.3**).

Figure 5.2: Workflow of the New AHS Seamless Discharge Summary

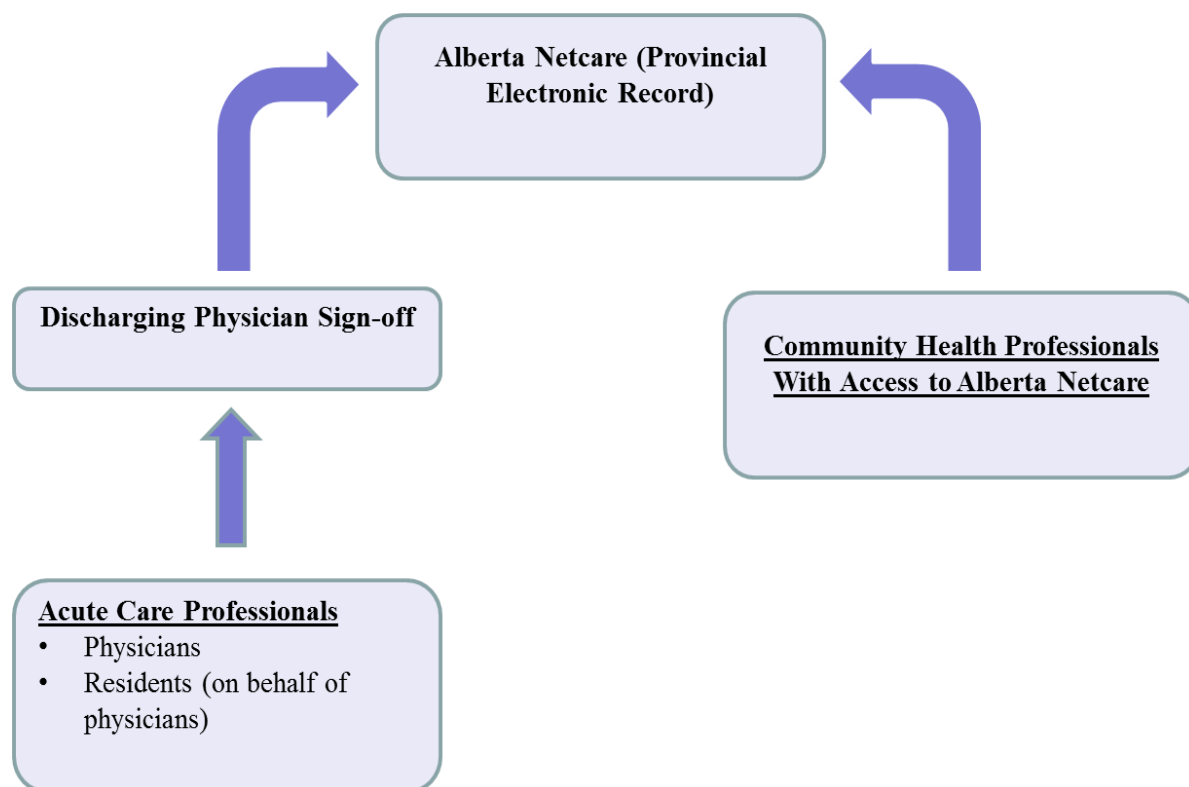


Figure 5.3 also shows the initial view of the new AHS Seamless Discharge Summary once the clinician has logged in to SCM (Demographics/Care Providers page). A quick view window is not available in this discharge summary.

Figure 5.3: The AHS Seamless Discharge Summary, Demographics/Care Providers (View 1)

Once a physician or resident logs in to SCM, this is the initial view which allows users to input basic patient demographic information as well as a list of clinicians actively involved in care.

Structured Notes Entry - DEVDischarge, Summary - Discharge Summary - Medical

Create Preview

Document Information

Authorized

Date Now

2010 - Aug - 30

Time: 03:37 PM

Authorized By

Me Other

Source:

Co-Signature

Sections

Demographics / Care Providers

Demographic Data

Admit Date

Discharge Date

Weight

Height

BMI

Discharged From

Care Providers

Additional Care Provider Details

Goals of Care

Allergies

Diagnosis

Events of Hospital Stay

Procedures

Medications

Follow-up and Recommendations

Copies

Retrieve Last Charted Va...

