ChargeMed: Development of a Mobile Application for Medical Coding and Billing within the Ontario Healthcare Environment

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Abstract

Traditional processes involved in coding and billing for medical services performed by physicians present many inherent challenges in complete charge capture, accurate coding and entry as well as timely submission for reimbursement. Process improvement facilitated by the adoption of mobile electronic billing management systems has demonstrated the potential for considerable financial benefit. This paper outlines the conceptual and technical architecture for a mobile coding and billing application facilitating physician remuneration for practices in Ontario, including a description of the relevant contextual background, potential mechanisms for the functional evaluation of this tool and a discussion of possible evolutionary modifications of the proposed application.

1. Introduction

The purpose of this paper is to outline the processes associated with medical coding and billing within the current healthcare environment in Ontario, and the proposal of a design for ChargeMed, a mobile application designed to facilitate these remuneration practices. Medical coding and billing (MCB) refers to the accurate and timely recording and submission of data associated with patient encounters for the purpose of remuneration. As a result of the complexities inherent in the medical coding and billing processes, it has been estimated that up to 15% of a physician’s gross annual income may be lost as a result of such billing process deficiencies[1]. Automation of this process on a mobile platform will facilitate the tasks of capturing required patient demographic information, selecting the correct charge code identification and applications, as well as streamlining the process of data submission to the payer or billing agent.

This paper is structured as follows: Section 2 outlines the context of MCB in the Ontario healthcare environment. Section 3 describes the general processes involved in MCB, and the functionality that is required for each. Section 4 details the data storage needs of the application, including the management of billing codes, patient, physician and encounter data. Section 5 presents the proposed application architecture in their various layers. Section 6 outlines security and privacy considerations. In Section 7, the paper concludes with a discussion related to development and evaluation methodologies of the application.

2. Background

Physician reimbursement for medical services represents a significant policy and management issue in the Canadian healthcare environment. As of 2008, government spending on healthcare reached $121.1 billion, with physician reimbursement accounting for $22.9 billion (13.3%) of this total expenditure [2]. The majority of Canadian physicians operate under a “fee-for-service” model of remuneration, which entails itemized per-service compensation for the healthcare that they deliver [3]. In Canada, each of the provinces are the administrative authority for healthcare delivery, which includes the definition of health-related services eligible for reimbursement by public funding [4]. In Ontario, the governing body is the Ministry of Health and Long-term Care (MOHLTC). The Ontario Medical Association (OMA), the representative body for physicians within Ontario, is responsible for generating the standardized Schedule of Benefits for Physician Services (“the schedule”), which describes the necessary requirements for service reimbursement, applicable diagnostic and service codes, and their associated fees. The spectrum of services and respective fees that are contained in the schedule are periodically negotiated between the OMA and the MOHLTC. Contained in the schedule are diagnostic
and service codes, which correspond to each service provided by physicians [5].

The legal framework for physician reimbursement is established in the Hospital Insurance Act (HIA) [6]. Payment to physicians for all medical services rendered is managed by the Ontario Health Insurance Plan (OHIP) through the schedule. OHIP reimburses physicians for claims submitted without requiring submission of documentation supporting the service which has been billed for and, thus, entrusts physicians with truthful and accurate representation of the work that they have performed. The physician is ultimately responsible for ensuring that the billing claim submitted and reimbursed is accurate and meets all specific requirements defined within the schedule. All submitted claims are initially screened by OHIP via an electronic system that verifies that the appropriate information and correct format for submission have been supplied. Patients in these submitted claims are referenced by a unique OHIP number. $10 million in claims are rejected monthly by the screening process for erroneous submissions. Furthermore, a formal post-payment audit system administered through the OHIP Medical Review Committee (MRC) and regulated by the HIA allows for the reconciliation of incorrect claims.

