Development of the Integrated Patient Information System for the Geriatric Day Hospital at the QEII

by

Tracey Fisher
B00497477
tjfisher@dal.ca

Division of Geriatric Medicine
Department of Medicine
Capital Health
Geriatric Medicine Research Unit
Veterans' Memorial Building, Suite 1421
5955 Veterans' Memorial Lane, Halifax, NS B3H 2E1
Tel: (902) 473-8687
Fax: (902) 473-1050

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Acknowledgement and Endorsement

The author has written this internship report to fulfill the requirements for the internship performed for the Master of Health Informatics Program at Dalhousie University. The Geriatric Day Hospital Integrated Patient Information System is still under construction although images of the completed sections of the tool are contained in this internship report.

I would like to thank Dr. Paige Moorhouse and Dr. Kenneth Rockwood for providing me with such a wonderful opportunity to use and improve upon my skills as a Health Informatician. The vision and conviction of Dr. Moorhouse has steered this project and I am privileged to be a part of her team. I would also like to thank the Geriatric Day Hospital for their dedication and help throughout the course of my internship and everyone else in the Geriatric Medicine Research Unit. Lastly, I would like to thank my supervisors, Dr. Paterson, Dr. Zitner and Dr. Abidi for supporting me, opening my mind and encouraging me to use my skills to make health care better.

Tracey Fisher

EXECUTIVE SUMMARY

The internship was completed at the Geriatric Medicine Research Unit in the Veteran's Memorial Building in Halifax. The internship work was performed from June 1st to August 31st, 2008. The internship objective was to design and develop two modules in a relational database that would track the patients' function and mobility. Information was gathered though staff meetings, observing work flow and surveys to gather the team's thoughts and ideas about how to create these modules that are user friendly and complimentary to their current workflow and processes.

During the course of the internship, a major problem arose in trying to separate the data into logical modules. Shadowing GDH team members found a large area of redundancy when collecting patient data. However once addressed, the issue was solved by looking deeper into what data was needed and how the Integrated Patient Information System could help. Once each team member had solidified the data they needed to collect and the data they needed access to, it became clear that using an online central repository would solve the issues.

This report outlines how the requirements were gathered and merged, how the module construction began and hurdles that were encountered and dealt with. The report will first provide an overview of the Geriatric Day Hospital (GDH) and the Geriatric Medicine Research Unit (GMRU). It then outlines specifically how the internship related to Health Informatics and suggestions for improving the data collection and knowledge sharing in Geriatric Medicine in the QEII are included at the end.

The internship performed at the GMRU was a valuable learning experience that allowed the author to apply the knowledge and skills obtained through the Master of Health Informatics program. Being immersed in such an environment not only stimulated critical thinking and ideas, it gave the author the opportunity to put skills learned to the test to develop effective solutions for issues around health information and data. The Integrated Patient Information System will continue to grow as more modules are designed and the author has begun collecting lessons learned from previous construction of modules. The GDH team has taken a solid and

dedicated investment in the tool, continue to be open to change and have worked very hard at identifying their processes and workflows to create structured requirements for each module.

Table of Contents

1 Introduction

The Geriatric Day Hospital (GDH) is a separate area of the Veteran's Memorial Building that specializes in providing comprehensive care for seniors on an outpatient basis. Geriatric Day Hospitals developed in the United Kingdom during the late 1950s and 1960s as part of the rapid changes that occurred in the care of frail older people [1]. They provide comprehensive multidisciplinary assessment for elderly patients who are experiencing a change in function, memory, mood, or have complex medical issues. Short-term intense outpatient treatment, counselling, and education are available to patients and their caregivers to facilitate community support and long-term care planning. The GDH provides the most help for elderly individuals who have the potential to improve in some areas such as function and mobility, so they can return to live in their homes with better skills and continue to be independent safely. The team at the Veteran's Building is made up of geriatricians, registered nurses, a ward clerk, occupational therapists, physiotherapists, a social worker, and consultation services (geriatric psychiatrists and neurologists).

Geriatric Day Hospitals have demonstrated to be an effective service provider of comprehensive assessment of frail older people and rehabilitation by reducing the likelihood of death or poor outcomes [2]. There is an immense amount of data collected by these hospitals which is patient focused however it is not well-communicated to other departments or community services that provide care after the patient leaves. In addition, the GDH in Halifax collects data at the time of entry into the program and the time of completion, providing baseline and outcome data that is desirable for research and analysis however currently it is paper-based and not easily converted into an analytical state.

The internship objective was to design and develop two modules in a relational database that would track the patients' function and mobility. Information was gathered though staff meetings, observing work flow and surveys to gather the team's thoughts and ideas about how to create these modules that are user friendly and complimentary to their current workflow and processes. Each staff member was individually interviewed and a specialized plan for their own area of the database was drafted. When the requirements were finally gathered, they were merged to try to remove redundancy and formalized requirements were agreed upon.

This report outlines how the requirements were gathered and merged, how the module construction began and hurdles that were encountered and dealt with. The report will first provide an overview of the Geriatric Day Hospital (GDH) and the Geriatric Medicine Research Unit. It will then outline specifically how the internship related to Health Informatics and then suggestions for improving the data collection and knowledge sharing in Geriatric Medicine in the QEII are included at the end.

2 Description of the Organization

2.1 Geriatric Day Hospital

The GDH is located on the 1st floor of the Veterans' Memorial Building (VMB) which is located on the corner of Robie Street and Veterans' Memorial Lane next to the Abbie J. Lane Memorial Building and the Halifax Infirmary. People 65 and over that require a team assessment involving the services of at least two Geriatric Day Hospital disciplines or that require a team assessment where mobility, balance and/or falls is the main concern are eligible. Some of the services provided are a medical assessment, nursing care and supervisions, diagnostic testing, physiotherapy, occupational therapy, social work services, medication monitoring and counselling, psychological testing and counselling, diet therapy and counselling, speech therapy, family conferences and home visits by various team members.

