

**MODELING AND ANALYSIS OF A CLINICAL DOCUMENTATION
IMPROVEMENT SYSTEM: CALCULATING PATIENT OUTCOMES**

By

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Final Dissertation Approval Form

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ABSTRACT

Modeling and Analysis of a Clinical Documentation Improvement System: Calculating Patient Outcomes

By
Chinwe Anyika

Over the past decade, clinical documentation improvement (CDI) programs have undergone quite an evolution and continue to evolve even today, particularly as the implementation of the new International Classification of Diseases, version 10 (ICD-10) system draws near. Before the Prospective Payment System (PPS) was established, Physicians focused on taking care of their patients without concerning themselves about quality or detailed documentation. They were reimbursed by Insurance companies without in-depth enquiries about services provided. With the introduction of the PPS, quality of patient care, length of stay during admission, severity of illness, and risk of mortality, became important benchmarks. CDI software models became more and more necessary as more hospitals adopted CDI programs to assist in improving Physician documentation in the patient's medical record. This study first describes the need for a comprehensive electronic CDI model. Secondly, descriptive statistics will be used to determine the relevance of the different metrics collected as data in the new CDI model. Then, analysis of the collected data will be performed using the MS-DRG severity level and APR-DRG severity level to show the effects and contributions of a functional CDI program in relation to a hospital's reported and coded statistics. Consequently, results of descriptive statistics show that between 19 to 32.5 percent of queries were generated monthly as a result of inadequate documentation by Physicians

in patients' medical records in relation to the total number of records reviewed and entered in the CDI software by the CDI Specialists. Other results of analyses show that a good CDI program significantly and positively impacts on different hospital metrics like the accuracy of coded data, case mix index (CMI), length of stay (LOS), severity of illness (SOI), risk of mortality (ROM), and reimbursement. In conclusion, the results of this study reveal that a significant positive ripple effect is achieved when an efficient CDI program is implemented, and this notion should serve as a basis to obtain a comprehensive CDI model where data collection can be better utilized to positively impact patient outcomes.

Keywords: CDI, clinical documentation, case mix index, CMI, length of stay, CDI models, risk of mortality, ROM, severity of illness, SOI, CDI software, DRG, APR-DRG, MS-DRG, patient outcomes, CDI benefits, revenue cycle, CDI data analysis.

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DEDICATION

I would like to dedicate this dissertation to God. With Him, all things are possible and having Him in my life makes me strive to be everything I can, and to teach my children to live right and walk a straight path. I would also like to dedicate this dissertation study to my family; my husband Kem, and my two children Buchi and Sarah. They are everything to me, make my very existence a necessity. My heart belongs to them. My husband Kem is my partner, my soul mate, my best friend, and his support, patient, assistance, suggestions, feedback, and incessant advice regarding this research have been unequivocal. Finally, I want to dedicate this dissertation to the rest of my extended family, and close friends for their love, support, and help that have impacted my life at some point.

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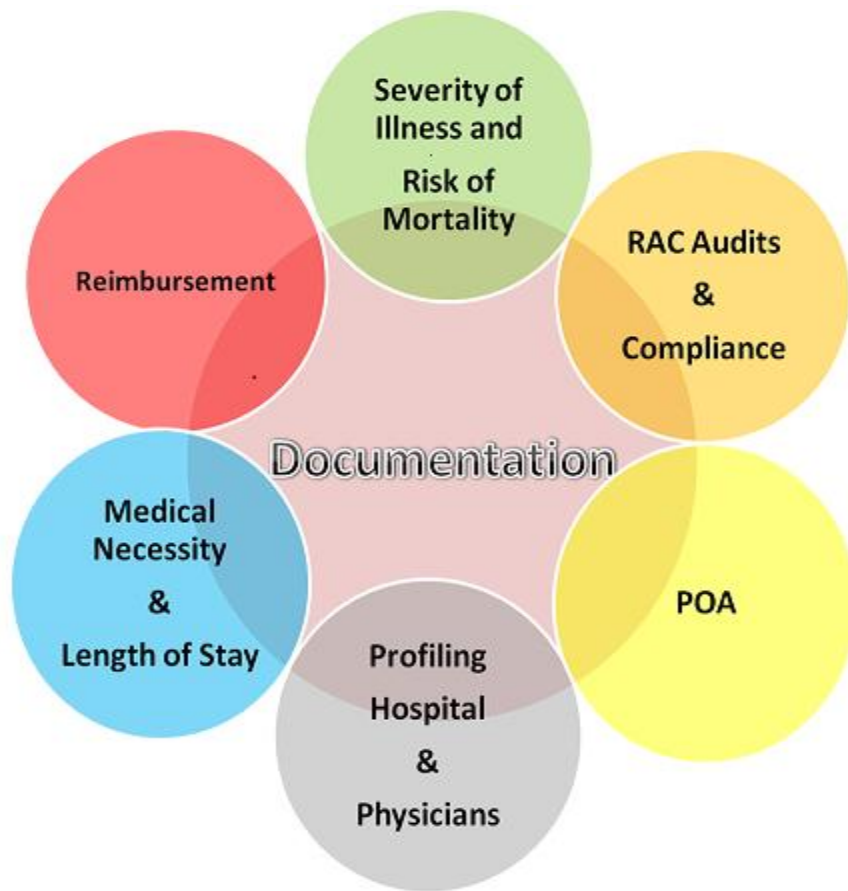
CHAPTER I

INTRODUCTION

1.1 Problem Statement

Accuracy and transparency of any medical record is necessary to impart on the severity of illness, quality and continuity of care, specificity, data collection, ease of flow and transfer of information among healthcare providers, and reimbursement in every healthcare institution (figure 1). A complete medical record should be eligible, precise, accurate, timely, consistent, relevant, and clear. From the time of admission to discharge of any patient in a healthcare facility, continuity of care is demonstrated solely by establishing a complete medical record. The CDI initiative arose from this need, and was made more imperative when the Center for Medicare and Medicaid Services (CMS) implemented the Medicare Severity diagnosis-related group system (MS-DRG) in 2007 to determine the method of reimbursement to facilities, with the implication that present-on-admission (POA) indicators be made clear on certain diagnoses, to prevent denial of payment for services rendered and improve mortality data reporting.

Figure 1: Global Impact of clinical documentation in the healthcare industry



With the indoctrination of performance-based practice as one of the many quality indicators for healthcare facilities, it became imperative that hospitals collect, maintain, monitor, track, and report quality-related ‘core measures’ as mandated by CMS. Performance for the most part, is captured solely based on the documentation in the patient’s medical record. Hence, the popular adage that if it was not documented anywhere in the chart, it did not happen.⁵⁰ A new one has been incorporated to ask how accurate the documentation is, if noted in the patient’s record.

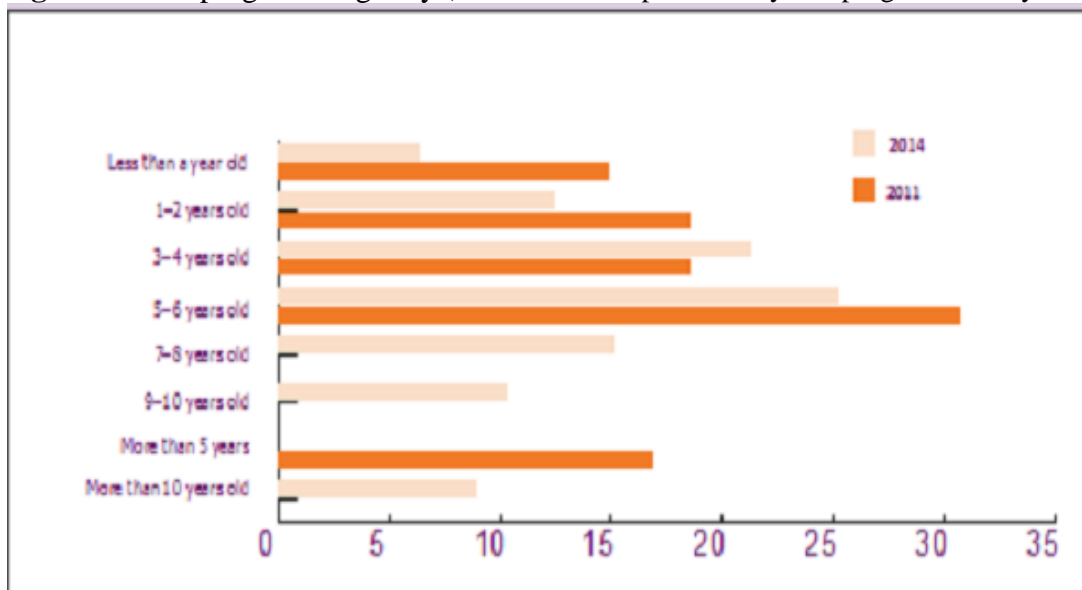
According to the results of a recent survey conducted by the Association of Clinical Documentation Improvement Specialists (ACDIS) on CDI program structure and productivity involving 592 survey respondents in 2014, 98.1% of CDI programs remain

focused on concurrent medical record reviews, while 70.7% focus on Physician education as their principal duties. This doctoral study will attempt to analyze different CDI software models available for data entry and documentation practices, and showcase a new and customized CDI software while analyzing different collected statistical data used to capture and interpret important core measures and quality metrics. Finally, recommendations will be made for a better and improved CDI software model that will incorporate all necessary measures and calculable patient outcomes, while saving cost.

1.2 Historical Background

The results of the 2014 ACDIS survey noted that about 25.3% of CDI programs have been in place for about five or six years, with roughly about 60% respondents working in CDI programs that have existed longer than five years (figure 2). In comparison, data from 2011 showed that only 17% of respondents worked in programs that old.

Figure 2: CDI program longevity (source: ACDIS productivity and program survey, 2014)



CDI bridges the gap between the patient's medical record, and medical coding by facilitating optimum accuracy and clarity of clinical documentation done by Physicians, and reconciling accuracy of the captured medical codes before the record is billed.³⁸ From the time of admission, capturing the complexity and severity of illness for the patient is highly essential. Done properly, the hospital's profile data will be accurate; data collection for reporting purposes becomes more precise; public and commercial access to Physicians' profile data will truly depict the collective and correct information to the highest degree of specificity possible, making selections by consumers easier; billing for records will be accurate, reimbursement for services rendered will be appropriate, and the hospital will be able to withstand legal scrutiny and not fall prey to the repayment of reimbursed money when audited according to regulatory requirements. Some public websites that publish Physician and Hospital profiles are: RateMDs.com, HealthGrades.com, UcompareHealthCare.com, Medicare.gov, and the Joint Commission.