2.1. Inherent Challenges in MCB

The processes associated with MCB are inherently complicated, with numerous steps presenting many potential administrative pitfalls. First, physicians must capture the patient encounter with specific demographic and health information (including patient name, OHIP number) and select appropriate diagnostic and service code from the schedule. Significant complexity can exist in selecting the correct service code given the incredible number of potentially applicable codes dictated by the service type, location of the patient encounter, on-call and after-hours assessment as well as many additional modifying clinical variables. Second, the codes in the schedule are revised on a regular basis, reflecting revisions to funded services. Due to the intrinsic administrative complexity of this process, many physicians employ third-party billing agents for management of claims submissions and rejected billings with the MOHLTC, although the comprehensiveness and quality of services provided by these billing agents can be variable.

Apart from the complexities inherent in MCB processes, the traditional paper based MCB inherits multiple potential sources of errors or omissions that can negatively impact reimbursement for the physician. Common problems include missing or erroneous encounter records, multiple claims applied to multiple visit codes, duplication in billing, miscalculations in percentages in partial claims, application of incomplete or erroneous billing codes and disparate documentation of patient encounters [7, 8]. These issues can culminate in significant effects on revenue within a medical practice, with recent estimates indicating that up to 15% of a physician’s gross annual income may be lost due to such billing process deficiencies [9].

Significantly more resources (and associated expense) are dedicated to administration of payment for services in healthcare than in many other business sectors [1]. Indeed, recent studies in the United States have estimated that administrative processes of remuneration can consume approximately 12% of net physician revenue, with nearly 13% of these costs being directly attributable to billing management processes and infrastructure [1]. Ever present demands for fiscal improvement in healthcare-related expenditure have become even more imperative given recent global economic downturn. Proposals for major changes in Canadian healthcare economics related to physician remuneration, including the implementation of more locally-administered, quality-based reimbursement models represent significant evolving challenges in the complexity of billing management, and accentuate the dire need for improvements in processes associated with healthcare administration [10].

2.2. Opportunities for Technology

Information and communication technologies (ICTs) have demonstrated process improvements in accuracy, efficiency and subsequent revenue generation when applied to the MCB process within a variety of physician practice environments [11–14]. Research largely focuses on the evaluation of the economic benefits of improved MCB [14, 15], as well as a function included within EMR systems [16–18]. Facilitating these improvements is the increase in adoption of mobile ICTs by physicians for various applications, as it has expanded rapidly in a variety of areas [19, 20]. Greater than 60% of physicians currently use a mobile device for clinical purposes related to healthcare provision and over 90% employ applications to access medical information [21, 22]. As such, the use of mobile technology for the purpose of documenting, processing and transmitting patient encounters at the point-of-service has the potential to significantly improve the existing process workflow, particularly within a hospital-based, inpatient care environment [23]. Indeed, mobile devices supporting such functionality have been used
by physicians with MCB process improvement and reimbursement benefits, while providing ease and satisfaction for the user [24–27]. Despite the inroads made in physician adoption of mobile ICTs for various purposes, as well the process improvements afforded by MCB applications, opportunities still exist in this area [23]. Notably absent from the literature are MCB applications catering to physicians in Ontario.

The viability of mobile MCB applications in the Ontario healthcare environment is suggested in the results of a preliminary, exploratory questionnaire administered to physicians within a large academic health sciences hospital network in Ontario. An online survey was conducted and distributed anonymously to academic physicians within various departments affiliated with McMaster University and Hamilton Health Sciences as well as St. Joseph’s Healthcare Hamilton, in order to practically assess the state of current billing practices within Ontario and more clearly identify interest in electronic software supporting such functionality. A total of 121 physicians responded, which included but were not limited to those in the areas of psychiatry, surgery, internal medicine, and family medicine. Although 64% of respondents relied on a billing agent or agency for submitting their bills, only 22% used these services for coding purposes. The process of coding of medical encounters was divided almost equally between physicians and administrative staff, with 39% of respondents reporting that coding was completed by them while 33% delegated this task to their administrative assistants. Furthermore, 83% of respondents reported using written documentation for the management and collection of their medical billings for clinical encounters, with 10% of respondents using computerized spreadsheets, and no respondents reporting using mobile applications for this purpose. The results of this preliminary survey suggest that such a mobile application supporting MCB functionality for the Ontario healthcare context may present a viable opportunity. These results mirror the importance of MCB expressed by physicians in other studies [17].