Insert Default Values

Clear Unsaved Data

Need Help? Mark Note As: Results Pending Priority Incomplete Calculate After Save Save Cancel

An expandable navigation menu is now available on the left hand side of the screen of all windows which includes key data pages:

- Demographics/Care Providers Page: basic demographic information about the patient and a list of clinicians actively involved with care.
- Goals of Care Page.
- Allergies Page.
- Diagnosis Page: includes primary diagnosis, working diagnoses, as well as a data field, “Resolved issues during hospital stay.” The Diagnosis page is presented in **Figure 5.4**.
- Procedures Page: includes a listing of all surgical and other non-surgical procedures performed during the course of hospitalization.
- Events of Hospital Stay Page: Information about the course of hospitalization can be entered into a large free text box (with spell check). Blood products and vaccinations administered in hospital can be entered in a similar fashion while relevant laboratory tests and diagnostic imaging results can be imported. The Events of Hospital Stay page is presented in **Figure 5.5**, **Figure 5.6**, and **Figure 5.7**.
- Medications Page: includes a free text box to manually enter admission medications, medications to continue after discharge (an imported list), and additional details such as dosing instructions. The Medications page is presented in **Figure 5.8**.
- Follow-up and Recommendations Page: includes information about when the patient is expected to follow up with their primary care physician, instructions to the patient (diet, activity, driving, work), whether specialist appointments/referrals are required, appointments/referrals to speciality clinics (anti-coagulation, home parenteral therapy program, cardiac functioning, living well, cardiac rehab, diabetes cholesterol hypertension clinic, or others), instructions to the primary care physician about what laboratory tests/diagnostic imaging to arrange, and information about what follow up was arranged for the patient prior to hospital discharge. The Follow-up Recommendations page is presented in **Figure 5.9** and **Figure 5.10**.

- Copies Page: the user is able to either select or manually enter the names and fax numbers of other clinicians who should get a copy of the discharge summary. The Copies page is presented in **Figure 5.11**.

Figure 5.4: The AHS Seamless Discharge Summary, Diagnosis (View 2)

This is a view of the Diagnosis Page. Active and working diagnoses as well as issues resolved over hospitalization are documented here by physicians or residents.

The screenshot shows the 'Diagnosis' page in the AHS Seamless Discharge Summary. The left sidebar lists various sections, with 'Diagnosis' selected. The main content area is divided into two sections: 'Diagnosis' and 'Resolved Health Issues During Hospital Stay'.

Diagnosis Section:

- Buttons: Copy Forward, Refer To Note, Preview, Modify Template, and navigation arrows.
- Filters: Show All Available (selected), Show Selected Only.
- Count: 3/3
- Table:

<input type="checkbox"/>	Category/Type	Display Name	Description
<input checked="" type="checkbox"/>	Primary Dx	Pneumonia	
<input checked="" type="checkbox"/>	Working Dx	Nonspecific chest pain	
<input checked="" type="checkbox"/>	Working Dx	Heart Attack (Acute Myocardial Infarction)	

Resolved Health Issues During Hospital Stay Section:

- Buttons: Copy Forward, Refer To Note, Preview, Modify Template, and navigation arrows.
- Filters: Show All Available (selected), Show Selected Only.
- Count: 0/0
- Table:

<input type="checkbox"/>	Category/Type	Display Name	Description
--------------------------	---------------	--------------	-------------

At the bottom left, there are three buttons: Retrieve Last Charted V..., Insert Default Values, and Clear Unsaved Data.

Figure 5.5: The AHS Seamless Discharge Summary, Events of Hospital Stay (View 3)

This is a view of the Events of Hospital Stay page. This is the first of 3 pages (actually 3 segments of 1 large page that the user can scroll through) dedicated to documenting information about the course of hospitalization. A large free text box (with spell check) is available for this purpose.

The screenshot displays the AHS Seamless Discharge Summary interface, specifically the 'Events of Hospital Stay' section. The interface is divided into several components:

- Sections Panel (Left):** A list of sections including Demographics / Care Providers, Goals of Care, Allergies, Diagnosis, **Events of Hospital Stay** (highlighted), Procedures, Medications, Follow-up and Recommendations, and Copies.
- Summary of Events of Hospital Stay:** The main content area, which includes a 'Significant Findings' section with a large text box for documentation. Below this is a 'Blood Products and Vaccinations' section with a text box containing 'Red Blood Cells - 1 Unit - August 24, 2009'.
- Lab Results:** A section at the bottom with a 'Show All Available' button and a 'Show Selected Only' button. It also displays a range of 'Start of Chart to 2010-May-12' and a chart scope of 'This Chart'.
- Bottom Panel:** Contains buttons for 'Retrieve Last Charted V...', 'Insert Default Values', and 'Clear Unsavd Data'.

The interface also features a top toolbar with options like 'Copy Forward', 'Refer To Note', 'Preview', and 'Modify Template', along with navigation arrows and a zoom level of 100%.