1.2.1 Recovery Audit Contractors

Recovery Audit Contractors (RAC) program was implemented with the specific goal of identifying and recovering improper and overpayments made on claims by healthcare institutions and Physician offices for health services rendered to consumers. The RAC also identified and reimbursed underpayments made to these facilities. Overpayments occur when providers submit claims that do not meet Medicare's coding or medical necessity regulations, for example, submitting a simple procedure claim as a more complex one. Underpayments occur when providers submit claims for a simple procedure, when the medical record reveals that a more complicated procedure was

performed.³⁷⁽¹⁾

The demonstration resulted in the recovery of over \$900 million in overpayments and nearly \$38 million returned in underpayments, between 2005 and 2008.³⁷⁽²⁾ Hospitals accounted for approximately 94% of the recovered overpayments. The improper payments fell into three categories: incorrect coding (42%), medically unnecessary or insufficient documentation (41%), and other (17%). From the noted results, the importance of clinical documentation cannot be stated enough.

After discharge, the diagnoses in a patient's medical record are transcribed into medical codes, which are then used to obtain a particular MS-DRG, the basis which CMS uses for payment of services rendered for that particular admission to the hospital. If documentation in the patient's chart barely reflects the severity of illness, and fails to capture data accurately, then that MS-DRG reached would be inaccurate – a fact which leads to either over-billing or under-billing among medical coders, and subsequent under or over-payment by insurance providers.⁷ The CDI Specialist proactively helps combat potential RAC issues and scrutiny by interacting with the Physician to provide a complete picture of patient care from the onset, so that continuum of care is properly demonstrated in the thoroughness of documentation.

A successful CDI program resonates positively and connects all areas of the patient's medical record, from the time of admission through discharge, and even until billing for that particular record is submitted. Proper and more specific clinical documentation is usually reflected in a better and improved case mix index (CMI), length of stay, quality of patient care, and resource utilization.⁸

1.2.2 Program for Evaluating Payment Patterns Electronic Report

Consistent with Sections 1833(e), 1842(a)(2)(B), and 1862(a)(1) of the Social Security Act, the Centers for Medicare & Medicaid Services (CMS) was required to protect the Medicare Trust Funds against inappropriate payments that pose the greatest risk, and take the proper corrective actions.²² The Program for Evaluating Payment Patterns Electronic Report (PEPPER) was one of the tools implemented by CMS and is a cumulative, electronic data analysis and tracking report that provides hospital-specific Medicare-severity diagnosis related groups (MS-DRGs) data statistics for discharges vulnerable to improper payments due to billing, coding, and/or admission necessity issues.⁴⁸⁽¹⁾ PEPPER supports any healthcare facility's compliance efforts by identifying specific target areas where it may be a potential outlier. To determine if a short-term acute care hospital is an outlier, PEPPER compares that hospital to other short-term acute care hospitals in three comparison groups: nationwide, Medicare Administrative Contractor jurisdiction and the State. This data can help identify both potential overpayments as well as potential underpayments. The term “outlier” is used when the hospital’s target area percent is in the top twenty percent of all hospital target area percents in the respective comparison group (at/above the 80th percentile) or is in the bottom twenty percent of all hospital target area percents in the respective comparison group (at/below the 20th percentile (for coding-focused target areas)). Formal tests of significance are not used to determine outlier status in PEPPER.⁴⁸⁽²⁾

Figure 3: Sample MS-DRG target areas for short-term PEPPER data analysis (source, PEPPER User Guide, 17th Edition)

TARGET AREA Full and Abbreviated Title	TARGET AREA DEFINITION
Stroke Intracranial Hemorrhage (Stroke ICH)	<p><i>Numerator (N):</i> count of discharges for DRGs 061 (acute ischemic stroke with use of thrombolytic agent with MCC), 062 (acute ischemic stroke with use of thrombolytic agent with CC), 063 (acute ischemic stroke with use of thrombolytic agent without CC/MCC), 064 (intracranial hemorrhage or cerebral infarction with MCC), 065 (intracranial hemorrhage or cerebral infarction with CC or tPA in 24 hours), 066 (intracranial hemorrhage or cerebral infarction without CC/MCC)</p> <p><i>Denominator (D):</i> count of discharges for DRGs 061, 062, 063, 064, 065, 066, 067 (nonspecific CVA and precerebral occlusion without infarct with MCC), 068 (nonspecific CVA and precerebral occlusion without infarct without MCC), 069 (transient ischemia)</p>
Respiratory Infections (Resp Inf)	<p><i>N:</i> count of discharges for DRGs 177 (respiratory infections and inflammations with MCC), 178 (respiratory infections and inflammations with CC)</p> <p><i>D:</i> count of discharges for DRGs 177, 178, 179 (respiratory infections and inflammations w/o CC/MCC), 193 (simple pneumonia and pleurisy with MCC), 194 (simple pneumonia and pleurisy with CC), 195 (simple pneumonia and pleurisy without CC/MCC)</p>
Simple Pneumonia (Simp Pne)	<p><i>N:</i> count of discharges for DRGs 193, 194</p> <p><i>D:</i> count of discharges for DRGs 190 (chronic obstructive pulmonary disease with MCC), 191 (chronic obstructive pulmonary disease with CC), 192 (chronic obstructive pulmonary disease without CC/MCC), 193, 194, 195</p>

PEPPER helps to prioritize hospital-specific findings and provide guidance on areas in which a hospital may want to focus auditing and monitoring efforts. The report identifies areas of potential over-coding and under-coding as well as areas that may be questionable in terms of medical necessity of the admission. The analysis can narrow its data down to specific Physicians who are offenders and admit patients without justified medical necessity thereby increasing the chance of claims and payment denials, underpayments and overpayments. Through a period of time, a trend or pattern may become clear so that regular offenders are identified. It has been frequently identified that some Physicians treat very sick patients, but do not document accurately or enough to depict the patient's severity of illness. For instance, patient A with a history of congestive heart failure (CHF), presents to the hospital with worsening shortness of breath and dropping Oxygen saturation of 89% on room air. A chest x-ray was done and showed

fluid overload. The patient is given intravenous Lasix for diuresis and is placed on supplemental oxygen at 4 liters per minute through nasal canula. His Physician wrote orders for him to be admitted as inpatient for continued treatment and documented his admitting diagnosis as 'shortness of breath.' The patient was discharged after two days, with the same discharge diagnosis. The noted diagnosis is then coded and the claim is submitted for billing. The PEPPER will show this case as a potential denial due to lack of medical necessity and will outline this Physician's name.

In the above instance, documentation is clearly insufficient and inaccurate. If the Physician had noted the diagnosis to be 'shortness of breath from fluid overload', the diagnosis would have been coded to the congestive heart failure and would represent the actual picture of the patient's presentation. The work of the CDI Specialist in this case would be to interact with the Physician and query for the etiology of the shortness of breath, and if confirmed to be from fluid overload due to CHF, the CDI Specialist would also query to clarify the type and acuity of the CHF. This would provide the specificity needed for the record, justify medical necessity for admission, length of stay, and accurate reimbursement when the claim is finally submitted.

1.2.3 Case Mix Index

The CMI is an index used to depict a facility's severity of illness based on discharged patient population. CMI is computed as the sum of the relative weight (RW) of all Medicare discharged patients (based on the final DRG), divided by the total number of discharged Medicare cases.³⁷⁽¹⁾ CMI is one of the metrics of the CDI program performance. It should be noted that many factors affect and influence a facility's CMI

for any given period, including the age of the patients, acuity or severity of illness, co-morbidities, number and type of procedures performed, number of admissions in any given month, and the quality of documentation in the patient's medical record.³⁷⁽²⁾ The quality of documentation is the only factor that can be influenced by the CDI team.

An efficient CDI initiative promotes lesser post-discharge queries initiated by the medical coders as a means to help with clarification in the medical record. If the documentation in the record is provided by the Physician or allied healthcare professional to the highest degree of specificity and accuracy, then a post-discharge query may not even arise at all. This will help in reducing the number of cases that have been discharged, but not final-billed (DNFB) due to coding-related queries and subsequent delays, which in turn will ease the flow and increase speed of reimbursement for the hospital. CDI specialists ensure that complete clinical documentation is captured at the point of care, so that real time events are documented accurately as they occur. This promotes better interaction, communication, and education exchange among the CDI staff, Physicians, Residents, Nurse Practitioners, Physician Assistants, and other essential healthcare professionals. Most CDI specialists concurrently identify principal diagnoses, nonspecific documentation in need of clarification, and working MS-DRGs as part of their daily documentation improvement responsibilities.

Reimbursement denials in healthcare facilities are escalating at an alarming rate due to provision of inadequate documentation, and lack of medical necessity. Standard evidence-based practice guidelines like InterQual and Milliman are available to healthcare facilities for determining medical necessity to justify admitting a patient into the hospital as an inpatient. In some cases where 'inpatient' status is not met, the patient

may be placed on ‘observation’ status for a specified period, after which discharge is mandatory if criteria are not met for the patient to be admitted. Usually, this situation arises if the patient has been treated and is not critically ill, thus, has no need for continued stay in the hospital or if the patient’s condition has been handled sufficiently and the patient is back to the original baseline level of functioning. CDI specialists communicate and interact with the Physicians, and case managers to ensure that patients meet medical necessity for admission, thereby reducing reimbursement denials from insurance companies.

1.2.4 Length of Stay

Length of stay (LOS) is defined as the length of an inpatient episode of care, calculated from the day of admission to day of discharge, and based on the number of nights spent in hospital.² Patients admitted and discharged on the same day have a length of stay of less than one day. Medicare reimbursement to hospitals are made based solely on the MS-DRG classification system, where payments are bundled into one depending on the final DRG class obtained by a coder from the patient’s record after discharge. The payment for the DRGs is predetermined. The amount doesn’t change regardless of the cost of care. The only way for hospitals to make a profit is to provide care for the patient in a manner that is medically appropriate, discharge the patient in a very stable condition, while maintaining lower length of stay and keeping cost below the amount of the expected DRG payment. If cost exceeds the expected payment, then the hospital incurs a loss for that case (Table 1).