Considering that the economic benefits of mobile MCB have been demonstrated [27], and the interest demonstrated by Ontario physicians at this preliminary stage, there exists a knowledge gap pertaining to the use of mobile applications utilizing the Ontario Schedule of Benefits for Physician Services for MCB. There is also a subsequent lack of research that richly describes the unique nuances of MCB in Ontario, which can serve the development of said applications.

3. MCB Processes and Required Functionality

The purpose of this section is to outline the functionality required for an application that facilitates MCB. Three overall processes characterize MCB: Encounter Coding, Charge Capture, and Charge Entry. Table 1 (below) summarizes the definitions of these processes, used by this research.

<table>
<thead>
<tr>
<th>Process</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>Encounter Coding</td>
<td>Encounter Coding is the selection of a code that corresponds to diagnostics or services performed during a patient encounter.</td>
</tr>
<tr>
<td>Charge Capture</td>
<td>Charge capture occurs when a physician enters data associated with a patient encounter, describing the services performed, for the eventual submission to a payer.</td>
</tr>
<tr>
<td>Charge Entry</td>
<td>Charge entry entails the submission of charge capture data to a payer, for the purpose of reimbursement.</td>
</tr>
</tbody>
</table>

3.1. Encounter Coding

The encounter coding process entails the selection of a code that corresponds to diagnostics or services performed during a patient encounter. The process of encounter coding is usually completed by the physician and requires manual review and application of the relevant service or procedural codes [28]. Existing coding applications cater to an American market, and are incompatible with the code schedules utilized in Ontario. Thus, generic systems have limited utility for improving the billing process for physicians practicing within Ontario.

A mobile application with a searchable and comprehensive electronic reference of the code schedule, incorporating features of predictive text recognition menu functions would allow for quick access to detailed descriptions of service or procedural requirements and the requisite codes for the patient encounter. Furthermore, generalist or specialist-specific modules with programmable common coding pattern capabilities would allow for a streamlined code application process tailored to the needs of the individual physician.
3.2. Charge Capture

Charge capture occurs when a physician enters data associated with a patient encounter, describing the services performed, for the eventual submission to a payer. This data includes the correct service or procedural code (as described in section 3.1) as well as any required data, such as patient demographics and OHIP number. Inpatient charge capture, for instance, may require the administration of care at locations that are remote from a practice management system and increased complexity in service value attribution [28]. This requires that the physician manually collect the relevant patient demographic data and related details of the services performed for every patient seen, presenting the risk of losing information before it is entered into the system [29].

A mobile device with software supporting charge capture with the collection of relevant patient data at the point-of-care would allow for minimization of human error as well as the integration of seamless mechanisms of charge reconciliation. Facilitation of charge capture can occur through manual entry of data into the mobile device (essentially emulating an electronic patient encounter form). Expanded functionality, increased usability and convenience can be accomplished by the capability for the mobile device to scan requisite patient data (including demographic information and OHIP numbers) from hospital patient cards with the device’s camera as an image for later reference in manual data entry and the possible use of optical character recognition technology. Additional mechanisms for capturing the relevant patient data could include the capability for the mobile device software to interface with the hospital electronic health record (EHR) and extract the relevant data.

3.3 Charge Entry

Charge entry entails the submission of charge capture data to a payer, for the purpose of reimbursement. Upon completion of service or procedural coding, a charge entry is made and a billing claim is generated for ultimate submission to the MOHLTC. At this point, so called “back-end” billing processes are initiated [28]. These processes are typically managed by the third-party billing agent that charges the physician for their services (ex. 2-3% of the gross per-billing amount). Upon generation of a billing claim, the submission is verified for containing the requisite information and then subsequently electronically transmitted to the MOHLTC for payment. The claim may be rejected for a variety of reasons (ex. missing information, inappropriate coding), compelling re-submission by the physician, billing agent, or office manager. [28]. The account is often resolved and payment transferred directly to the physician’s account from the MOHLTC.