Figure 5.6: The AHS Seamless Discharge Summary, Events of Hospital Stay (View 4)

This is another view of the Events of Hospital Stay page. This is the second of 3 pages dedicated to documenting information about the course of hospitalization. A selection of key laboratory results can be imported.

Sections

- Demographics / Care Providers
- Go to Sections
- Allergies
- Diagnosis
- Events of Hospital Stay
- Procedures
- Medications
- Follow-up and Recommendations
- Copies

Retrieve Last Charted V...

Insert Default Values

Clear Unsaved Data

Lab Results

Copy Forward Refer To Note Preview Modify Template

Show All Available Show Selected Only 0/339

Range: Start of Chart to 2010-May-12 Chart Scope: This Chart

Result	Value	Abn	Range
Complete Blood Count (CBC): 2009-Nov-10 07:30			
Hemoglobin	98	↓	120 - 160 g/L
Hematocrit	0.29	↓	0.36 - 0.48 L/L
RBC	3.0	↓	4.0 - 5.6 10E12/L
MCV	98		82 - 100 fL
MCHC	336		320 - 360 g/L
RDW	16.6	↑	11.0 - 16.0 %
Platelet Count	115	↓	150 - 400 10E9/L
WBC	6.5		4.0 - 11.0 10E9/L
Neutrophils..	6.1		2.0 - 9.0 10E9/L
Lymphocytes...	0.3	↓	0.5 - 3.3 10E9/L
Monocytes	0.1		0.0 - 1.0 10E9/L
Eosinophils.	0.0		0.0 - 0.7 10E9/L
Basophils..	0.0		0.0 - 0.2 10E9/L
Creatinine LEVEL: 2009-Nov-10 07:30			
Creatinine LEVEL	31	↓	35 - 100 umol/L
Electrolytes (Na, K, Cl, CO2): 2009-Nov-10 07:30			

Figure 5.7: The AHS Seamless Discharge Summary, Events of Hospital Stay (View 5)

This is an additional view of the Events of Hospital Stay page. This is the last page dedicated to documenting information about the course of hospitalization. A selection of key diagnostic test results can be imported. A free text box is also available to summarize findings.

Sections

- Demographics / Care Providers
- Goals of Care
- Allergies
- Diagnosis
- Events of Hospital Stay**
- Procedures
- Medications
- Follow-up and Recommendations
- Copies

Diagnostic Imaging / Special Tests Performed

Copy Forward Refer To Note Preview Modify Template |< << >> >|

Show All Available Show Selected Only 0/5

Range: Start of Chart to 2010-May-12 Chart Scope: This Chart

Result
<input type="checkbox"/> GR Chest, 1 Projection: 2009-Nov-11 20:44
<input type="checkbox"/> GR Chest, 1 Projection
<input type="checkbox"/> GR Chest, 1 Projection: 2009-Nov-14 09:03
<input type="checkbox"/> GR Chest, 1 Projection
<input type="checkbox"/> GR Chest, 1 Projection: 2009-Nov-21 10:11
<input type="checkbox"/> GR Chest, 1 Projection
<input type="checkbox"/> GR Chest, 1 Projection: 2009-Nov-23 10:02
<input type="checkbox"/> GR Chest, 1 Projection
<input type="checkbox"/> GR Chest, 1 Projection: 2009-Nov-24 12:45
<input type="checkbox"/> GR Chest, 1 Projection

Other Pertinent Lab / DI Results

Other Pertinent Lab / Diagnostic Imaging

Retrieve Last Charted V... Insert Default Values Clear Unsaved Data

Figure 5.8: The AHS Seamless Discharge Summary, Medications (View 6)

This is an additional view of the Medications page. The medication page includes a free text box to manually enter admission medications (in an unstructured format), medications that are to be continued after discharge (an imported list), and additional details such as dosing instructions.

Sections

- Demographics / Care Providers
- Goals of Care
- Allergies
- Diagnosis
- Events of Hospital Stay
- Procedures
- Medications**
- Follow-up and Recommendations
- Copies

Copy Forward Refer To Note Preview Modify Template |< << >> >|

Home Medications

Medications at Admission

Medications to Continue After Discharge


 ☒ Show All Available ☐ Show Selected Only 0/8

Chart Scope:

<input type="checkbox"/>	Order Name	Order Summary Line
<input checked="" type="checkbox"/>	Medications and IV's	
<input type="checkbox"/>	dimenhyDRINATE inj	25 to 50 mg IV q4h PRN
<input type="checkbox"/>	fentanyl inj	25 to 50 microgram IV Q5M PRN, --To a cumulative maximum of 200mcg. Hold Fentanyl and noti
<input type="checkbox"/>	morphINE inj	2.5 to 5 mg IV Q5M PRN, --To a cumulative maximum of 20mg. Hold Morphine and notify MD if S
<input type="checkbox"/>	heparin inj	5,000 unit(s) SUBCUTANEOUSLY q8h
<input type="checkbox"/>	ranitidine inj	50 mg IVPB q12h
<input type="checkbox"/>	penicillin G sodium inj	2.5 million units IVPB q4h
<input type="checkbox"/>	penicillin G sodium inj	2.5 million units IVPB q4h
<input type="checkbox"/>	penicillin G sodium ini	2.5 million units IVPB q4h

Retrieve Last Charted V...