Patients must be referred by a health professional to be seen in the Geriatric Day Hospital, and the family physician must be aware of and in agreement with the referral. Patients go in for a preliminary assessment and then attend the treatment center twice a week for half a day for six to eight weeks. A discharge summary will be provided at the end of their treatment and forwarded to the family physician.

2.2 Geriatric Medicine Research Unit

The Geriatric Medicine Research Unit (GMRU) was founded by Dr. Kenneth Rockwood has gained national and international stature. The research program is very active, investigating aspects of dementia, frailty in the elderly, medications and the elderly, and conducting drug trials. Most researchers have a background in medicine or epidemiology/statistics. Moving with

the shift of technology being used to make care better, the author was hired for an internship to bring a health informatician's insight into the research environment. Currently there are approximately fifteen researchers and assistants working in the GMRU.

3 Work Performed for the Internship

3.1 Description and Role

The purpose of the internship was to design and construct two modules in the Geriatric Day Hospital Integrated Patient Information System to specifically collect and manage function and mobility data of the patients. Before the internship had begun, the author under the direction of Dr. Paige Moorhouse had created the initial structure for the relational database and the 'Patient Assessment' module. This module is for entering the patient's data collected from an initial screening process. From the data collected in this module, a decision is made whether or not the patient qualifies for the GDH services. Upon meeting the requirements for the GDH, the patient is then be seen by the entire team and assessed. In order to collect the function and mobility data, two modules were needed. The role of the author was to gather the requirements, design a prototype to be accepted by the GDH staff and then build the modules. In addition, the author was to assess the amount of new hardware the GDH needed and order it, design and plan individual training plans for each group on the interdisciplinary team.

For this internship, a plan was established and timelines were identified in order to complete this section of the system. Meetings were held weekly with Dr. Moorhouse and the author to report on progress and monthly meetings with the GDH team were held in the conference/consultation room in the hospital to report on overall progress. The modules overall design was decided ahead of beginning the prototypes to remain consistent with the previously built assessment module. The modules are organized in a folder-like tabbed manner to simulate an organized patient chart. Patient flow and data flow were analyzed from a previous report of the author on the GDH (see appendix 9.2) for processes and workflow documentation.

3.2 Designing the Function Module

Research into existing functional assessment tools was organized and studied to ensure that the data captured can be reported in a meaningful way. Functional status is generally conceptualized as the ability to perform self-care, self- maintenance and physical activity. Function is usually

classified into two types: the Instrumental Activities of Daily Living (IADLs) and basic Activities of Daily Living (ADLs). One of the best ways to evaluate the health status of older adults is through functional assessment which provides objective data that may indicate future decline or improvement in health status, allowing the clinician to intervene appropriately.

When patients come into the Geriatric Clinic in Capital Health (a separate area for clinical assessment in the VMB, not the GDH), they are asked to fill out a form which is a self reported assessment of their functional abilities related to their activities of daily life (basic and instrumental). Most times this form is filled out by the caregiver or proxy (if accompanying) for collaborative reasons to attempt to get a more robust picture of their capabilities.

In keeping with the standards of the clinic and with the research collected about function, the function module was designed. It involved collecting data that could be organized into two scales; the Lawton Brody Instrumental Activities of Daily Living scale and the Katz Activities of Daily Living scale and then generating a score for each. The Katz ADL Index was first developed in an effort to find a way to assess function and how it changed over time in the elderly [3]. It is an ordinal index designed to assess the physical functioning using a dichotomous rating (dependent/independent) of six ADLs in hierarchical order of decreasing difficulty as listed: bathing, dressing, toileting, transferring, continence, and feeding, rated on a scale of independence. The Lawton Instrumental Activities of Daily Living Scale (IADL) is an instrument developed to assess independent living skills [4]. These skills are considered more complex than the basic activities of daily living as assessed by the Katz Index of ADLs. The instrument is considered useful for identifying how a person is functioning at the present time as well as detecting improvement or decline. The author wrote a report on the Katz ADLs and Lawton Brody IADLs in late June 2008 (see appendix 9.3 and 9.4) which was referenced frequently when building the function module to ensure the vocabulary of the options on the form was consistent with the literature. See figures 1 and 2 below.