The process of claims submission can also be facilitated by mobile billing software through secure electronic wireless transmission of the coded patient encounters to an EMR or third-party billing agent for claim review prior to submission to the MOHLTC, or direct submission if no third-party is involved in the process. In order to facilitate this process, interoperability and data compatibility with the relevant payer or billing agent is essential.

4. Data Requirements for MCB

The purpose of this section is to explain the nature of the data involved in the MCB processes. Specifically, this section describes the nature of the codes contained in the schedule, as well as other data associated with charge entries.

The first and the most important part of any system which acts as an aid for billing is providing a way to search through the fee schedule [30] and find out the correct set of applicable codes for any patient encounter. The latest schedule published by the MOHLTC is an eight hundred pages long document. It provides detailed information about the billing codes, describing what codes are applicable in what scenarios for what services.

The billing codes in the schedule of benefits published by MOHLTC [30] are alphanumeric codes, starting with a letter and followed by 3 digits. The schedule uses the letter prefix to categorize the codes based on services, although exceptions to this convention. For example, codes with the “A” prefix are described as the “General Listings”, “C” prefix codes are non-emergency in-patient services in acute care hospital, “W” prefix codes are used for non-emergency in-patient services in long term care institution, “H” prefix codes are for services rendered in emergency department by a physician on duty.

4.1. Classification of Codes

The schedule of benefits by MOHLTC [30] is divided into various sections, including but not limited to Consultation and Visits, and Diagnostic and Therapeutic Procedures. Apart from these two, the other top level categories are mainly related to imaging and surgical procedures, which are classified according to the organ systems in the human body, such as haematopoietic, musculoskeletal or...
gastrointestinal systems. These two codes are then subdivided according to the various specialities.

In the application, first level of classification is based on the speciality of the physician searching for codes. This narrows down the set of applicable codes to a small subset. Further, as in the schedule of benefits by MOHLTC, the codes are broadly classified into consultation and visits, or procedures.

Further details are entered, depending on the type of entry. For instance, Consultation and Visits related codes generally require the following information:

1. Type of consultation
2. Location at which the consultation was given (patients’ residence, emergency department, inside hospital)
3. Day of the week and time of the day when the consultation was given
4. The age of the patient
5. Duration of the patient encounter

However, Diagnostic and Therapeutic Procedures codes require the following information:

1. Reason for performing procedure
2. Part of the body (or organ system) was the procedure performed on
3. Actions performed during the procedure

Table 2 below contains an example of both a consultation and procedure code for a gastroenterologist, along with the data required by the charge entries, demonstrating the complexity in this process:

<table>
<thead>
<tr>
<th>Code</th>
<th>C765</th>
<th>Z400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>Consultation</td>
<td>Procedure</td>
</tr>
<tr>
<td>Desc.</td>
<td>Patient age sixteen years of less, who is a non-emergency Hospital In-Patient, on a weekday in regular working hours.</td>
<td>Endoscopy in the oesophagus for an active bleeding.</td>
</tr>
<tr>
<td>Info Req’d</td>
<td>- Location: In Hospital - Patient age: 16 or less - Day and Time: Weekday in normal working hours</td>
<td>- Where: Oesophagus - Why: Active bleeding</td>
</tr>
</tbody>
</table>

4.2. Charge Entry Data

In the previous section a method of classification of codes in the schedule of benefits was examined, along with the types of information associated with them. This forms the basis of the design and working of the application system. In order to enter a charge, further information pertaining to the work performed is required:

- Physician’s specialty
- Patient Info (Age, OHIP number)
- Encounter (Date, time, type, location)
- In case of a procedure
  - Reason
  - Part of body or organ system
  - Work performed

The application is targeted towards scenarios where a physician has to see multiple patients at multiple locations when they are on call, for example different departments within a hospital. For such scenarios, a smart device application provides the required location-independence. The data in MCB can be classified in four broad categories: User Profile, Patient Data, Encounter Notes, and Codes.