Insert Default Values

Clear Unsaved Data

Medication Details

Additional Medications	Medication Instructions / Titrat

Figure 5.9: The AHS Seamless Discharge Summary, Follow-Up and Recommendations (View 7)

This is a view of the Follow-Up and Recommendations page. This is the first of 2 pages (actually 2 segments of 1 large page that the user can scroll through) that allows the user to input patient instructions and information relevant to the primary care physician. Specialist and speciality clinic appointments are noted here along with information about the tests organized prior to the patient's discharge.

Sections

- Demographics / Care Providers
- Goals of Care
- Allergies
- Diagnosis
- Events of Hospital Stay
- Procedures
- Medications
- Follow-up and Recommendations**
- Copies

Copy Forward **Refer To Note** **Preview** **Modify Template** |< << >> >|

Family Physician Follow-up

☐ Family physician follow-up required in

☐ one week ☐ two weeks ☐ one month

and the appointment will be arranged ☐ prior to discharge ☐ by the patient

Patient Instructions

Diet <input type="checkbox"/> No restrictions <input type="text"/>	Activity <input type="checkbox"/> No restrictions <input type="checkbox"/> No strenuous <input type="checkbox"/> Gradually increasing <input type="text"/>	Driving <input type="checkbox"/> No restrictions <input type="checkbox"/> No valid license <input type="text"/>	Work <input type="checkbox"/> No restrictions <input type="text"/>
---	---	---	---

Other Patient Instructions (including Discharge Instruction Orders)

Appointments and Referrals - Specialists

Specialist 1 ☐ Yes

Specialist 2 ☐ Yes

Additional Specialists ☐ Yes

Appointments and Referrals - Clinics

Home Care ☐ Yes

Anti Coagulation Clinic ☐ Yes

Home Parenteral Therapy ☐ Yes

Retrieve Last Charted V...
Insert Default Values
Clear Unsaved Data

Figure 5.10: The AHS Seamless Discharge Summary, Follow-Up and Recommendations (View 8)

This is another view of the Follow-Up and Recommendations page. This is the second of two pages that allows the user to input patient instructions and information relevant to the primary care physician. The hospital physician can provide instructions to the primary care physicians regarding the tests his/her office is required to arrange.

Sections

- Demographics / Care Providers
- Goals of Care
- Allergies
- Diagnosis
- Events of Hospital Stay
- Procedures
- Medications
- Follow-up and Recommendations**
- Copies

Copy Forward **Refer To Note** **Preview** **Modify Template** |< << >> >|

Anti Coagulation Clinic ☐ Yes

Home Parenteral Therapy Program (HPTP) ☐ Yes

Cardiac Function Clinic ☐ Yes

Living Well ☐ Yes

Cardiac Rehab ☐ Yes

Diabetes Hypertension Cholesterol Centers (DHCC) ☐ Yes

Other ☐ Yes

Family Physician to Arrange

Recommended Follow-up Tests

- ☐ CBC
- ☐ Electrolytes
- ☐ Creatinine
- ☐ Urea
- ☐ INR

Details / DI / Other (incl recommended testing date)

Arranged PRIOR to Discharge (requisitions given to patient)

Recommended Follow-up Tests

- ☐ CBC
- ☐ Electrolytes
- ☐ Creatinine
- ☐ Urea
- ☐ INR

Details / DI / Other

Result(s) to be followed up by

Retrieve Last Charted Va...
Insert Default Values
Clear Unsaved Data

Figure 5.11: The AHS Seamless Discharge Summary, Copies (View 9)

This is a view of the Copies page. This page allows the user to select or manually enter the names and fax numbers of relevant health professionals who should get a copy of the discharge summary.