Table 1: Sample effects on a hospital's reimbursement using LOS metric for heart failure DRGs

MS-DRG type	Cases	ALOS	GMLOS	Variance	Hospital Expenses	Medicare Reimbursement
DRG 291 (CHF with MCC)	34 19%	9.08	4.6	+4.48	\$45,794	\$35,721 \$-10,253/case
DRG 292 (CHF with CC)	54 29%	5.17	3.7	+1.47	\$25,989	\$21,118 \$-4,871/case
DRG 293 (CHF w/o CC/MCC)	115 59%	3.49	2.6	+.89	\$20,468	\$15,496 \$-4,972/case

However, in some cases, a patient's LOS may get extended when some condition develops or worsens during admission. This may warrant the utilization of more intensive resources to stabilize the patient. Accurate documentation by the Provider will ensure that the correct diagnoses codes are captured. LOS and use of more resources will be justified, and the DRG will move to another class with possibly a higher relative weight, and much higher reimbursement.²⁶

1.3 CDI Trends and Process

Some healthcare institutions are choosing to implement CDI now to assist with the rapidly changing advances in the reporting of quality patient care, and to track key metrics for success, continued research, and innovation. The paper method of record keeping has become increasingly labor intensive and cumbersome, and many organizations are choosing to automate this process. Technological initiatives and approaches such as computer-assisted coding (CAC) and natural language processing (NLP) have become the tools used to accomplish this automation. However, as with

every new technology, there are some risks associated with the implementation. For example, there are limitations when using NLP in a hybrid record environment. It is important to properly investigate whether NLP can truly be beneficial to the organization to ensure that the appropriate technology is utilized. Technologies such as speech recognition, NLP, and CAC can only be effective and efficient if the documentation being captured and analyzed is of good quality.

1.3.1 Electronic Health Record

Electronic health records (EHR) changed the process of CDI dramatically. Although EHRs have been in existence since the 1960s, in 2009 their use increased greatly due to Federal Government subsidies. Spurred by incentives in the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009, electronic health records (EHR) are now widespread in the healthcare industry.¹

Globally, EHRs represent a positive development in healthcare. EHRs facilitate more efficient documentation collection and storage, promote patient safety and quality initiatives by allowing widespread access to health information, and allow for easier transaction of claims data for professional and hospital billing.³⁹ Increasingly, CDI programs now depend on the use of EHRs for querying physicians, capturing more specific and accurate diagnoses and procedures, and even tracking important CDI quality metrics such as query rates, physician response rates, complication and comorbidity capture rates, severity of illness, and risk of mortality scores.

More advantages are noted in the ability of the CDI Specialist to quickly review more records since eligibility is no longer a hindrance, thereby increasing productivity in

terms of number of charts reviewed per day; the CDI Specialist is able to query Physicians electronically and can notify, prompt or alert them easily through the same means to ensure timely response to the query; and the CDI Specialist can review records from a remote location without the need to stay onsite. This property enables hospitals to hire and retain experienced and qualified CDI staff that need flexibility through a work-at-home arrangement.

However, EHRs have some disadvantages and compliance risks being discovered as the technology improves. For instance, daily progress notes are usually duplicated without new modifications to reflect current assessment done for the patient.²³ There are also copy and paste functionality errors. Other reported problems with EHRs include:

- Inadequate physician and non-provider training related to EHR use
- Lack of onsite expertise to troubleshoot problems
- Physician time constraints, leading to inability to enter sufficient documentation
- Poor Physician buy-in
- Physician forms and templates lack indepth review and signature

EHRs often promote copy and paste functionality to save time, however, when used inappropriately, this can lead to reimbursement denials and/or allegations of medical fraud.

1.4 Study Purpose

This dissertation is a study designed to analyze the usefulness and impact of complex CDI software models used to capture data in hospitals for inpatient admissions, introduce a new customized CDI software model that is tailored to the specific needs of a

smaller healthcare institution, and determine whether it is more prudent and economical to acquire the more expensive popular CDI models or design a custom CDI model using in-house personnel who would be able to maintain, modify and analyze data sets as needed. Data sets obtained from a sample population over four years through entry in the new CDI software, will be used to conduct multiple analyses to determine impact of CDI and its implications in the healthcare setting.

Analyses and interpretations will be made from a number of sources including business intelligence, clinical analytics, and statistical modeling tools. Specifically, descriptive and inferential statistical analyses will be performed on the custom-designed CDI software data set to outline the usefulness of cost savings and eliminating unnecessary waste depending on the size of the hospital or healthcare facility requiring the services of the CDI software program.

This study will attempt to investigate the impact of CDI on some major hospital quality metrics like CMI, LOS, SOI, ROM, MS-DRGs, APR-DRGs and reimbursement. It will also showcase how statistical analyses obtained from these metrics affect a healthcare institution's profile and public data, which in turn may determine which consumers decide to use their services.

1.5 Study Hypotheses

Study hypotheses, based on descriptive and inferential statistical analyses of the data set obtained from the custom-made CDI software model seek to answer the following research questions:

1. Are there statistically significant impacts on a hospital's LOS, CMI, ROM,

SOI, and reimbursement based on the data set obtained from the SIM model?

2. Are there statistically more effective methods for obtaining or sending Physician queries with higher response rates than the SIM model?
3. Are there statistically significant differences or better benefits in utilizing other more complex CDI software models than the SIM model to calculate patient outcome?

1.6 Intended Results

Intended results from statistical modeling analyses described in the previous section of this dissertation will demonstrate that a considerable amount of money is spent in obtaining and maintaining several complex CDI software systems; whereas a simple customized design may achieve the same purpose, eliminating waste of resources in some smaller hospitals. Intended results of this dissertation will show that:

- There are statistically significant impact on a hospital's LOS, CMI, ROM, SOI, and reimbursement based on the data set obtained from the SIM model.
- Methods for obtaining or sending Physician queries and their response rates, are not statistically significantly better using other complex models compared to the SIM model.
- Utilization of a custom-made CDI model instead of a vendor-purchased model is statistically significant in terms of cost of purchase and continued maintenance.
- CDI software use increases and improves productivity.

- Good Physician queries and response rates are determined by the human factor.
- A custom-made CDI model is cheaper to design and maintain and may be the best economic choice for a smaller facility.

1.7 Study Significance

This study will be significant to the healthcare practice in the following ways: a smaller healthcare facility may decide to use or hire in-house trained personnel to achieve the custom design and continued maintenance of a CDI software tailored to its specific group of population – by utilizing only the needed data fields based on specific factors unique to, and required by the facility.

This process eliminates the high cost associated with purchasing and maintaining a popular CDI software. Additionally, if any field needs to be modified based on the needs of the hospital at any particular time, the custom software is easier to manipulate since the designers are in-house personnel who already know the specifics of the design parameters.

Also, the facility's worry and purchase of extensive security to protect confidential information when dealing with a more complex and global CDI software will be reduced since all information and security needs will be narrowed towards the system designed by in-house personnel.

CHAPTER II

RELATED LITERATURE

2.1 Role of Business Intelligence and Clinical Analytics in Healthcare

Before the Prospective Payment System was established, Physicians focused on taking care of their patients without concerning themselves with their length of stay, risk of mortality, and so on. Such concepts as Physician profiling, Medicare Administrative Contractors (MACs) and Recovery Audit Contractors (RACs) were uncommon, and things like documentation and reimbursement were not a concern.³⁹ In line with this is the rapid technological advancement that has seen most of the previous CDI models become less and less apt for Clinical Documentation Improvement.

Physicians are generally required to document experiences they have with patients in order to ensure that crucial information necessary for decision-making is captured and appropriate actions taken are recorded also. Documentation is also important as it acts as an archival storage of the happenings surrounding any hospital or clinical visit. Generally, Physicians dislike the task of documentation, since it detracts them from their primary task which is to take care of patients.³⁶ They also begrudge the duplication of effort brought about by documentation, since every medication written on a prescription pad, every x-ray ordered, and every lab test ordered require to be re-written in a chart so as to maintain a credible record. Communication between practitioners then becomes difficult because in most scenarios, the information collected is highly fragmented, recurrently redundant and voluminous.⁵⁴ Moreover, Physicians are continually inundated with new information with no tools to assist them incorporate these new methods and

treatments into day-to-day activities they are involved in, apart from using their memories or requiring lugging around voluminous textbooks.

The idea of patient information being recorded electronically rather than on a piece of paper, what we now call the Electronic Medical Record (EMR), has existed since the late 1960s with the introduction into medical practice of the idea of Problem Oriented Medical Record by Larry Weed.³² Prior to this time, Doctors usually only recorded their diagnoses as well as the treatment provided. Weed's innovation would help in generating a record that would enable a third party to verify the diagnosis independent of the first physician. In 1972, the first medical record system was developed by the Regenstreif Institute. Although this concept was widely recognized as a huge development in medical practice, most Physicians did not adopt the technology.³³ In 1991, there was a recommendation by the Institute of Medicine, a then highly respected think tank within in the USA, that by the turn of 2000, every Physician should have started using computers within their medical practice in order to improve patient care. Policy recommendations were also made on how to achieve that objective.