4.2.1. User Profile. This section contains the information which is common to most encounters. The first one is the specialty of the physician, which remains constant throughout for the application user. The second one is the location; there are multiple locations where a physician-patient encounter can occur. In most cases, there are a defined set of location a physician’s works, for example, an emergency department at a particular hospital. The user can create a set of predefined locations and activate the relevant one before starting work in a particular location, which would be the default location for all subsequent encounters until changed.

4.2.2. Patient Data. In many cases a physician sees the same patient multiple times on a regular basis. Therefore, the application should provide a feature to store the basic patient information needed for billing purposes locally on the mobile for future reference. For other cases of unexpected or single encounters the application should provide multiple methods to capture that info, for example taking a picture of the patient health card for reference, and/or automatic recognition of data through Optical Character Recognition (OCR) techniques.

4.2.3. Encounter Notes. Various data is to be captured in this section. The date and time of the encounter can be automatically noted. The other notes acts as keywords providing other information required for finding the right codes. Therefore, the application should provide a section to enter this information. With the advancement to technology, a few smart devices offer speech recognition which can act as an alternate way of entering notes.
4.2.4. Codes. A searchable registry of codes would be provided as a web service. This would allow for less processing and memory resources used on a smart device, as well as the ability to update the code schedule, when updated by the MOHLTC. Most smart device would have the capability to connect to the Internet to search for the most current code.

5. ChargeMed Application Architecture

Previous sections discussed the data that is involved in MCB processes. This section outlines the architecture of ChargeMed, which consists of four layers, explained in detail below: the Presentation layer, Application layer, Business layer and Data layer.

5.1 Presentation Layer

The presentation layer forms the Graphical User Interface (GUI) of the application. Being a smart device application, the interface would be designed keeping the currently popular smart devices in mind. There are a few basic considerations when designing an interface for a smart device app. The home screen, schedule search screen, patient list, encounter list, and encounter details screens for an iPhone version of the application is depicted in Figure 1 (below).

5.1.1. Screen size. The screen size of a smart device is very small when compared to a desktop or a laptop screen. The current version of iPhone has a screen of 3.5-inches (diagonal). Thus, efficient usage of screen space is an important consideration.

5.1.2. Touch Screen. Most popular smart devices have a touch screen display. While designing the GUI of an application for these smart devices, making sure that it is easy to navigate through the app using a touch screen is very important.

5.1.3. Multiple Input Methods. Most modern smart devices come with a touch screen based keyboard, a microphone and a camera. All of these can be used as a potential input mechanism for an application. The application should be designed keeping this in mind to make full use of all ways of the entering data into the application.

5.2. Application Layer

The summary of functionalities implemented in this user-facing layer is described in this section.

5.2.1. Predictive text input. The content of the patient encounter notes will be used as keywords in searching for possible codes the physician would like to associate with the charge entry. This form of predictive text entry would improve the efficiency of searching for codes and taking notes by decreasing the number of keystrokes, preventing spelling mistakes and code selection errors.

5.2.2. Data formatting. This layer would contain the implementation for the formatting of all the data being exchanged with other systems. All the data would be available for export in popular formats.

5.2.3. Encryption. As the application would provide the facility to store a small amount of patient related information on the device, this layer would also contain the implementation of encryption and decryption of the patient-related data being stored.

5.2.4. Communication. This component would contain the implementation for communicating with the web service which implements the business logic part of the application and provide the facility to email the billing details with all the applicable codes, in user desired format, for further use.

5.3. Business Layer

This layer would contain the logic behind the application. It would be implemented as a web service which would provide a searchable registry of all the codes in the schedule. This would allow the future extension of the project to use the same service from multiple applications. Further, it would allow the central updating of the code registry, when codes are changed by the MOHLTC. This service would also allow searching of codes given the data as described in earlier sections. It would also supply the client with the detailed description and other related codes for the relevant billing codes.