Sections

- Demographics / Care Providers
- Goals of Care
- Allergies
- Diagnosis
- Events of Hospital Stay
- Procedures
- Medications
- Follow-up and Recommendations
- Copies**

Copy Forward **Refer To Note** **Preview** **Modify Template** |< << >> >|

Send Copies To 2/5

☐ Show All Available ☐ Show Selected Only

<input type="checkbox"/>	Provider Role	Provider Name	Occupation	Status
<input checked="" type="checkbox"/>	Family	Babins, Eric Michael	MD-Family Practitioner	Inactive
<input type="checkbox"/>	Consulting	Kraft, Scott	Physician	Active
<input checked="" type="checkbox"/>	Attending	Jamieson, Peter C	MD-Family Practitioner	Active
<input type="checkbox"/>	Consulting	Jamieson, Peter C	MD-Family Practitioner	Inactive
<input checked="" type="checkbox"/>	Family	Aasman, Edward J	MD-Family Practitioner	Active

Send Copies to Other

Other Recipients

Completion

☒ Summary Complete

☐ Yes

Instructions

DISCHARGE SUMMARY COMPLETION INSTRUCTIONS / NOTES

- 1.) Indicate 'Summary Complete' when all discharge data has been charted.
- 2.) Residents / Students must select a co-signing physician before marking a discharge summary complete.
- 3.) Discharge Summaries that are marked as complete will AUTOMATICALLY be sent to NetCare AND forwarded by health records (via fax or mail) to the care providers indicated on this page.

Retrieve Last Charted V...
Insert Default Values
Clear Unsavd Data

5.5 Evaluation of the AHS Seamless Discharge Summary

The final phase of the Seamless Discharge Project as identified in the project charter is Phase 4 Evaluation. This component of this work is divided into 2 parts and briefly described below:

1. A pilot evaluation of 100 patient discharges using the tool to permit assessments of performance, provider satisfaction, and patient perspectives.
2. A larger clinical trial, with formal evaluation of the tool examining hard clinical endpoints.

5.6 Pilot Trial Evaluation

It is our expectation that this pilot phase will help us to refine the tool and enhance the extent to which it is considered favourable by discharging physicians, receiving physicians, and patients. The pilot phase will also permit us to ensure that technical aspects of the tool (for example, successful remote access and successful transfer of information from the hospital information system) are working well and to the satisfaction of providers before the planned clinical trial begins. Formal usability testing methodology will be employed. This pilot will be conducted on Unit 36 at the Foothills Medical Centre in Calgary and will be completed using the AHS Seamless Discharge Summary.

Pilot Objectives

The objective of the pilot evaluation is to obtain detailed answers to the following questions:

1. Is the seamless discharge summary satisfactory from the perspectives of physicians and patients?
2. Does the seamless discharge summary transfer appropriate, complete and accurate discharge information in a timely manner?
3. What is the quality of the discharge summary? This will include: completeness of data entry in key data fields, accuracy of imported data, length of the resulting document, completeness, and overall accuracy of information.

Measures of Interest and Data Analysis

The perspectives of discharging physicians (at time of discharge), receiving physicians in the community (1 month post discharge) and patients (1 month post discharge) will be examined through the use of brief survey instruments. Simple descriptive statistical analyses will be performed including reporting of proportions for categorical measures, and means (with standard deviations) for continuous measures. Likert scale data will be reported categorically. The inpatient medical record will be used as a source document to determine quality.

Discharging physicians will be asked to rate their general satisfaction with the tool, the extent to which they like the computer tool relative to the existing model of handwritten and dictated discharge summaries, and will be asked to estimate how long it took them to complete the discharge communication using the tool.

Receiving physicians (of patients discharging using the tool) will be asked whether they accessed the discharge communication document produced by the tool, whether they had the information in hand when they first saw the patient in their office, and will also be asked to rate their general satisfaction with the information received. The survey will also permit receiving physicians to provide open-form opinions on the tool's value and the quality of information.

Consenting patients will be asked if they were aware of a new discharge communication process applied to their case, whether they were given a copy of their discharge summary, and will be asked to provide an opinion on the extent to which information on their hospital stay was communicated to their physicians in the community. Patients will also be given the opportunity to provide general perspectives (in open-form) on the quality of communication that surrounded their transition from the hospital to the community.

5.7 Clinical Trial Evaluation

Once a thorough understanding of the perspectives of discharging physicians, receiving physicians, and patients regarding the AHS Seamless Discharge Summary are obtained, and it has been established that appropriate, complete, accurate, and timely discharge information is possible with this tool, a formal clinical evaluation will be conducted. The objectives of this trial are to evaluate whether the AHS Seamless Discharge Summary is associated with reduced hospital readmission within 3 months, post-discharge mortality at 3 months, and the occurrence of post-discharge adverse events and adverse drug events. As with the pilot evaluation (Chapter 5), the trial will be conducted on the Unit 36, Special Services Building, Foothills Medical Centre in Calgary. The full research protocol for this clinical trial continues to be developed in collaboration with the Primary Investigator, Dr. William Ghali. It has recently received a favourable review by the Canadian Institutes of Health Research (CIHR). We anticipate that recruitment for this trial will begin in early 2010 in accordance with the Calgary Zone roll out of the AHS Seamless Discharge Summary.