In 1983 with the introduction of the Prospective Payment System, the healthcare industry started to give more attention to physician documentation as well as relating it to medical necessity and reduction of costs. In the year 2007, the Medicare Severity Diagnosis Related Groups (MS-DRG) system was introduced by Medicare. In this situation, an additional level was added and secondary diagnoses became a new consideration. Each MS-DRG has three levels of severity for secondary diagnoses codes:

- Major Comorbidity/Complication (MCC), this reflects the highest degree of severity of illness;
- Comorbidity/Complication (CC), this is the next degree of severity of illness; and
- No comorbidity/Complication, this does not in any significant degree affect the severity of illness or resource consumption.³⁸

These Medicare severity-adjusted DRGs allowed the Centers for Medicare & Medicaid Services (CMS) offer bigger reimbursement to hospitals which served patients that were more severely ill. Hospitals are generally paid a fixed fee for treating all kinds of patients within the MS-DRG, despite the actual cost expended on each patient. Each MS-DRG is given a relative weight (RW). The weight is applied in adjusting for the consideration that different kinds of patients will consume different amounts of resources and they will be associated with different costs. Groups of patients that are expected to need above-average resources are assigned higher RW compared to those expected to need fewer resources.⁴⁹

In 2011, a new initiative was started by Medicare called Hospital Value Based Purchasing (HVBP) aimed at expanding the bundled payment concept so as to connect payment for multiple services received by patients during episode of healthcare. The objective of today's bundled payment system by Medicare is to offer incentives to clinicians to deliver healthcare in a more efficient manner while at the same time maintaining and improving the quality of care. During the 2013 fiscal year, CMS reduced the base operating DRG payment provided to all hospitals entitled for reimbursement under the Inpatient Prospective Payment System (IPPS) framework by 1%. This number is expected to gradually increase to 2% by the fiscal year 2017. The

money that is withheld from this initiative is intended to be utilized in creating an incentive fund from which the agency will reimburse hospitals based on how they perform in certain domains regarding quality measures. These funds are approximated to have reached about \$850 million. In that case, hospitals are given an opportunity to recoup payments withheld from them by improving the quality of their healthcare.

2.2 Current Challenges and Trends

With the healthcare industry continuing to evolve, there are certain global drivers as well as industry trends creating ongoing challenges. These are:

- **Increased government reform:** with such initiatives as the Accountable Care Act, Pay for Performance, Meaningful Use, and National Agency Reporting. This gives healthcare greater exposure to the public in regard to the quality of care provided by hospitals.
- **Globalization:** Travel and migration, medical tourism, prevention of epidemics are bringing new challenges to the industry.
- **Aging population:** With the older generation growing at an increasing rate, more complex healthcare is required, coupled with shrinking reimbursement to hospitals.
- **Economic recession:** hospitals are being asked to offer better quality care but with less resources; healthcare facilities have less funds to spend on innovation while providers continue to consolidate as economic times get harsh.
- **Growth of data:** healthcare industry has a lot of data but very little information; as medical knowledge increases, there is a growing need for comparative data, but

EMRs are not designed to analyze data.²³ As such, the challenge is to decrease costs while improving quality. Specific challenges are such as:

- i) **Quality:** need to provide accurate and consistent documentation that offers the specificity required for ICD-10 as well as reducing exposures to abuse and fraud.
 - ii) **Financial:** need to reduce costs of labor, denials and DNFB while at the same time optimizing reimbursements.
 - iii) **Strategic:** need to create integration of clinical data in order to support IT, HIM as well as financial goals.
- **Human Resources:** the need for resource management, outsourcing, monitoring, and role consolidation. Additionally, there is the need for employee training and developing not just in regard to ICD-10 but also on other initiatives such as value-based purchasing, and so on.

2.3 The CDI Program

The CDI programs have become increasingly essential as hospitals battle with increasing regulatory requirements as well as optimizing reimbursement within the MS-DRG system, which demands that severity of illness be captured. Initially, HIM professionals depended on major indicators like hospital acquired conditions (HACs), present on admission (POA), and also recording secondary diagnoses as MCCs and CCs. Currently, providers are required to assess the entire patient experience – treating and caring for them through discharge from the hospital. With the Accountable Care Act, Meaningful Use, ICD-10 and continuing RAC initiatives, CDI programs have become

every healthcare organization's "survival kit."³⁷⁽³⁾

According to the Advisory Board Financial Leadership Council, 67% of healthcare systems have initiated CDI programs for their facilities. However, they are stifled by insufficient staff as well as inadequate tracking mechanisms. The rest 33% do not have a CDI program incorporated in their facility. CDI programs are modeled to fill the discrepancy between ambiguous clinical documentation and coding tendencies, by obtaining accurate written information from the providers, bringing in improved accuracy in coding, appropriate reimbursement and better reported outcomes.⁹

2.4 Existing CDI Models

2.4.1 DocuComp Trac™ Model

DocuComp Trac™ Clinical Documentation Improvement software was developed by DocuComp® LLC. It is a fully featured interactive database application that tracks and analyzes all aspects of clinical documentation, converting the data into real time reports formatted into tables and charts, accessible from any computer with an internet connection. The utilization of intuitive dashboards allows customization to meet unique CDI department's needs for optimizing workflow and increasing productivity.

This software continuously tracks and calculates the impact made by CDI personnel including realized revenue. Real time concurrent analytics and reporting allow a view of statistics for that exact moment, allowing users to track trends and proactively implement improvement measures as changes occur.

At-a-glance Business Intelligence – the software includes views of any format (chart's, tables, calendars and more) and information base (revenue, queries, physicians

and more) customized to the facility's preference, compiled on one page and fully interactive. It provides streamlined data management and quantitative informational results in one click.

Streamlined Workflow to enhance productivity – the software provides current listings of all cases easily customized to reveal those in progress, completed, needing review, awaiting query response and more in individual choice of format, on one dashboard page available as start page once logged in. **It** minimizes the time required for data entry as data is entered one time in one place.

Simplified user navigation - From each page you can add a case, search, work on case in progress, add a query, and more. The dashboard may be customized to include all frequently used data and pages are accessible with one click. Data is organized, managed and stored at time of input.

DocuComp TracTM tracks and calculates the following:

- MS-DRG assignment
- Original MS-DRG's relative weight and revised MS-DRG's relative weight to continuously calculate the financial impact
- Physician queries and response clarification to determine the impact of clinical documentation
- Overdue, incomplete, completed and discharged cases to determine efficiency of CDI
- Revenue generated by accurate documentation
- Revenue missed by under coding due to ambiguous, incomplete or absent documentation

DocuComp TracTM software has the following properties: it ensures compliance, contains internal listings of MS-DRGs with relative weights, creates key performance indicators, generates daily work list filters cases for review by multiple criteria, provides information in a variety of formats for greater visual impact and clearer understanding, organizes, manages and stores data at time of input, and provides user management and security by allowing assignment of roles, locations and groups.³⁰

Figure 4: Sample interactive dashboard generated by the DocuComp Trac Model (source: DocuComp LLC website)



2.4.2 ChartWise 2.0 CDI Model

ChartWise 2.0 CDI, is a Computer-Assisted Clinical Documentation Improvement (CACDI) software system designed to improve precision in quality clinical documentation to support revenue assurance. The program is easy for medical

professionals to understand and use, has a light technological footprint, and offers hospitals a way to mitigate risk, maximize reimbursement, and gain insight into their medical documentation improvement efforts. The software has the following capabilities:

- The built-in intelligent expertise guides Physicians and CDI Specialists toward a complete diagnostic picture, using lab data, medications and procedures to help find complications and additional diagnoses that have not been specified completely in the Doctor's notes.
- System-generated suggestions help identify possible diagnoses to query, resulting in more complete documentation.
- AHIMA-compliant electronic queries are easy to create, and the application will send the Physician an email. The Physician logs in, responds to the query with a few clicks, the response is recorded and the query is completed. The CDI Specialist may still print the query if desired, and leave it for the Physician in the chart, entering the reply to capture the information.
- The software has the ability and intelligence to offer suggestions for additional diagnoses automatically triggered from the lab data, medications, existing diagnoses and procedures, helping find complications that might otherwise have been overlooked and gone uncoded.
- Extensive on-demand reporting tools provide the documentation and tracking to support the CDI program. Program impact, case mix index, response rates, complication rates, query reasons, and APR severity and mortality rates are among the included reports— available with a click of the button.

Figure 5: ChartWise 2.0 Demo showing multiple reports on a single dashboard screen (source: ChartWise website)

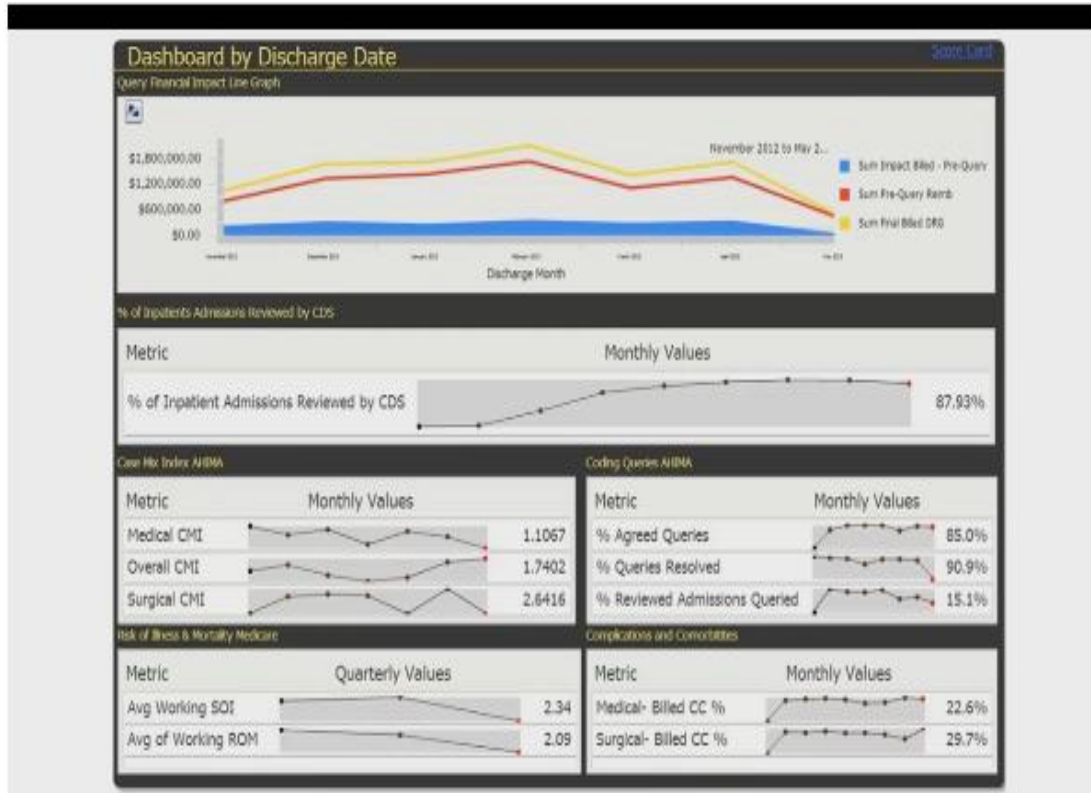


Figure 6: ChartWise 2.0 demonstration of CDI revenue impact at a glance (source: ChartWise website)