5.4. Data Layer

The Data Layer for this application would be divided into two parts: on-device storage, and web-based storage.

5.4.1. On-device storage. The data stored over the device would the user profile information, patient details, set of relevant keywords (for predictive text input), recent encounter notes and the recent billing details. The recent encounter notes and billing details are the bulkiest data managed by the application.
Thus, this data would only be temporarily stored on the device, and would be erased once the associated billing transactions have been completed. As dictated by the privacy policy, the patient related info would be encrypted before saving on the device.

5.4.2. Web-based storage. This component includes the entirety of the schedule of codes in a structured electronic format. All codes will be tagged with keywords to enable effective searching.

5.5 Technology Overview

The application follows a client server architecture pattern. As described in the sections above the business layer of the application would be implemented as a RESTful web service [31] and the Presentation and Application layers would be implemented as native mobile applications. Implementing the business layer as a web service would allow it to be independent of the technology platform used at the client side. Also, modern cloud computing platforms, such a Google App engine [32] allow for easy implementation and deployment of the solution in a highly scalable manner. The client can be implemented as a native Android and/or iOS application.

6. Privacy and Security

Privacy and security are a concern, due to the sensitivities in dealing with personal healthcare information, and the subsequent regulation for its protection. The following section describes the regulatory background that is applicable to this application, as well as the considerations that will be made for ensuring privacy and security of data, and the compliance to the applicable legislation.

6.1. Regulatory Background

The Personal Health Information Protection Act (PHIPA) is the provincial legislation in Ontario that defines key regulations that must be adhered to, in the collection, usage and distribution of personal health information (PHI). PHI is defined as identifying information about an individual in various forms, relating to a person’s physical or mental health, or health services provided to the individual [33]. PHIPA gives patients the right to access their health records and request revisions of any errors, as well as restricting access to the medical record, in part or as a whole. Furthermore, In PHIPA, healthcare providers (doctors, nurses, physiotherapists etc.) and the institutions that they work for (hospitals, long-term care facilities, MOHLTC etc.) as well as Medical Officers of Health and any person operating a health facility are defined as health information custodians (HICs). This legislation also encompasses agents of HICs, persons who provide goods and services to custodians to enable electronic handling of PHI (whether or not they act as agents of the custodians), recipients of PHI from custodians and everyone in Ontario with respect to health numbers and health cards.

PHIPA defines HICs as being required to:
1. Collect only the information needed for occupational activities related to the patient.
2. Take any steps necessary to safeguard all PHI.
3. Take all reasonable measures to ensure that health records are accurate and complete.
4. Inform the patient of any unauthorized usage or disclosure of PHI at the first reasonable opportunity.
5. Provide a written description of the security practices used to protect PHI in addition to a contact person should any question arise.
PHIPA explicitly addresses the requirements for the electronic management of health information [33]. A person who provides goods or services that enable a HIC to use electronic means for the collection, usage, disclosure or retention or disposal of PHI must comply with the requirements set out in the regulations. PHIPA includes requirements for such providers, including restrictions on the provider’s use and disclosure of this information. The PHIPA legislation also defines a health information network provider as the provider of services to multiple HICs where the provision of services to the HICs enables them to use electronic modalities for the disclosure of PHI amongst them [34].

PHIPA also defines a spectrum of additional specific requirements for health information network providers including:

1. The provision of notification of any inappropriate usage and disclosure of PHI.
2. Transparency with respect to PHI security measures for the public.
3. Documentation of audit trail reports.
4. Privacy Impact Assessment and a Threat and Risk assessment of all electronic systems.
5. Legally-binding written contracts with all relevant parties (such as HICs).

HICs must also ensure that all information practices, including methods of electronic information management and the related technical, administrative and physical safeguards of these systems, comply with PHIPA [34].