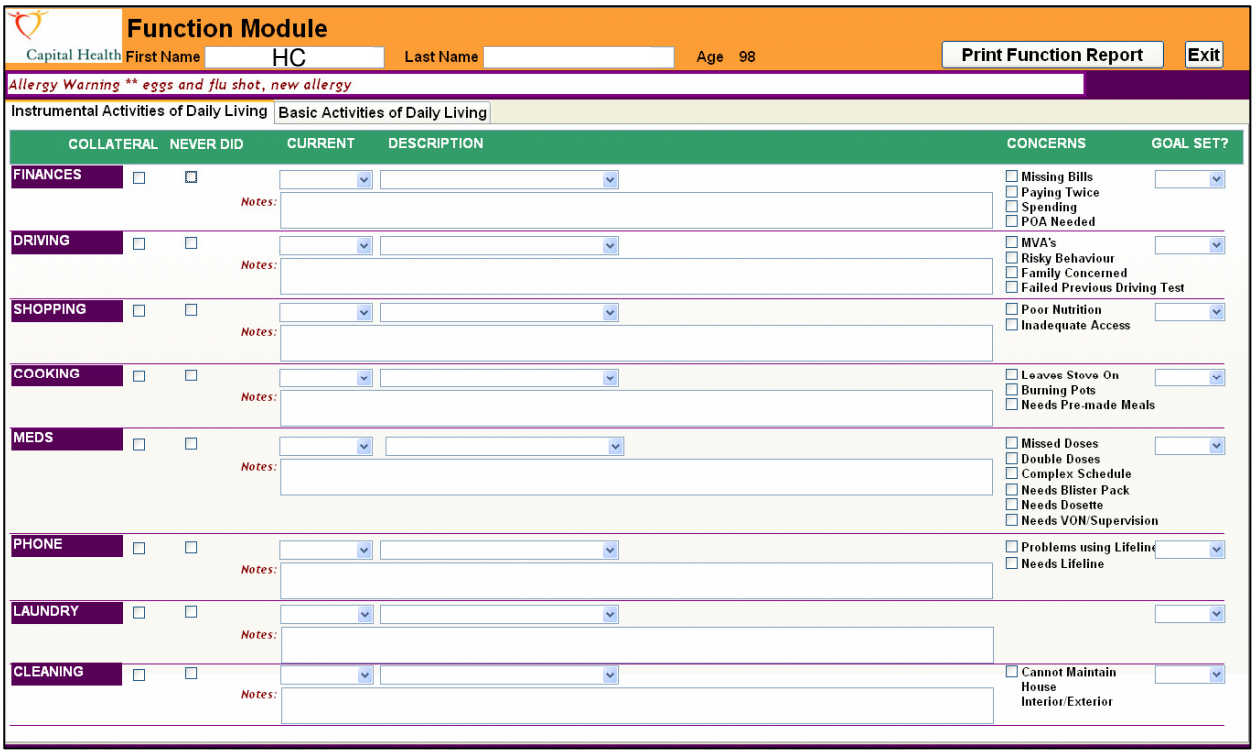


Figure 1: GDH Integrated Patient Information System, Instrumental Activities [5]

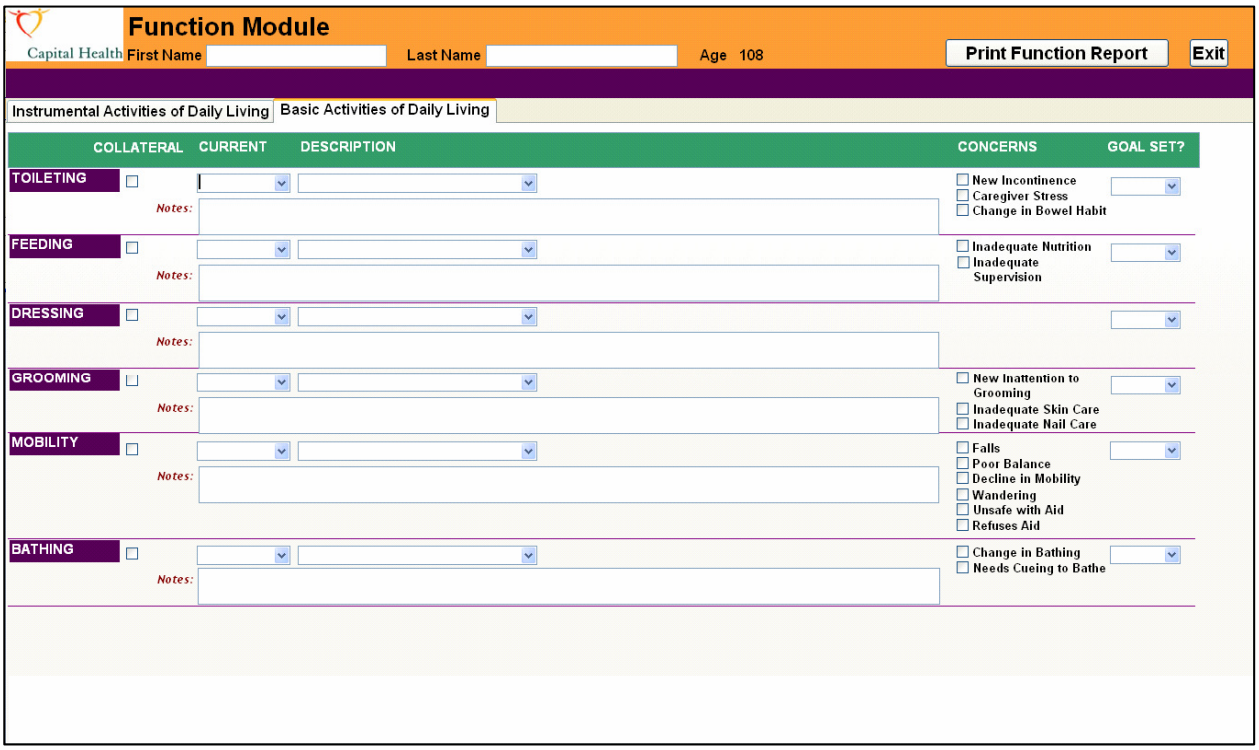
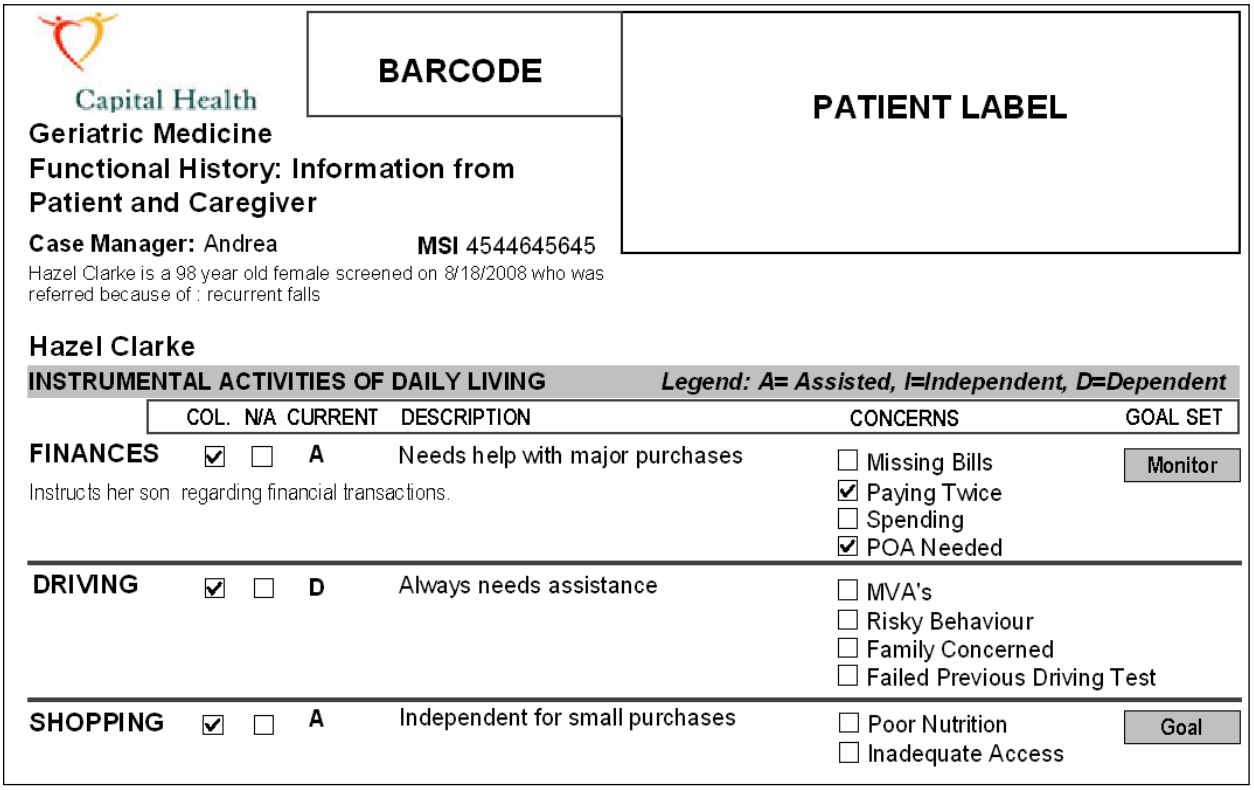