5.8 Conclusions

In conclusion, the academic research described in this thesis has precipitated a much larger initiative within Alberta Health Services (AHS). A new AHS Seamless Discharge Summary was built and integrated into an existing physician order entry system, Sunrise Clinical Manager 5.0. The next steps are to implement the tool and to conduct an evaluation of the technology through a pilot study and a formal clinical evaluation.

CHAPTER 6: DISCUSSION

6.1 Reiteration of Thesis Components

The work of this thesis has involved 4 key components. The first component, a qualitative study to understand information needs and challenges at time of hospital discharge, revealed 5 key themes and 11 recommendations that could improve the overall quality of communication at time of discharge as well as the value of the discharge summary.

The second component, a systematic review to evaluate the efficacy of computer-enabled discharge communications, revealed some possible benefit in reducing long term hospital readmission and post-discharge adverse events. More definitive benefits were apparent in terms of improved quality, completeness, legibility, timeliness of delivery, and physician/patient satisfaction.

The third component involved the development of a series of electronic discharge summary prototypes including a mature version, termed the Web-Based Seamless Discharge Communication Tool. The final software tool was a standardized discharge summary template designed to be immediately transmitted at time of discharge via automatic fax and also available through a secure internet data repository.

The fourth and final component involved the re-development of a new Alberta Health Services Seamless Discharge Summary that was integrated with Sunrise Clinical Manager 5.0.

The journey to complete this thesis has been a long and remarkable one. We started with a problem, poor discharge communication, and then built the foundation for a solution using a powerful combination of mixed methods research design. Many individuals were involved in the success of this work to date. There is still considerable work to do in the years ahead as outlined in preceding sections of this document. A strong academic-

industry-clinical partnership between the University of Calgary, Clarity Inc., and the Ward of the 21st Century has provided the opportunity for me to continue to learn and contribute to development, implementation, and evaluation efforts within Alberta Health Services. Creating innovation in healthcare is an uphill process. It is a worthwhile and rewarding process also, particularly as there is a pressing need to improve the safety of patients in our healthcare system.

6.2 Potential Contributions

The work of this thesis can potentially contribute to the existing body of knowledge in several ways. First, the development of two viable electronic discharge solutions was described as well as the implementation of one solution into a large provincial health region. The original Web-Based Seamless Discharge Communication Tool was particularly innovative because it was built on the feedback of stakeholders who are not typically part of the discharge communication model. Secondly, our research team has provided a full description of the software tool we developed. Other currently available software solutions are not well documented in the literature. We feel this practice is important because it could potentially encourage the shared or customized uptake of electronic discharge summaries in many clinical settings. Thirdly, this thesis has highlighted the importance of identifying minimum data sets for the content of electronic discharge summaries so that measurable improvements in patient safety can be made. Several studies have now made the case for establishing evidence based standard templates (69) in order to improve the overall quality of these summaries. Agreement about standards is made complex because of differences in perceptions about what information is important to exchange. For example, acute care staff may take shorter term perspectives in contrast to long term perspectives taken by community care providers (22, 51). Finally, the systematic review performed to evaluate the efficacy of electronic summaries is, as far as we know, unique in the literature. The 11 interventions we identified evaluated a broad range of outcomes, making it impractical to pool data. This suggests that more work is needed in

this area to standardize the outcomes that will define success of future electronic discharge summaries.

6.3 Limitations

Despite our best intentions to create a viable multi-disciplinary Web-Based Seamless Discharge Communication Tool, there were some barriers that hindered implementation of this stand-alone software. The first limitation is that the ability to automatically populate information from existing sources is critical as previous studies have reported that electronic discharge summaries can contain the same number of errors (or even more) than traditional discharge summaries when heavy reliance on human data entry is required (22, 51). This necessitates integration with other information systems, which in our experience can be a daunting task. Secondly, the work of this thesis emphasizes the need to explore integration issues early on in the product development cycle, while acknowledging that even doing so may not be enough to ensure uptake. Thirdly, undertaking an academic evaluation plan designed for one ward/one hospital may not be a viable plan for another centre given variability in needs and practices. It is perhaps not surprising that implementing new technology in and of itself, however useful, is not sufficient to guarantee successful patient outcomes. Strategic thinking, strong leadership, collaboration with stakeholders from an early stage, communication, and coordination have also been identified as key factors for positive implementation of electronic discharge summaries (22). The fourth limitation is that there are a variety of factors that may contribute to poor outcomes following hospital discharge aside from sub-optimal discharge communication. This is particularly true for elderly patients with many co-morbid illnesses (38). It is therefore somewhat difficult to design a protocol to evaluate the efficacy of electronic discharge summaries in relation to mortality, hospital readmission, and the occurrence of adverse events. The fifth limitation is that data synthesis on this topic area is imperfect because there is presently very sparse clinical trial data available. When trial data is available, study quality is compromised because random allocation typically cannot be