6.2. Application Privacy and Security

The mobile MCB described involves management of PHI including the patient name, age and OHIP number. Given the PHI management design intrinsic to the proposed application, data storage and wireless data transmission in addressing relevant privacy and security issues to the application is elaborated upon.

6.2.1. Data storage. Any PHI stored on the mobile device necessitates adherence to the aforementioned regulatory requirements as they apply to electronic data management. The information stored on the device is the inherent responsibility of the HIC (physician) who owns and operates the device as well as the associated application. Requisite technical safeguards would include the encryption of all PHI stored on the device and the use of time-sensitive protective passwords for system access. Higher level technical and administrative safeguards, including variable system access authorization capacities and internal audit mechanisms for system access are not applicable to the proposed application, as this is designed as a single user program. The integrity of PHI privacy and security within the proposed application is also further supported from unauthorized system access through data locking for repeated erroneous login and password insertion.

6.2.2. Data transmission. Information transmission from the mobile device in the proposed application is realized through communication of information to the web service in code application and wireless conduction of the information for remote personal electronic storage or direct billing submission. In data communicating with the web service, information being transferred would be encrypted and de-identified for the maintenance of system privacy and security integrity. Transmission of billing information through email would not be a default action performed by the application. The application would necessitate the user to manually email the details, thus ensuring that the email ID given is authenticated and authorized to perform such an action.

7. Development and Evaluation

As of the writing of this paper the ChargeMed application exists conceptually. Specifically, the needs and potential benefits have been identified, the core functionality has been defined, a software and hardware application has been proposed, and the applicable regulatory framework has been defined and addressed. The application proposed would be used by physicians for their personal use, although it will be used in the context of a hospital or clinic. It is meant to be a low cost solution that benefits individual physicians in their coding and billing, allowing the easy and timely retrieval of correct codes, the accurate recording of patient encounter data, and the subsequent absence of billing errors upon submission, whilst offering adequate security and privacy protection of patient data. In validating these benefits it is necessary to evaluate the application, in various ways at various times during the development process. A roadmap has been formulated, consisting of six distinct and sequential phases, in which ChargeMed will be developed, in conjunction with a healthcare organization that provides specialized outpatient care.

The initial exploratory phase will be used to assess the interest of this application in physicians, as well as document concerns, desired features, context of use, outcomes and other emergent themes associated with the application. This phase will employ various research methods, such as focus
groups and surveys, and will attempt to include the perspectives of administrative staff, security officers, along with those of physicians.

The results of the initial exploratory phase will be used to inform the prototype development of the application. Throughout this phase, physicians and will be iteratively employed to provide refinement to the application, through usability testing using scenarios and test data. Administrative staff will also be used to inspect and provide feedback on the billing reports.

Also throughout the prototype development phase, security concerns will be addressed through the liaison between the development team and the individuals responsible for healthcare information security at the organization. This may include that sufficient audit trail generation, encryption and other security measures are built into the application.

Also occurring during the development phase will be the gathering of data for pre-implementation performance measurement. This data will be used later in validating the value of the application. This data will include labor hours, number of rejected claims, remuneration, or any other outcome of importance identified in the initial exploratory phase.

After sufficient usability testing and addressing of security concerns, ChargeMed will undergo a limited implementation. This entails the use of the application by a small number of physicians, for the purposes of performing encounter coding and charge capture processes. Charge entry processes will be performed by administrative staff in parallel with existing processes, so that the integrity of the charge entry data can be assured before it is submitted to the payer.

After the limited implementation yields satisfactory results, the full implementation will commence. At this time, the outcomes of importance previously identified will be measured post-implementation. These will be suitably compared to the pre-implementation metrics, so that the benefits of ChargeMed can be objectively demonstrated. As well, levels of user satisfaction will also be assessed.

The successful validation of ChargeMed in this manner can be utilized to seek future work in other areas in healthcare in which this application may prove valuable, or other systems in which this application may be integrated, such as an electronic medical record (EMR) system.

6. References