Figure 2: GDH Integrated Patient Information System, Basic Activities [6]

Keeping in mind that the assessment of function in the elderly is critical in advancing our knowledge of how the body declines late in life and making sure the data collected could eventually be transformed into knowledge for translation and innovation, leading to better care was another important requirement.

The requirements were drafted into a model on a form for a prototype that had to be approved by Dr. Moorhouse. The requirements of the GDH needed to be merged with the requirements of following a relational database design.

Accompanying the function module was a formatted report seen below that follows the guidelines and template style for the Horizon Patient Folder System used in CDHA hospitals to ensure the patient information can be scanned into the system and remain in the patient chart.



Capital Health

BARCODE

PATIENT LABEL

Geriatric Medicine
Functional History: Information from Patient and Caregiver

Case Manager: Andrea **MSI** 4544645645

Hazel Clarke is a 98 year old female screened on 8/18/2008 who was referred because of : recurrent falls

Hazel Clarke

INSTRUMENTAL ACTIVITIES OF DAILY LIVING *Legend: A= Assisted, I=Independent, D=Dependent*

	COL.	N/A	CURRENT	DESCRIPTION	CONCERNS	GOAL SET
FINANCES	☑	☐	A	Needs help with major purchases	☐ Missing Bills ☑ Paying Twice ☐ Spending ☑ POA Needed	Monitor
Instructs her son regarding financial transactions.						
DRIVING	☑	☐	D	Always needs assistance	☐ MVA's ☐ Risky Behaviour ☐ Family Concerned ☐ Failed Previous Driving Test	
SHOPPING	☑	☐	A	Independent for small purchases	☐ Poor Nutrition ☐ Inadequate Access	Goal

Figure 3: GDH Integrated Patient Information System, partial view of Function Report [7]

3.3 Designing the Mobility Module

An essential component of the assessment of frail elderly persons is the evaluation of physical mobility and to be considered independently mobile and safe, an elderly person must be able to perform such basic skills as getting in and out of a bed or a chair, getting on and off of a toilet and walking a few feet. Taking this into consideration, there are mobility assessments that are complete by the GDH staff for each patient. The Berg Balance Scale (Berg) [8], the Tinetti Balance and Gait Assessment (also known as the POMA: Performance-Oriented Assessment of Mobility) [9] and the Timed Up and Go (TUG) [10] are three tools used to measure the patient's mobility, balance and gait. Please see the appendix 9.5 for the three scales.

The requirements of being able to generate a score from the data collected were built into the mobility module. In addition, extra data that is commonly uncollected but determined needed and potentially valuable was entered in the mobility module as well. The entire module is a vast area of data collection organized harmoniously with the human body from top to bottom. It is extremely valuable because of the amount of detail the module contains, and will be an interesting and fruitful dataset for research once the tool has had time to collect data. For mobility, the system captures: tone for arms and legs strength for arms and legs, bulk for arms and legs, range of motion of head to feet (all joints), reflex data, sensation data, cerebella data, praxis data, musculoskeletal data, balance and gait data.

A report accompanying all the data reported upon from the mobility module was designed and completed by the author. The report follows the guidelines and template style for the Horizon Patient Folder System to ensure the patient information can be scanned into the system and remain in the patient chart. Images of the mobility module are seen below.