done because the process of preparing and disseminating electronic discharge summaries is quite different than the current process for traditional summaries.

A final limitation is that at the time of thesis completion, Alberta Health Services was not planning to provide patients with web-based access to their own health records. Patients do play a critical role in the success of their own transitions from hospital (38, 51, 70). There is also evidence to suggest that providing patients with the ability to view and modify their own health information has positive impacts on satisfaction and perceived preparedness for follow up visits (70).

6.4 Conclusions

Globally, electronic discharge communications do appear to be a promising innovation in hospital systems, and if appropriately employed, may lead to significant gains in patient safety following discharge.

The next steps of this research will be to carry out the evaluation of the AHS Seamless Discharge Summary to understand what gains are truly possible. This evaluation will inform not only Alberta Health Services, but health systems elsewhere in Canada and internationally as they contemplate the development and implementation of similar tools to address the universal challenge of discharge communication.

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APPENDIX A: ORIGINAL SEARCH STRATEGY FOR SYSTEMATIC REVIEW, MEDLINE

1. exp Patient Discharge/
2. exp Patient Transfer/
3. exp Transfer Agreement/
4. exp "Continuity of Patient Care"/
5. (patient\$ adj3 (discharg\$ or transfer\$)).ti,ab.
6. (discharg\$ adj3 (letter\$ or document\$ or summar\$ or report\$ or form or forms or note or notes or intervention\$ or hospital\$)).ti,ab.
7. (medical adj3 summar\$).ti,ab.
8. (discharge or discharged or discharging).ti,ab.
9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10. exp Computer Systems/
11. medical record linkage/ or medical records systems, computerized/
12. information systems/ or exp databases/ or exp decision support systems, clinical/ or exp hospital information systems/ or exp medical records systems, computerized/ or exp online systems/ or exp reminder systems/
13. exp Medical Informatics/
14. exp Electronic Mail/
15. exp computer communication networks/ or exp internet/
16. exp Online Systems/
17. telecommunications/ or exp telemedicine/
18. (computer\$ or electronic or internet or web or web-based or "world wide web" or telemedic\$ or telecare or telehealth or ehealth or email or e-communication).ti,ab.
19. (database or automated or "medical informatic\$" or telecommunication\$ or "information system\$" or online).ti,ab.
20. 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19
21. 9 and 20
22. limit 21 to animals
23. limit 21 to (humans and animals)
24. 22 not 23
25. 21 not 24
26. (clinical trial or controlled clinical trial or randomized controlled trial or meta analysis or evaluation studies).pt.
27. exp clinical trials/ or exp cohort studies/ or exp evaluation studies/
28. double blind method/ or meta analysis/ or placebos/ or random allocation/ or research design/ or single-blind method/ or time factors/
29. ((single or double or triple or treble) adj2 (blind\$ or mask\$)).ti,ab.
30. (cohort or cohorts or control\$ or follow up or followup or longitudinal\$ or metaanalys\$ or metanalys\$ or prospectiv\$ or rct\$ or random\$ or time series or volunteer\$ or placebo\$ or trial or trials or groups).ti,ab.
31. (systematic\$ adj2 (review\$ or overview\$)).ti,ab.
32. (pre adj1 post).ti,ab.

- 33. (before adj1 after).ti,ab.
- 34. latin square.ti,ab.
- 35. intervention studies/ or pilot projects/
- 36. control groups/
- 37. 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36
- 38. 25 and 37