CDI Impact Report							
CDS Owner	Discharge Month		Pre-Query Reimb	Post-Query Reimb	Final Billed DRG	Impact Post-Query (-) Pre-Query	Impact Billed (-) Pre-Query
CDS 1	September	2012	\$115,743.16	\$196,080.16	\$209,468.06	\$80,337.00	\$93,724.90
	October	2012	\$126,232.36	\$171,783.40	\$185,764.82	\$45,551.04	\$59,532.46
	Total		\$241,975.52	\$367,863.56	\$395,232.88	\$125,888.04	\$153,257.36
CDS 2	November	2012	\$196,645.75	\$228,345.49	\$273,606.64	\$31,699.74	\$76,960.89
	December	2012	\$329,791.46	\$401,350.13	\$391,953.58	\$71,558.67	\$62,162.12
	January	2013	\$100,841.22	\$106,194.78	\$106,562.66	\$5,353.56	\$5,721.44
	Total		\$705,179.56	\$819,287.03	\$861,175.12	\$114,107.47	\$155,995.56
Total			\$6,594,765.43	\$8,048,174.31	\$8,229,201.96	\$1,453,408.88	\$1,634,436.53

2.4.3 The Optum CDI Model

Optum CDI model is founded on a three-tiered model of information. This model relies on a discreet data baseline called clinical indicators, which come together to compose clinical scenarios. These scenarios, taken together, become the evidence for clinical markers. These Clinical markers provide the platform for CDI specialists to query the physicians in regard to potential documentation deficiencies. The description provided below provides a deeper understanding of how this model functions;²¹

- **A clinical indicator;** this is a specific fact or event that is recognized by NLP engine. Clinical indicators constitute discrete data points derived from either structured or unstructured sources captured from various components of medical

records. Examples of clinical indicators are pieces of information derived from an EMR, results of tests done in the lab, from radiology, and pharmacy systems, or results documented or observations reduced into transcribed or typed notes.

- **A clinical scenario;** this is a group of indicators which, when combined, form points of evidence for a given diagnosis or procedure. All clinical scenarios by Optum are derived from collaborations with clinical experts as well as with national references and other standards developed for identifying CDI opportunities. Each scenario is assigned a strength level starting from high, medium, and low, and demonstrates how indicating the probability of these scenarios yields a result.
- **A clinical marker:** this is a representation of one or more scenarios, every one of which may find the clinical profile of a specific condition. If that condition was not documented as required in terms of specificity or with definitive clarity, then a marker will provide the evidence supporting a physician query.

The three-tiered information model for this program renders the technology consistent in terms of how it represents information as well as in making the technology scalable. This software can integrate new markers, and can also reuse indicators for different scenarios and even go beyond different markers. In addition, the software does not curtail the quantity of clinical markers that may be associated with a given case.³⁴ The LifeCode's compositional NLP technology enables this information model to be possible. The NLP engine is able to review data stored within various parts of the medical record as well as combine these indicators into cohesive scenarios.

The traditional CDI program addresses two kinds of documentation deficiencies.

These are: specificity and clinical clarity. Whenever Physicians use such clinical terms as “CHF” or “kidney disease,” but the documentation requires a more specific diagnosis, a CDI specialist can request additional specificity by asking for the type and acuity of said diagnosis. However, when Physicians use such vague terms as “fluid overload,” the CDI specialist will need additional clinical clarity by presenting the treating Physician involved with a collection of relevant clinical data and requesting that a diagnosis be identified to explain the etiology of the fluid overload. The Optum CDI Module is specifically involved in identifying such documentation deficiencies, i.e. the easier “specificity” deficiencies, and also the more difficult “clinical clarity” deficiencies.⁵¹

The NLP engine continuously analyzes the components of a patient’s record, i.e. Physician documentation, diagnostic testing, nursing, lab work, and other clinical documentation, as more data are added to the case. Optum CDI Module sums up clinical indicators within the documentation, then applies specific rules that can help trigger CDI workflow when the indicators condense into scenarios meeting the requirements for a low-, medium-, or high-strength CDI marker. Workflow routing rules that are configured by the provider healthcare determine which cases require to be reviewed by a CDI specialist, and on review, whether any individual case warrants a query. If a query is needed, the technology automatically generates a compliant query based on scenarios making up the clinical markers. Since the scenarios are integrated in the query, together with appropriate references to patient record, Physicians are able to see exactly what necessitated the query. The capability helps free the CDI specialists or coders from building a query that is needed clinically.¹⁰ It also helps the healthcare facility remain compliant.

Linking the CDI Module with Optum CAC solution makes the query process more efficient and improves downstream coding. As the CDI specialist reviews cases and manages queries, the NLP engine continuously suggests codes. Although coding the case does not become final until after the patient has been discharged, the CDI Module will automatically validate its findings against codes suggested by Optum CAC as they are added.³¹ When the CDI Module identifies a clinical marker for sepsis, but the NLP has already suggested a code for sepsis which matches the degree of severity of the clinical marker, no further clarity will be required by the case and the system will resolve the marker without shifting the case to the CDI workflow.

Whenever a query is needed and prompts the Physician to add specificity or more clinical clarity into the medical record, NLP technology resets the analysis of documentation, resolves the clinical marker, while also updating the suggested code.³² After the patient has been discharged and the case ready for coding, the particular documentation and codes associated with it are likely to be accurate and more complete. Since coders are able to see a history of CDI activities as well as physician queries, they are not likely to request a retrospective query but more likely to pick the correct code set.

2.4.4 UPMC CDI Model

As a cheerleader in automating manual coding processes with the use of NLP, UPMC was determined to supercharge its CDI program using a concurrent program supported by an automated, NLP-based solution. With the firsthand knowledge of the benefits offered by Optum's advanced compositional NLP system, it chose Optum as a development partner. Therefore, Optum and UPMC together launched the healthcare's

industry's first inpatient computer-assisted coding solution in the year 2008. The CAC system that resulted, now known as Optum CAC, was found to be accurate, efficient, and effective, and helped organizations to dramatically increase the case mix index as well as coder productivity.³⁵

The Optum CAC was developed having an intuitive user interface as well as an optimized workflow, and based on a high-powered, sophisticated NLP engine, known as LifeCode®. This CDI solution is module of Optum CAC and adheres to similar successful template. It utilizes the robust LifeCode technology together with CDI-specific business rules, and leveraging them for exact, automated CDI case-finding and physician querying, being the most time-consuming components of a CDI workflow. This Optum CDI Module optimizes the efficiency and productivity of CDI specialists. Through automation of patient medical record review, the CDI Module is able to review hundreds of cases every day and identifies those having a high probability of documentation improvement.

2.4.5 Nuance CDI Model

Nuance is a Clinical Documentation Improvement that is powered by Nuance's Thomas & Associates also referred to as JATA, and offers clinically based strategies in the Compliant Documentation Management Program (CDMP®), and provides hospitals with a clear path for easy navigation and transition into the new era. Apart from the Clinical Documentation Improvement, Nuance also offers Clintegrity 360 CDI software, which is based on advanced speech recognition as well as natural language processing technologies. There is also the Clinical Language Understanding infrastructure (CLU)

which helps to improve accuracy and efficiency in clinical documentation.²⁹

Nuance also provides CLU-driven solutions which include Computer Assisted Physician Documentation (CAPD), Computer Assisted Coding (CAC), Computer Assisted Clinical Documentation Improvement (CACDI), together with several other best practice support offerings which could be promulgated from the CLU. Nuance's optimal combination of clinical approaches and automated workflow processes facilitate healthcare organizations in transitioning smoothly.

Clinical Documentation Improvement provides the largest opportunity for engaging healthcare systems and hospitals at whatever stage with their journey in transition. Due to the nature of the Clintegrity 360 CDI solution by Nuance and the JATA approach to CDI, Nuance is able to engage a healthcare facility that is primarily paper-based all the way through to a fully integrated electronic clinical documentation system of care. This is crucial since clinical documentation improvement forms one of the biggest and most necessary key factors in the transition process.²⁴ It allows optimization not only of revenue within the existing fee-for-service system, but also begins to create a much stronger image of the degree of severity of illness for the population requiring care within a value-based payment system in the second era. The more a hospital delays working on this challenge, the more they are positioning themselves further behind for success.

As such, this basic building block requires to be strategically imperative for any given hospital and healthcare system in the country. This is a strategic imperative due to several reasons. First, it helps a healthcare facility reduce the effect of the significant variation that occurs due to the current clinical documentation and coding practices in the

country. The sooner a healthcare facility begins the path to manage that variation, the better it will be positioned to understand the population it cares for, along with optimizing revenues required to care for the population. This is important because of the serious delays regarding the ability of policymakers currently to access timely data. Failure of an organization to begin the process now will only lead to an understatement of the actual severity of illness of the population during the transition from fee-for-service to the value-based care payment as they will become predominant.

The recognition and solution for this dilemma is seen through implementation of Clinical Documentation Improvement programs as well as the utilization of a CDI software such as the JATA CDMP®, to help streamline the process. Statistics show that there is a consistent 4 - 8% enhancement in Case Mix Index (CMI) when these programs are implemented. Even though implementation requires tremendous amounts of revenue due to the size and scope of this system, it also means there will be a significant understating of the real population's severity of illness existing prior to implementation of the new CDI program. Both factors are absolutely crucial to the success of an organization in managing change.

The reason Nuance's CDI software solution has been largely successful in this aspect is due to JATA's clinical-based approach to CDI. Whereas most CDI programs utilize coding software as the base, JATA approaches CDI from a clinical or physician/patient perspective. By taking into consideration the clinical nature of a patient, and the clinical as well as the patho-physiological documentation by the healthcare provider, the physician in his documentation is guided through software as well as trained clinical documentation specialists through the establishment of a clinical dialogue. The

documentation that results utilizes the appropriate clinical language understandable by the coders, in order that they can apply the correct codes to describe the patient and the severity of their illness more accurately. Although the revenue consequences of such significant changes are fairly obvious, the effect on the severity of illness for a facility's target population, is monumental.