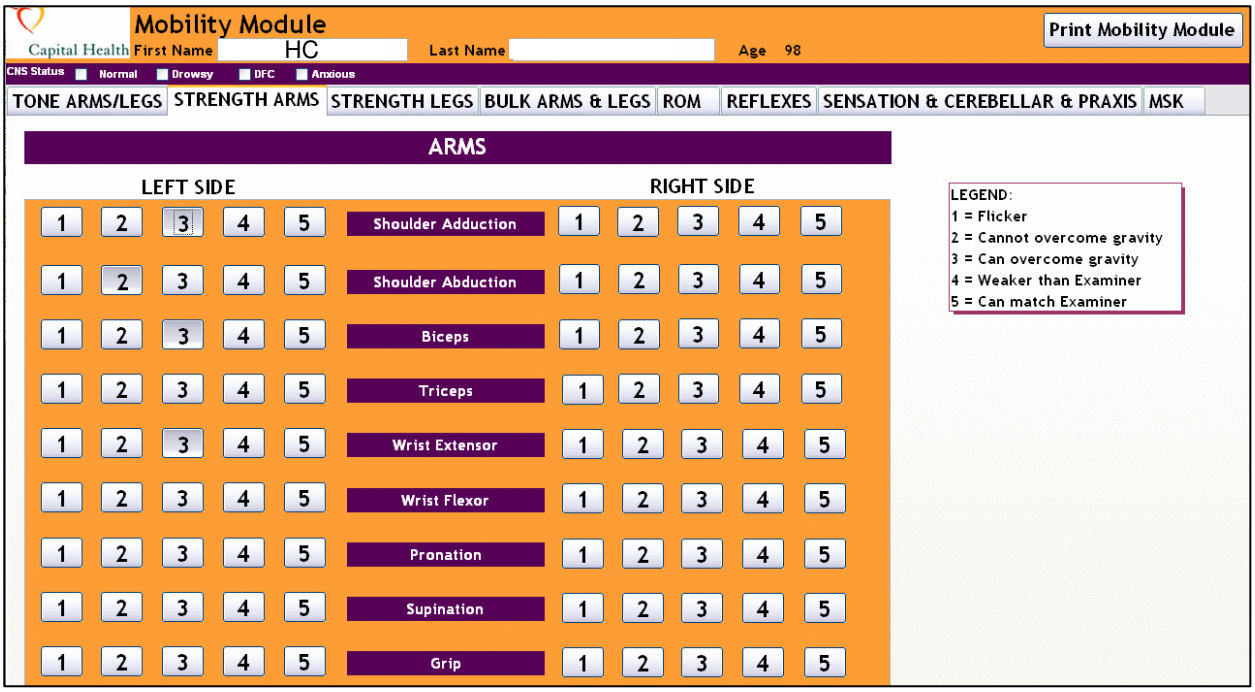


Figure 4: GDH Integrated Patient Information System: Mobility [11]

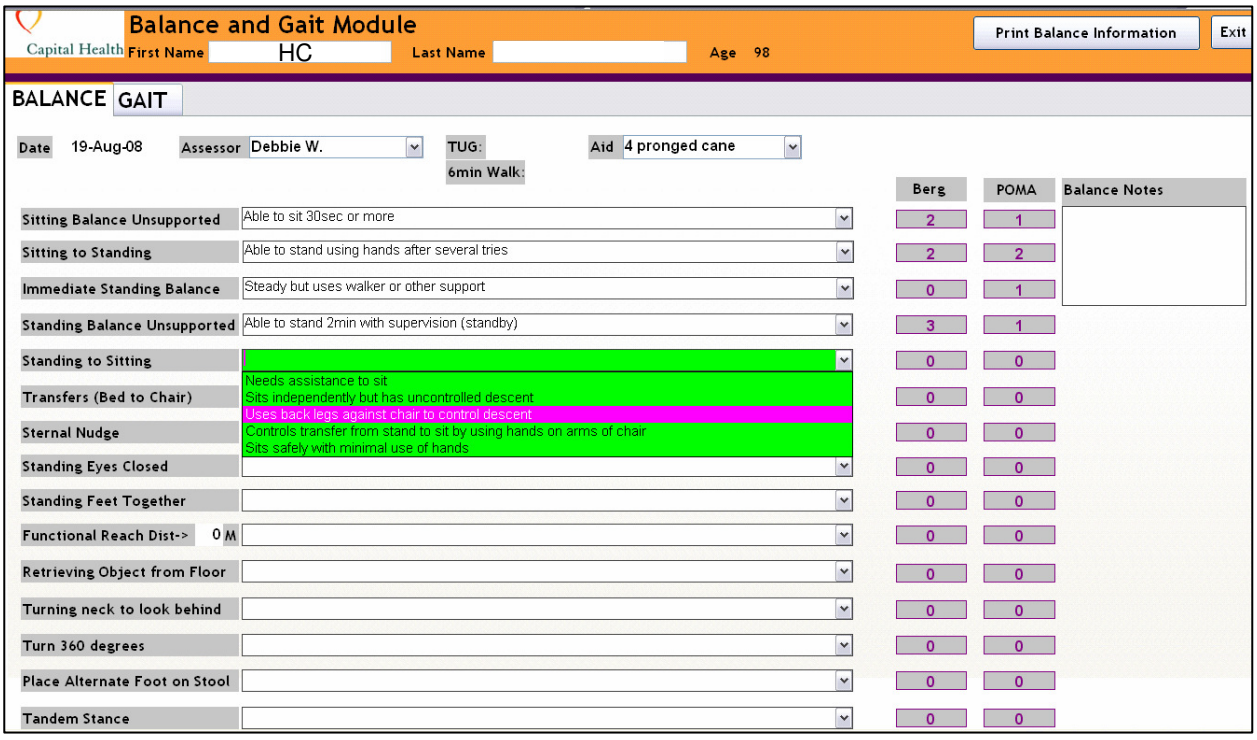
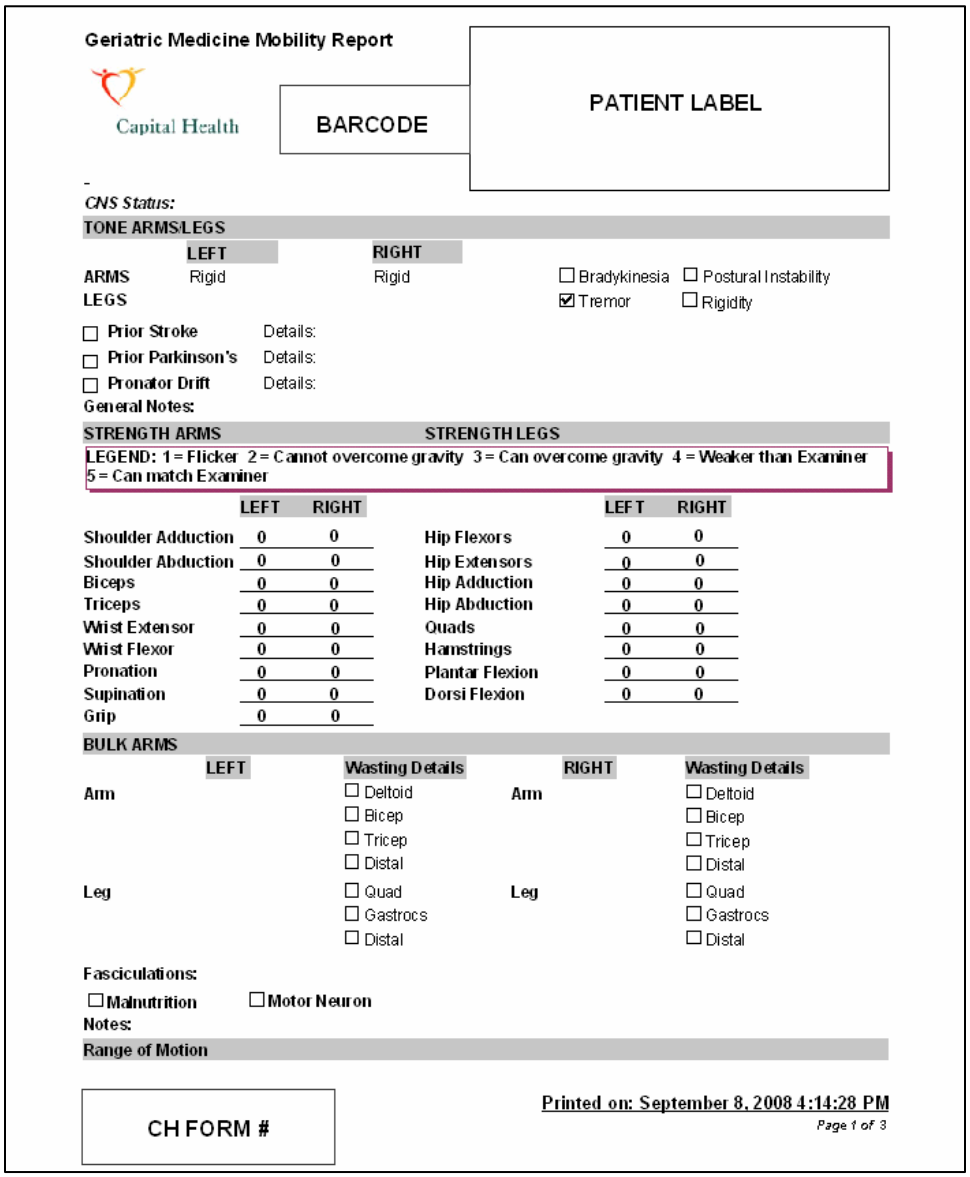