APPENDIX B: ADAPTED/COMBINED SEARCH STRATEGY FOR SYSTEMATIC REVIEW

1. hospital discharge/ or patient referral/
2. patient care planning/ or patient care/ or patient monitoring/
3. discharg\$.ti,ab.
4. 2 and 3
5. (patient\$ adj3 (discharg\$ or transfer\$)).ti,ab.
6. (discharg\$ adj3 (letter\$ or document\$ or summar\$ or report\$ or form or forms or note or notes or intervention\$ or hospital\$)).ti,ab.
7. (medical adj3 summar\$).ti,ab.
8. 1 or 4 or 5 or 6 or 7
9. (computer\$ or electronic or internet or web or web-based or "world wide web" or telemedic\$ or telecare or telehealth or ehealth or email or e-communication).ti,ab.
10. (database or automated or online).ti,ab.
11. exp Computer System/
12. Data Base/ or knowledge base/ or factual database/ or exp Electronic Medical Record/
13. exp Decision Support System/
14. exp online system/
15. exp reminder system/
16. exp e-mail/
17. exp Computer Network/
18. exp internet/
19. exp TELEHEALTH/
20. 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19
21. 8 and 20
22. limit 21 to (amphibia or ape or bird or cat or cattle or chicken or dog or "ducks and geese" or fish or "frogs and toads" or goat or guinea pig or "hamsters and gerbils" or horse or monkey or mouse or "pigeons and doves" or "rabbits and hares" or rat or reptile or sheep or swine)
23. limit 21 to human
24. 22 and 23
25. 22 not 24
26. 21 not 25
27. ((single or double or triple or treble) adj2 (blind\$ or mask\$)).ti,ab.
28. (cohort or cohorts or control\$ or follow up or followup or longitudinal\$ or metaanalys\$ or metanalys\$ or prospectiv\$ or rct\$ or random\$ or time series or volunteer\$ or trial or trials).ti,ab.
29. (systematic\$ adj2 (review\$ or overview\$)).ti,ab.
30. (pre adj post).ti,ab.
31. (before adj after).ti,ab.
32. Clinical Trial/
33. Randomized Controlled Trial/

34. Controlled Study/
35. exp Cohort Analysis/
36. exp Evaluation/
37. Double Blind Procedure/
38. Meta Analysis/
39. exp "Systematic Review"/
40. exp Randomization/
41. Single Blind Procedure/
42. exp Triple Blind Procedure/
43. exp Time/
44. exp Intervention Study/
45. exp Pilot Study/
46. exp Control Group/
47. pretest posttest control group design/ or pretest posttest design/
48. 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 44 or 45 or 46 or 47
49. 26 and 48
50. hospital discharge/
51. (patient\$ adj3 (discharg\$ or transfer\$)).ti,ab.
52. (discharg\$ adj3 (letter\$ or document\$ or summar\$ or report\$ or form or forms or note or notes or intervention\$ or hospital\$)).ti,ab.
53. (medical adj3 summar\$).ti,ab.
54. 50 or 51 or 52 or 53
55. (computer\$ or electronic or internet or web or web-based or "world wide web" or telemedic\$ or telecare or telehealth or ehealth or email or e-communication).ti,ab.
56. (database or automated or online).ti,ab.
57. exp Computer System/
58. Data Base/ or knowledge base/ or factual database/ or exp Electronic Medical Record/
59. exp Decision Support System/
60. exp online system/
61. exp reminder system/
62. exp e-mail/
63. exp Computer Network/
64. exp internet/
65. exp TELEHEALTH/
66. 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65
67. 54 and 66
68. limit 67 to (amphibia or ape or bird or cat or cattle or chicken or dog or "ducks and geese" or fish or "frogs and toads" or goat or guinea pig or "hamsters and gerbils" or horse or monkey or mouse or "pigeons and doves" or "rabbits and hares" or rat or reptile or sheep or swine)
69. limit 67 to human
70. 68 and 69

71. 68 not 70
72. 67 not 71
73. ((single or double or triple or treble) adj2 (blind\$ or mask\$)).ti,ab.
74. (cohort or cohorts or control\$ or follow up or followup or longitudinal\$ or metaanalys\$ or metanalysis\$ or prospectiv\$ or rct\$ or random\$ or time series or volunteer\$ or trial or trials).ti,ab.
75. (systematic\$ adj2 (review\$ or overview\$)).ti,ab.
76. (pre adj post).ti,ab.
77. (before adj after).ti,ab.
78. Clinical Trial/
79. Randomized Controlled Trial/
80. Controlled Study/
81. exp Cohort Analysis/
82. exp Evaluation/
83. Double Blind Procedure/
84. Meta Analysis/
85. exp "Systematic Review"/
86. exp Randomization/
87. Single Blind Procedure/
88. exp Triple Blind Procedure/
89. exp Intervention Study/
90. exp Pilot Study/
91. exp Control Group/
92. pretest posttest control group design/ or pretest posttest design/
93. 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80 or 81 or 82 or 83 or 84 or 85 or 86 or 87 or 88 or 89 or 90 or 91 or 92
94. 72 and 93
95. 49 not 94
96. Find similar to Telemedicine and the relationship between hospital and primary care