The significance of these outcome variations cannot be understated. However, more importantly, the CDI program by Nuance powered by JATA provides a vital strategic initiative that should be undertaken by all hospitals and healthcare systems. Implementation of this CDI program provided by Nuance creates an environment within which hospitals can be able to maximize current revenues in a fee-for-service world while at the same time establishing a strong and more realistic severity-adjusted view of their target population. This new view of their target population will help set the reimbursement degrees in an accountable care organization (ACO), and population-based payment system to the future. The Clinical Documentation Improvement program by Nuance helps hospitals transition between two curves - to survive the move from the fee-for-service, and then guarantee success within the value-based economy.

2.4.6 Clintegrity 360 CDI Model

This system helps to reward and reimburse healthcare providers for quality care and outcomes. To meet these objectives, new reimbursement models have been developed, rendering complete and compliant codes more critical. Clintegrity 360/Computer Assisted Physician Documentation helps increase the accuracy and specificity necessary in physician documentation by utilizing a clinically focused

technology solution. This is very crucial for success within the new regulatory regime. Clintegrity 360 also helps to ensure a complete capture of a patient's complexity, severity of illness, complications, risk of mortality, and 'never events' which not only impact on payment, but also defines the hospital's case mix index, that will have a direct impact on incidences of reimbursement. Entering accurate clinical data is crucial in proactively managing preventable readmissions, physician profiling, negotiating managed care contracts, and hospital performance reporting. Also, federal programs including the Medicare Recovery Audit Contractors (RACs) make the documentation process a lot more complex than it has ever been before. Perhaps the greatest challenge involves the transition to ICD-10, which incidentally places physician documentation at great risk.

Increased application of Clinical Documentation Improvement programs in major healthcare systems has produced positive results for Clintegrity 360. However, traditional CDI programs need labor intensive manual data collection and will undergo evaluation in order to maintain the current rates of reimbursement in ICD-10. Majority of organizations are using Computer Assisted Coding solutions that help make coders more productive. Due to the fact that coders are still required to validate the codes suggested by CAC, putting enough attention on the clinical documentation source ensures that the transition to CAC has also been set up for success. The Clintegrity 360 CAPD program supplements current CDI tools existing in the market but also differentiates from these by offering real-time documentation support when physicians dictate—and by so doing gives additional incentives for physicians to voice their ideas rather than just do tedious data entry. One of the major obstacles to physicians adopting electronic templates is navigating lists of diagnoses as well as picking values for defining such details as status,

timing and location. Predictably, with the increase in the number of diagnoses and their different attributes, structured data entry tools are expected to become more burdensome.

Clintegrity 360 CAPD assists physicians to capture the necessary information for coding in ICD-10, which is in real time, on the point of documentation without availing manual data entry. The CDI specialists are left with fewer documentation gaps to manage, and coders are provided with the information necessary to access the most appropriate codes in regard to each patient which is achieved by allowing physicians to capture fully detailed, complete documentation upfront.²⁰

An important component of the Clintegrity 360 CAPD is the Clinical Language. CLU is a complex software technology with the ability to parse clinical notes while capturing key clinical findings in these notes, such as diagnoses, allergies, vital signs, medications, or social history items. They are then standardized from descriptive expressions into ICD-10 codes using a wholly compliant and predictable manner by the software. The second component is Clintegrity 360 | Clinical Documentation Improvement (CDI). This is a technology that uses extensive knowledge of the coding system by ICD-10 in order to determine whether there is need for more information so as to help in assigning the most accurate codes.¹¹ The power of the two technologies when combined offers a solution that, in real time, translates the voice of a physician into text, analyzes it to identify any gaps and ambiguities that may affect coding accuracy, then immediately provides targeted feedback to the physician to be incorporated into his notes.

Clintegrity 360 CAPD automatically detects missing information, unspecified diagnoses or unclear associations in relevant findings.⁴⁹ Then, it highlights them for the consideration and correction by the physician. For instance, a patient is admitted to

emergency room due a serious episode of asthma attack. Typically, a Doctor would record “acute asthma exacerbation” as the reason for the patient admission. ICD-9 provides only one code assigned to this diagnosis. However, ICD-10, has four possible codes, which are based on the severity of the asthma episode from mild, intermittent, mild moderate, to severe persistent.⁹ More information is required in determining the ICD-10 code that is most clinically useful. A Computer-Assisted Physician Documentation software requires that the physician, while dictating, adds the severity factor by dictating the extra text or by allowing the Physician to choose the correct description provided by the system.

2.4.7 EPIC CDI Model

EPIC, which stands for Executive-Process Interactive Control, enables both procedural-cognition as well as motor control and perceptual-motor communications to be treated more explicitly and parsimoniously in combination with formal hypotheses in regard to supervisory executive cognitive processes as well as task-scheduling strategies. With such treatment, it is possible to construct precise computational models to explain and predict response accuracy, the reaction times (RTs), and other measurable features of people's overt behavior within various domains requiring that multiple tasks be performed concurrently.

A major bottleneck that may arise while seeking to use the existing EPIC models in clinical documentation improvement is the human interface design. Even the highest

performing hardware or software may be seriously hindered if the person operating the system must work slower than is necessary. Thus, modeling human interfaces for healthcare systems that help in maximizing the total performance of the system is crucial to the future success of the rapidly evolving healthcare technology. A more cost-effective method of achieving this would be to use human performance models to develop the human-system interaction, in order that the quality of the interface may be assessed faster. Recent developments in cognitive science have enabled construction of such models quickly and effectively, while research also validates the predictions provided by such models.

Human performance in a task is simulated by programming the cognitive processor with production rules organized as methods for accomplishing task goals. The EPIC model then is run in interaction with a simulation of the external system and performs the same task as the human operator would. The model generates events (e.g. eye movements, key strokes, vocal utterances) whose timing is accurately predictive of human performance.

2.4.8 EPicCare CDI Model

This is a hospital's electronic health program used in clinical documentation improvement. It integrates both inpatient and outpatient clinical records together with registration, billing, appointments, and other related functions. This is a single system but which integrates the functions of a total of 65 current systems. It was created using software developed by Epic Systems Corp., but has been modified in order to accommodate how a healthcare system works. It is believed that EpicCare has the

potential to take the healthcare CDI program to new global heights to become the worldwide leader in healthcare. EpicCare provides high quality in the following areas:

- Patient care
- Education
- Innovation
- Research

EpicCare helps healthcare facilities enhance quality, improve safety, as well as standardize patients' experience of healthcare wherever they are seen. Also, the program ensures that patients experience similar type of care whenever they are being served. The program is able to offer an increased quality of care compared to other programs as a result of:

- Improved continuity of care
- Thoroughly coordinated care planning
- Enhanced patient safety
- Better integration of best practice and evidence-based medicine
- Easier scheduling as well as simplified billing

2.5 Solutions Offered By the New CDI Model

The key function of clinical documentation is to reflect the patient's condition as well as the services provided more accurately and also to serve as a channel of communication between the various clinical providers. Failure to provide accurate and complete documentation may result in the utilization of nonspecific and general codes, something which will impact on data integrity and reimbursement as well as potential

compliance risks for a healthcare facility. One of the main benefits offered by an integrated CDI program is providing a concurrent, intuitive documentation clarification process that would minimize the negative impact associated with downstream coding activities.³ Technology is able to allow documentation review concurrently and also ensure that a physician is as precise as possible during capturing of data relating to severity of illness as well as the acuity of their patient's condition.

The SIM CDI model was designed with specific factors in mind:

The cost associated with acquiring and maintaining existing CDI models are very high and run in hundreds of thousands of dollars. This is a major undertaking for any healthcare institution that decides to automate its CDI program considering the extensive advantages involved. However, for a smaller facility, this cost may be substantial and unattainable based on its budget. The SIM CDI model will eliminate the need to use extensive monetary resources since it is very simplistic in design and nature, and requires little management or maintenance protocols.

CDI professionals work hand in hand with each other within any organization. They review cases concurrently while the patient is admitted, and ask Physician queries when obtaining, clarifying or specifying diagnoses are warranted. Data entry within the SIM CDI model is very simple and detailed. This enables cross-coverage by other CDI Specialists when the original reviewer is absent for any reason, if another CDIS is on vacation or doesn't work there anymore. Also, it is easier to do a second or follow-up review during cross-coverage without needing to start a fresh review of a patient's medical record.

Most existing automated CDI models incorporate NLP and CAC to ease the

workflow process by suggesting codes to improve specificity based on existing clinical markers, and automating queries that allow Physicians to provide clarification. However, despite this useful quality, the systems may not be able to fully co-ordinate diagnoses together when a combination code is required per coding guidelines, for example if a Physician documents hypertensive heart disease in one section of the medical record, chronic kidney disease, and then exacerbation of diastolic congestive heart failure (CHF) in another section – no connection is made to code these diagnoses to hypertensive heart and renal disease with diastolic CHF exacerbation, which is a coding guideline and uses combination codes 404.91, 428.32, 585.9, and 428.0. Human factor is still basically required to make the connection and decipher if the suggested codes or queries are necessary, and to make corrections if not. This takes some amount of time to achieve and sometimes, may be counter-productive. The smaller, custom designed model eliminates this problem by allowing the CDIS to generate a clinically relevant query as needed – when impact on DRG, reimbursement, SOI or ROM will be affected; to build codes and queries specific only to the patient's unique case using clinical indicators and discard unnecessary ones. This makes them spend less time in each case, thereby increasing productivity and efficiency. Less time will be spent on one case and many more relevant cases may be reviewed by the CDI Specialist.

In the modern healthcare environment, correctly measuring for quality is crucial. Quality scores are brought to the public domain, and facilities are compared with each other, which affects where insurers steer their members and also where patients choose to go for inpatient care. By implementing a concurrent CDI program using the custom designed SIM CDI Model, healthcare facilities lower their external audit risk.

Documentation accuracy as well as completeness increases, and the numbers of retrospective queries decrease.

Modifying existing popular models is a very difficult and extensive task that may involve many different levels of protocols and requests before any changes are made to suit the needs of an institution. However, with the SIM CDI model, modifications are very easy to achieve since maintenance is done by existing in-house personnel who designed it or have been trained on how to maintain it. Healthcare facilities can change specific parameters based on target population being reviewed or identifying the specific kinds of cases to review.