Figure 5: GDH Integrated Patient Information System: Balance and Gait [12]



Geriatric Medicine Mobility Report

Capital Health

BARCODE

PATIENT LABEL

-

CNS Status:

TONE ARMS/LEGS

	LEFT	RIGHT		
ARMS	Rigid	Rigid	☐ Bradykinesia	☐ Postural Instability
LEGS			☑ Tremor	☐ Rigidity

☐ Prior Stroke Details:
☐ Prior Parkinson's Details:
☐ Pronator Drift Details:
General Notes:

STRENGTH ARMS **STRENGTH LEGS**

LEGEND: 1 = Flicker 2 = Cannot overcome gravity 3 = Can overcome gravity 4 = Weaker than Examiner 5 = Can match Examiner

	LEFT	RIGHT		LEFT	RIGHT
Shoulder Adduction	0	0	Hip Flexors	0	0
Shoulder Abduction	0	0	Hip Extensors	0	0
Biceps	0	0	Hip Adduction	0	0
Triceps	0	0	Hip Abduction	0	0
Wrist Extensor	0	0	Quads	0	0
Wrist Flexor	0	0	Hamstrings	0	0
Pronation	0	0	Plantar Flexion	0	0
Supination	0	0	Dorsi Flexion	0	0
Grip	0	0			

BULK ARMS

	LEFT	Wasting Details		RIGHT	Wasting Details
Arm		☐ Deltoid	Arm		☐ Deltoid
		☐ Bicep			☐ Bicep
		☐ Tricep			☐ Tricep
		☐ Distal			☐ Distal
Leg		☐ Quad	Leg		☐ Quad
		☐ Gastrocs			☐ Gastrocs
		☐ Distal			☐ Distal

Fasciculations:
☐ Malnutrition ☐ Motor Neuron
Notes:

Range of Motion

CH FORM #

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Figure 6: GDH Integrated Patient Information System: Mobility Report [13]

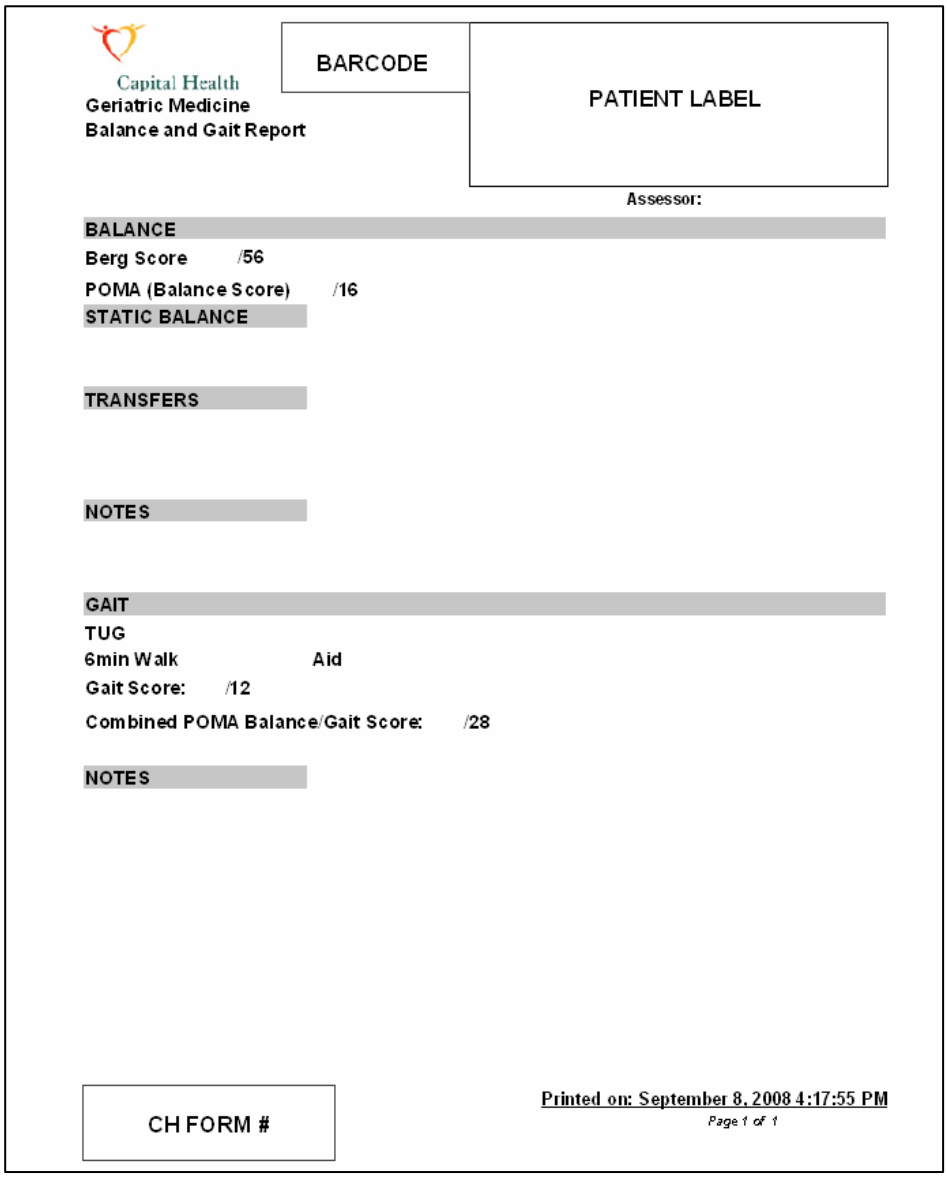

Figure 7: GDH Integrated Patient Information System: Balance and Gait Report [14]

Due to the size of the data collected in the mobility module, it had to be broken down into two modules: Strength & Range of Motion and Balance & Gait. The specific reasons for this will be discussed in section 5.

4 The Relationship with Health Informatics

Preliminary data from the GDH indicates improvement in functional, cognitive, and medical outcomes [15] but data regarding longer term outcomes in Canadian day hospital programs is largely inconclusive [16, 17] due to lack of systematic data collection and methodological pitfalls in defining and measuring outcomes. The GDH program does have much to offer to their partners in primary care and continuing care, but these collaborations require more sophisticated measurement of patient outcomes, better models to identify appropriate goals of therapy and better avenues of communication with primary and continuing care. The internship focused directly on managing and storing healthcare data and being able to report on this data in a meaningful way that can contribute to effective knowledge management and exchange, areas that help form the discipline of Health Informatics.

In fact, upon the beginning of the internship, research was done by the author to familiarize with using technology in geriatric care. It was found that there is a subset of Health Informatics that supports geriatric medicine called Gero-informatics [18]. Gero-informatics involves using technology for initiatives to promote healthy, active aging; and to encourage more care to be delivered in home and community settings. Gero-informatics specifically targets physical functional status, IADLs and ADLs, cognitive status, patients' preferences for care and key information from and about caregivers. Technology, research and innovation are major enablers of these areas of medicine to help the ageing population and all three were directly used in creating the two modules.

The internship duties were designing and constructing two modules of an online customized patient information program which is designed around patient goals instead of around administrative lines. It was strategically aligned with the new care model employed by the hospital which is to center the care on patients and not the institution. This is a major part of Health Informatics, making care better by focusing on the patients.

The paper-based GDH charts are already invaluable source of clinically relevant data, but the collection of this information is often redundant and could be used more efficiently to improve current patient outcomes and streamline care pathways for future patients. When gathering

requirements for the modules, the goal was to reduce redundancy in data collection while planning for reporting on the data in a meaningful way. It was found that some questions were being asked by multiple members of the team, which can be difficult for an older patient experiencing a loss in functional ability, as the assessment takes on average three hours. By creating modules like the function and mobility modules, it provided an area available to all team members to be able to view previously collected data, making the assessment process faster and easier on the patient, thereby making care better.

The modules provide a centralized repository for the entire team to access, view and enhance functional and mobility information collected by other team members to allow more patient-centered goal setting. The modules will improve the efficiency and quality of care measured through GDH patient capacity, wait times, initial assessment duration and patient and caregiver satisfaction (to be measured by questionnaires). Once fully implemented this program will facilitate effective knowledge exchange between the GDH and other patient care-partners by constructing a progress report for weekly interdisciplinary patient rounds and a customized summary of each patient's progress for primary and continuing care partners and the patient. Care partner satisfaction and knowledge exchange will be qualitatively measured by survey and knowledge exchange will also be assessed by the type and appropriateness of referrals to the GDH.

There were components of the internship that involved gathering requirements and acting as a bridge between the clinical field and a piece of technology. It was heavily based on being able to program in Visual Basic for Applications and building modules that conformed to a normalized relational database design. Although these parts were heavy on the technical side of things, they were synonymous with Health Informatics from the author's point of view. According to the author, Health Informatics is the rational way patients are thought about in terms of their care plans, and the way medical knowledge is shaped, shared and applied. Depending on the informatician, it is important that they use their existing skill-set and marry it with the tools learned in the informatics education. The author is primarily a software developer and has used this internship as a vehicle to test the new knowledge gained while completing the masters program.

5 Health Informatics Problem and Solution

The major issue encountered while planning and designing the two modules occurred while shadowing staff members during their daily activities when treating patients. It became apparent that there was a large amount of redundancy in the information being collected. At one point a patient was asked a fairly in depth and lengthy question three times. When designing the two modules, the function module was primarily supposed to be used by the occupational therapist, while mobility was primarily to be used by the physiotherapists. Certain fields associated with function were placed on the function form and others on mobility, but when presented to the staff, there was a definite overlap in where staff thought they should be entering data.

In addition, in creating the mobility module, it became apparent that after the prototype had been approved and once construction started that the amount of objects needed to collect data on the form were slowly down the form immensely. There were too many fields and they were affecting the database and causing performance issues.

Further research was done on how to properly divide up the mobility form into two forms while maintaining the fluidity of the program and remaining as close as possible to the current workflow and processes. The mobility module was then divided into two modules; 'strength and range of motion' and 'balance and gait'. The author had to reconcile the situation, even after design had been signed off and the GDH was expecting the mobility module to appear a certain way. It was a delicate situation due to the fact that a lot of time had been put into designing the form with different team members and now a new design was needed. Under time constraints, the new design was created and tested to ensure that it would improve the performance, and was quickly submitted to the GDH for approval with clear reasons on why the change was needed. With proper change management, this problem was solved efficiently and effectively with benefits for all parties involved.

Furthermore the issue remained as how to approach the redundancy in the data collection process and who would be responsible for what fields. The author consulted literature on how to handle a problem such as this and be able to convey the change to use as a positive change, instead of the user just being unhappy with the product. What began as an issue that was affecting patients,

turned into an opportunity to clarify which staff members need to be collecting which data. Meetings were held to rectify the issue and during these meetings, staff members began to see the true benefits of having a centralized storage area. As one member enters the data they are responsible for, they still have access to other modules to review previously collected data by their team and the patient assessment process became faster, putting less stress on the patient and the caregiver. While working on a solution for both problems, the author kept in mind the benefits of health informatics theories such as managing medical knowledge storage, retrieval and how it is used and was able to create effective solutions that positively affected the team and the GDH patients.

6 Conclusions

The internship performed at the GMRU was a valuable learning experience that allowed the author to apply the knowledge and skills obtained through the Master of Health Informatics program. Being immersed in such an environment not only stimulates thought and ideas, it gave the author the opportunity to put their skills to the test to develop effective solutions for issues around health information and data. The Integrated Patient Information System will continue to grow as more modules are designed and the author has begun collecting lessons learned from previous construction of modules. The GDH team has taken a solid and dedicated investment in the tool, continue to be open to change and have worked very hard at identifying their processes and workflows to create structured requirements for each module. The overall vision for the tool once completed is to begin measuring associated outcomes (each measured before and after implementation of the program) such as:

- Each time a patient identifies a health concern, the program generates a customized assessment and goal-setting module that can be used concurrently by multiple team members in real time so that more time can be spent working on the solutions instead of just documenting the patient's problems. This will be measured through interdisciplinary team member task logs.

- Once fully implemented this program will facilitate effective knowledge exchange between the GDH and other patient care-partners by constructing a progress report for our weekly interdisciplinary patient rounds and a customized summary of each patient's

progress for primary and continuing care partners and the patient. Care partner satisfaction and knowledge exchange will be qualitatively by survey and knowledge exchange will also be assessed by the type and appropriateness of referrals to the GDH.

- The program provides a centralized forum for the entire team to access, view and enhance information collected by other team members to allow more patient-centered goal setting. Interdisciplinary team member satisfaction will be measured.

- The program will improve the efficiency and quality of care measured through GDH patient capacity, wait times, initial assessment duration, patient/caregiver satisfaction questionnaires and goal attainment scaling.

7 Recommendations

It is recommended that the GDH team continue to move forward and hammer down their workflow processes to complete the tool. It will provide the GDH staff with a consistent reliable process of collecting data and organizing modules, acting as a reminder system to ensure all modules were completed. The system will have extensive reports, one for each module that can be printed and inserted into the patient chart, statistical output reports based on the attributes of patients, an electronic discharge summary and an entire e-chart printout to be sent to HPF in the future for possible inclusion with the paper chart scanned (eliminates illegible hand writing).

The data could also be exported in a format to be sent to CIHR and CIHI to aid in the collection and analyzing of country-wide data in hospitals, this could prove very important because our of aging population and may lead to new knowledge. Lastly, there will be a component to measure the satisfaction of the patient and patient care-giver on the care they received at the GDH, which in turn will be used to promote policy change and improve services. By having a system to manage the amount of data that flows through the GDH, it can only improve their patient care and lead to a dataset that is new and rich to be studied by the research unit.

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9 Appendices

Please see attached Documents.

9.1 Appendix 1- Grand Rounds Presentation

Grand Rounds Presentation presented on September 2nd, 2008 for Geriatric Medicine.

9.2 Appendix 2: GDH Flow Project

The GDH Flow Report completed by Tracey Fisher and Tanay Sharma in March 2008 was referred to when completing the requirements and prototype for the two modules.

9.3 Appendix 3: Katz ADL and Lawton IADL- Tracey Fisher June 2008 Report

The report consisted on an in depth view of the Lawton Brody and Katz Index completed late June 2008 to validate the ability and appropriateness of the scales to measure functional status in the elderly.

9.4 Appendix 4: Lawton Brody IADLs & Katz ADLs

The function module requirements were to be able to generate a Lawton Brody and Katz score for each patient by the data the GDH collects. Please see attached PDF or both scales.

9.5 Appendix 5: Berg Balance Scale, Tinetti POMA and TUG

The mobility module requirements were to be able to generate a Berg score, POMA score and TUG score for each patient by the data the GDH collects. Please see attached PDF or all three scales.