Data analyses using information obtained from the SIM CDI model are simpler and more directly related to needed parameters, requiring very little or no cleanup of unnecessary collected or junk data that may be present in other popular models. For example, in-house personnel may be required to track mortality ratios for patients diagnosed with ‘severe sepsis’ over a period of time. Data collected from the SIM model may be used easily to track this ratio (Table 2).

Table 2: Sample Quarterly Severe sepsis cases mortality percentage report (2010 – 2012)

Month	Severe sepsis (Numerator)	Severe sepsis (Denominator)	Percent
Q2 2010	32	142	22.5%
Q3 2010	32	146	21.9%
Q4 2010	29	137	21.2%
Q1 2011	31	126	24.6%
Q2 2011	53	186	28.5%
Q3 2011	41	157	26.1%
Q4 2011	34	142	23.9%
Q1 2012	43	140	30.7%
Q2 2012	48	177	27.1%
Q3 2012	49	205	23.9%
Q4 2012	34	184	18.5%

The SIM CDI model was designed to assist smaller healthcare facilities that cannot afford the huge cost associated with purchasing and maintaining the complex CDI models already existing. In most cases, these smaller facilities may have or not transitioned completely to EHR, or they may have an existing EHR model like HMS (Healthcare Management Systems Inc), which is efficient only for a small, up to a 400-bed facility. For those facilities that have partly transitioned to EHR, the SIM CDI model can simply provide their needs and is able to calculate patient outcomes based on data entered into it by the CDI Specialists. Tracking, trending and data analyses are easier to obtain since it is a smaller system and simpler to manipulate in any required capacity.

CHAPTER III

METHODS OF DATA ANALYSIS

3.1. SIM CDI Data Set Overview

The sample data set used for this dissertation, is a compilation of all data entry made by four CDI Specialists working in sample Hospital A located in New Jersey, during the period from April 2010 through March 2014. Microsoft Access database was used as the base to design the SIM CDI model. It is important to note that all patient confidentiality rules were complied with, during the procurement and extraction of the data used for the analyses contained in this Dissertation. The data set comprises about 29,790 total cases available for review by the CDI team over the four years (Table 3). Of these cases, 23,409 or 78.5% were actually reviewed (Table 4). The remaining 21.5% of non-reviewed cases were part of the exclusion list for this hospital which included cases from the Psychiatry, mother and baby, newborn, rehabilitation, one-day-stays, and observation units. About 4,882 or 18.5% Physician queries were generated out of the actual reviewed cases by the CDI Specialists (Table 5).

Table 3: Total number of patient cases admitted by Hospital A

	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Year 1	414	432	445	502	404	431	569	370	498	473	482	497
Year 2	717	440	570	695	551	703	515	466	581	564	651	938
Year 3	630	674	838	599	821	640	688	829	675	730	699	823
Year 4	678	803	696	621	862	615	678	751	643	752	539	598

Table 4: Total number of actual cases reviewed by CDI Specialists

	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Year 1	318	311	294	358	292	308	401	250	374	352	355	407
Year 2	578	375	456	531	395	509	354	358	455	445	504	713
Year 3	531	548	683	475	628	500	555	675	561	629	560	684
Year 4	559	694	602	515	740	540	563	610	509	659	487	509

Table 5: Total number of Physician queries generated by CDI Specialists

	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Year 1	128	92	89	113	91	70	90	66	75	60	76	106
Year 2	164	109	83	138	95	120	82	72	72	111	93	153
Year 3	113	125	152	150	121	125	123	111	77	108	78	108
Year 4	97	103	65	64	109	67	75	128	96	134	111	94

3.2 SIM CDI model Framework

The SIM model is a custom-made data entry system which incorporates all the required elements and fields specified by the sample Hospital A, needed for detailed CDI review. Data is comprised of the inpatient census for the hospital. Typically, the CDI Specialists reviewed cases for patients that were already admitted for forty-eight hours. Patient census and demographics were input into the system through a module developed to import data from the hospital SQL server. The system's interface is used to input data obtained from reviewing the patient's record obtained through paper or electronically.

Figure 7: SIM CDI model user interface for data entry – section 1

CLINICAL DOCUMENTATION IMPROVEMENT WORKSHEET

PT NAME: ACCOUNT NO: 0

UNIT: MEDICAL RECORD NO: 000000000

ROOM NO: BED: DATE OF ADMISSION:

PHYSICIAN: DATE OF DISCHARGE:

CLASS: DATE OF REVIEW:

REVIEWER: * Please fill out date of review and reviewer

ER INFORMATION | HEMATOLOGY/CHEMISTRY | URINALYSIS | PROCEDURES/DIAGNOSTICS | RESPIRATORY | DIAGNOSES/DRG | COMMENTS

ER INFORMATION

Chief Complaint

Past Med Hx

Primary Dx

Additional Dxs

Systems Review

ER Medications

INITIAL VITAL SIGNS

O2sat Mode

BP Pulse

Temp Resp

BODY MASS INDEX

Height

Weight

BMI

The patient demographic information is always prefilled from imported hospital admission data, is fixed or constant, and does not change when the user moves within tabs to enter data in the system. The system is able to save all entered information automatically or the user has the option to save at any time.

The Emergency Department is usually the first port of entry for the patient and represents a very important source where almost every pertinent information about the patient - past medical history, first vital signs, insurance information, presenting factors and complaints - are all obtained and documented. The first interface shown above for

data entry is regarded as the most important, for the CDI Specialist to obtain a quick, yet detailed summary and overview about the patient. Each field is very pertinent to determine the specific course of action to be charted for the patient.

Figure 8: SIM CDI model user interface for data entry - section 2

CDI... Daily worksheet

CLINICAL DOCUMENTATION IMPROVEMENT WORKSHEET

PT NAME: <input type="text"/>	ACCOUNT NO: <input type="text" value="0"/>	Search
UNIT: <input type="text"/>	MEDICAL RECORD NO: <input type="text" value="000000000"/>	
ROOM NO: <input type="text"/> BED: <input type="text"/>	DATE OF ADMISSION: <input type="text"/>	Save
PHYSICIAN: <input type="text"/>	DATE OF DISCHARGE: <input type="text"/>	
CLASS: <input type="text"/>	DATE OF REVIEW: <input type="text"/>	Print
REVIEWER: <input type="text"/>	* Please fill out date of review and reviewer	

ER INFORMATION
HEMATOLOGY/CHEMISTRY
URINALYSIS
PROCEDURES/DIAGNOSTICS
RESPIRATORY
DIAGNOSES/DRG
COMMENTS

HEMATOLOGY

*	CBC Name	Value	Date

TRANSFUSIONS

*	Transfusion	Date	Units

CHEMISTRY

*	Electrolytes	Value	Date

CARDIAC MARKERS

*	Component	Value	Date

Figure 9: SIM CDI model user interface for data entry - section 3

CDI... Daily worksheet

CLINICAL DOCUMENTATION IMPROVEMENT
WORKSHEET

PT NAME:

ACCOUNT NO:

0

Search

UNIT:

MEDICAL RECORD NO:

000000000

Save

ROOM NO:

BED:

DATE OF ADMISSION:

PHYSICIAN:

DATE OF DISCHARGE:

Print

CLASS:

DATE OF REVIEW:

REVIEWER:

* Please fill out date of review and reviewer

ER INFORMATION

HEMATOLOGY/CHEMISTRY

URINALYSIS

PROCEDURES/DIAGNOSTICS

RESPIRATORY

DIAGNOSES/DRG

COMMENTS

URINALYSIS

Component

Value

Date

*

COAGULATION

Component

Value

Date

*

URINE CULTURE

Component

Value

Date

*

CULTURES

Component

Value

Date

*

Figure 10: SIM CDI model user interface for data entry - section 4

CDI... Daily worksheet

CLINICAL DOCUMENTATION IMPROVEMENT

WORKSHEET

PT NAME:

ACCOUNT NO:

0

Search

UNIT:

MEDICAL RECORD NO:

000000000

ROOM NO:

BED:

DATE OF ADMISSION:

Save

PHYSICIAN:

DATE OF DISCHARGE:

CLASS:

DATE OF REVIEW:

Print

REVIEWER:

* Please fill out date of review and reviewer

ER INFORMATION

HEMATOLOGY/CHEMISTRY

URINALYSIS

PROCEDURES/DIAGNOSTICS

RESPIRATORY

DIAGNOSES/DRG

COMMENTS

DIAGNOSTICS

	Test	Date	Result
*			

PROCEDURES

	Procedure	Date	Time In	Time Out
*				

Figure 11: SIM CDI model user interface for data entry - section 5

CDI... Daily worksheet

CLINICAL DOCUMENTATION IMPROVEMENT

WORKSHEET

PT NAME:

ACCOUNT NO:

0

UNIT:

MEDICAL RECORD NO:

000000000

ROOM NO:

BED:

DATE OF ADMISSION:

PHYSICIAN:

DATE OF DISCHARGE:

CLASS:

DATE OF REVIEW:

REVIEWER:

* Please fill out date of review and reviewer

Search

Save

Print

ER INFORMATION

HEMATOLOGY/CHEMISTRY

URINALYSIS

PROCEDURES/DIAGNOSTICS

RESPIRATORY

DIAGNOSES/DRG

COMMENTS

ARTEIAL BLOOD GASES

ABG

Value

Date

*

URINE DRUG SCREEN

Component

Value

Date

*

PROFILES

Lipid Profile

Component

Value

Date

*

Thyroid Profile

Component

Value

Date

*

Hepatitis Profile

Component

Value

Date

*

Figure 12: SIM CDI model user interface for data entry - section 6

CDI... Daily worksheet

CLINICAL DOCUMENTATION IMPROVEMENT WORKSHEET

PT NAME:
UNIT:
ROOM NO:
PHYSICIAN:
CLASS:
REVIEWER:

ACCOUNT NO:
MEDICAL RECORD NO:
DATE OF ADMISSION:
DATE OF DISCHARGE:
DATE OF REVIEW:

0
000000000

Search
Save
Print

* Please fill out date of review and reviewer

ER INFORMATION
HEMATOLOGY/CHEMISTRY
URINALYSIS
PROCEDURES/DIAGNOSTICS
RESPIRATORY
DIAGNOSES/DRG
COMMENTS

DIAGNOSES

Diagnosis	Location in chart	POA	PDX	MCC
*				

REVIEW INFORMATION

Reviewed By		Physician	
Initial DRG	000	Initial RW:	0
DRG Desc:		CDIS DRG	312
Any Query		CDIS RW:	0.7228
Date		DRG Desc	SYNCOPE & COLLAPSE
Addition		Coder DRG	000
Description		Coder RW:	0
Response		DRG Desc:	
		Final DRG	000
		Final RW:	0
		DRG Desc:	

Figure 13: SIM CDI model user interface for data entry - section 7

CDI... Daily worksheet

CLINICAL DOCUMENTATION IMPROVEMENT WORKSHEET

PT NAME:	<input type="text"/>	ACCOUNT NO:	<input type="text" value="0"/>	Search
UNIT:	<input type="text"/>	MEDICAL RECORD NO:	<input type="text" value="000000000"/>	
ROOM NO:	<input type="text"/>	BED:	<input type="text"/>	Save
PHYSICIAN:	<input type="text"/>	DATE OF ADMISSION:	<input type="text"/>	Print
CLASS:	<input type="text"/>	DATE OF DISCHARGE:	<input type="text"/>	
REVIEWER:	<input type="text"/>	DATE OF REVIEW:	<input type="text"/>	

* Please fill out date of review and reviewer

ER INFORMATION

HEMATOLOGY/CHEMISTRY

URINALYSIS

PROCEDURES/DIAGNOSTICS

RESPIRATORY

DIAGNOSES/DRG

COMMENTS

NOTES

Only 255 characters are allowed

The collective data obtained from the SIM model was input by four CDI Specialists working in sample Hospital A over four years, from 2010 through 2014. For purposes of this dissertation study, it should be explained that the fiscal year for the SIM model was from April 2010 through March 2011 (Year 1), April 2011 through March 2012 (Year 2), April 2012 through March 2013 (Year 3), and April 2013 through March 2014 (Year 4).

3.3 SIM model data set Unit of Analysis

Each record in the SIM model is comprised of one patient visit or encounter. Each patient has a unique medical record number or identifier. One patient may visit the hospital and get admitted multiple times. Each visit has a unique encounter or account number, and cannot be duplicated. The SIM model identifies each visit using the unique account number. One patient may have multiple account numbers depending on how many times he or she may have visited the hospital.

3.4 Statistical Modeling Analysis

In this section, statistical modeling analysis of the SIM model data set will be conducted. Statistical modeling analysis was performed using Microsoft Excel 2007 within a Windows X P environment. Statistical modeling analyses include descriptive statistical analysis, MS-DRG severity level analysis, and APR-DRG severity level analysis. The simplicity involved in these analyses goes to argue the point that the same efficiency and results may be obtained when using a custom made CDI model as much the results obtained using the complex methods of analyses inherent in the popular and expensive CDI models.

3.4.1 Descriptive Statistical Analysis

Overall, the objective of the descriptive statistical analysis is to produce a well detailed summary and aggregate of the SIM model's data file in terms of frequencies and percentage counts among different age population admitted in the hospital over the period of time studied. In this dissertation, descriptive statistical

analysis will be used extensively within other analysis tools to denote numerical observations within the SIM model's data set indicative of the general sampling population within various age groups that get admitted into the hospital.

Table 6: Total number of inpatient admissions per age group population type

Age	0 – 20 years	21 – 40 years	41 – 60 years	61 - 80 years	>80 years
Year 1	244	607	529	2118	2019
Year 2	375	713	760	3500	2043
Year 3	416	744	1001	3482	3003
Year 4	301	719	1039	3177	3000

Secondly, extensive descriptive statistical analysis of the SIM model data set will be carried out to compare reimbursement obtained from the impact made by asking Physician queries over the period of four years. Also, other impact metrics were analyzed using the descriptive method – the SOI, ROM, CMI – comparing the impact of the CDI program on hospital metrics and profile data.

3.4.2 MS-DRG Severity Level Analysis

In this section, we will perform an analysis of the severity of illness in patients, and its impact on hospital profile measures using the Medicare Severity Diagnoses Related

Groups (MS-DRG). For definition purposes, the principal diagnosis is defined as the condition determined after study, to be chiefly responsible for occasioning the admission to the hospital while the secondary diagnoses are defined as conditions that have been clinically evaluated and deemed relevant for continued therapeutic treatment, undergone diagnostic procedures and testing, extend length of stay during admission, and cause increased monitoring or nursing care.

The MS-DRG severity of illness level will be utilized to test the hypothesis that there exist statistically effective analytical methods to show the effect of CDI reviews and queries on hospital profile and severity of illness metrics. Most MS-DRGs have three levels of severity for secondary diagnoses codes:

- Major Comorbidity/Complication (MCC) - this reflects the highest degree of severity of illness;
- Comorbidity/Complication (CC) - this is the next degree of severity of illness; and
- No comorbidity/Complication - this does not in any significant degree affect the severity of illness or resource consumption.³⁸

Under the MS-DRGs, there are three groups of DRGs with CCs and/or MCCs:

- Group 1: MS-DRGs broken out into three tiers: with MCC, with CC, without CC or MCC
- Group 2: MS-DRGs broken out into two tiers: with MCC, without MCC
- Group 3: MS-DRGs are broken out into two tiers: with CC/MCC, without CC/MCC

Table 7: Count of Principal diagnosis (Pdx) changes, MCC and CC additions by CDI Specialists from reviewed cases over four years

		Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Year 1	Pdx	6	2	4	7	13	4	8	5	5	8	5	6
	MCC	15	12	13	18	19	12	23	11	8	18	13	14
	CC	64	40	54	62	48	59	49	41	46	34	41	51
Year 2	Pdx	7	3	5	5	3	4	2	5	0	3	6	16
	MCC	15	28	12	10	8	28	10	5	7	12	15	21
	CC	82	69	50	108	72	44	52	32	26	59	35	88
Year 3	Pdx	6	3	8	9	7	20	9	6	9	10	6	7
	MCC	15	21	18	21	14	10	16	19	12	13	6	10
	CC	57	58	65	65	64	42	57	60	32	53	39	46
Year 4	Pdx	6	11	8	4	15	10	9	11	9	25	21	6
	MCC	14	12	12	8	9	7	7	13	14	19	11	12
	CC	49	36	21	26	36	35	34	40	40	47	41	42

3.4.3 APR-DRG Severity Level Analysis

In the APR-DRG system, a patient is assigned three distinct categories:

- The base APR-DRG (for example, APR-DRG 194 Heart Failure)
- The severity of illness subclass
- The risk of mortality subclass

Severity of illness (SOI) and risk of mortality (ROM) relate to distinct patient attributes.

Severity of illness is used to define the extent of organ or physiological dysfunction present in the patient's body, while the ROM describes the likelihood of a patient dying.

The All Patient Refined DRGs (APR-DRG) incorporate SOI and ROM by adding four subclasses to each DRG. The addition of these four subclasses addresses patient

differences relating to severity of illness and risk of mortality.

Figure 14: Classification of APR-DRG defined SOI and ROM subclasses

<ul style="list-style-type: none">• Four <u>SOI</u> Subclasses<ol style="list-style-type: none">1. Minor2. Moderate3. Major4. Extreme	<ul style="list-style-type: none">• Four <u>ROM</u> Subclasses<ol style="list-style-type: none">1. Minor2. Moderate3. Major4. Extreme
--	--

For example, a patient with acute pancreatitis as the highest secondary diagnosis (Sdx) may be considered to have a major SOI but only a minor ROM. The SOI is major because there is significant organ dysfunction associated with acute pancreatitis. However, it is unlikely that this acute episode alone will result in patient mortality. So, the ROM for this patient is minor.

Table 8: Impact of accurately specified Secondary diagnoses (SDx) on APR-DRG components

Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
PDx: Pneumonia	PDx: Septicemia	PDx: Septicemia	PDx: Septicemia	PDx: Septicemia
MS-DRG 194	MS-DRG 871	MS-DRG 871	MS-DRG 871	MS-DRG 871
SDx: Bacteremia	SDx: Pneumonia	SDx: Pneumonia Systolic CHF Exacerbation	SDx: MRSA pneumonia Systolic CHF Exacerbation	SDx: MRSA pneumonia Systolic CHF exac Acute resp. failure
APR-DRG 139 SOI 2 ROM 1	APR-DRG 720 SOI 2 ROM 2	APR-DRG 720 SOI 2 ROM 3	APR-DRG 720 SOI 3 ROM 3	APR-DRG 720 SOI 4 ROM 4

This dissertation study will utilize the APR-DRG level analysis to present the different SOI and ROM of patient cases reviewed from the SIM model data set and explain the implication on Hospital A's core metrics and profile information.

Table 9: Average SOI values per month for all cases reviewed by CDI Specialists

	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Year 1	2.40	2.29	2.32	2.37	2.29	2.36	2.32	2.31	2.44	2.32	2.21	2.31
Year 2	2.51	2.52	2.49	2.47	2.49	2.52	2.53	2.48	2.49	2.48	2.53	2.51
Year 3	2.41	2.33	2.4	2.19	2.30	2.33	2.39	2.38	2.37	2.37	2.32	2.35
Year 4	2.11	2.24	2.31	2.15	2.15	2.25	2.53	2.45	2.21	2.43	2.34	2.35

Table 10: Average ROM values per month for all cases reviewed by CDI Specialists

	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar
Year 1	1.96	1.91	2.21	1.92	2.24	2.09	2.18	2.25	2.01	1.96	2.17	2.21
Year 2	2.22	2.23	2.17	2.16	2.18	2.24	2.20	2.19	2.18	2.17	2.23	2.23
Year 3	2.15	2.22	2.19	2.3	2.07	1.99	2.16	2.25	2.16	2.17	2.19	2.26
Year 4	2.07	2.17	2.18	2.24	2.19	2.15	2.24	2.31	1.99	2.26	2.19	2.21

CHAPTER IV

RESULTS OF DATA ANALYSIS

In this chapter, results of various statistical modeling analyses performed in the previous section are explained in detail. Results of descriptive statistical analysis, MS-DRG severity analysis, and APR-DRG severity analysis are reviewed and discussed.

4.1 Results of Descriptive Statistical Analysis

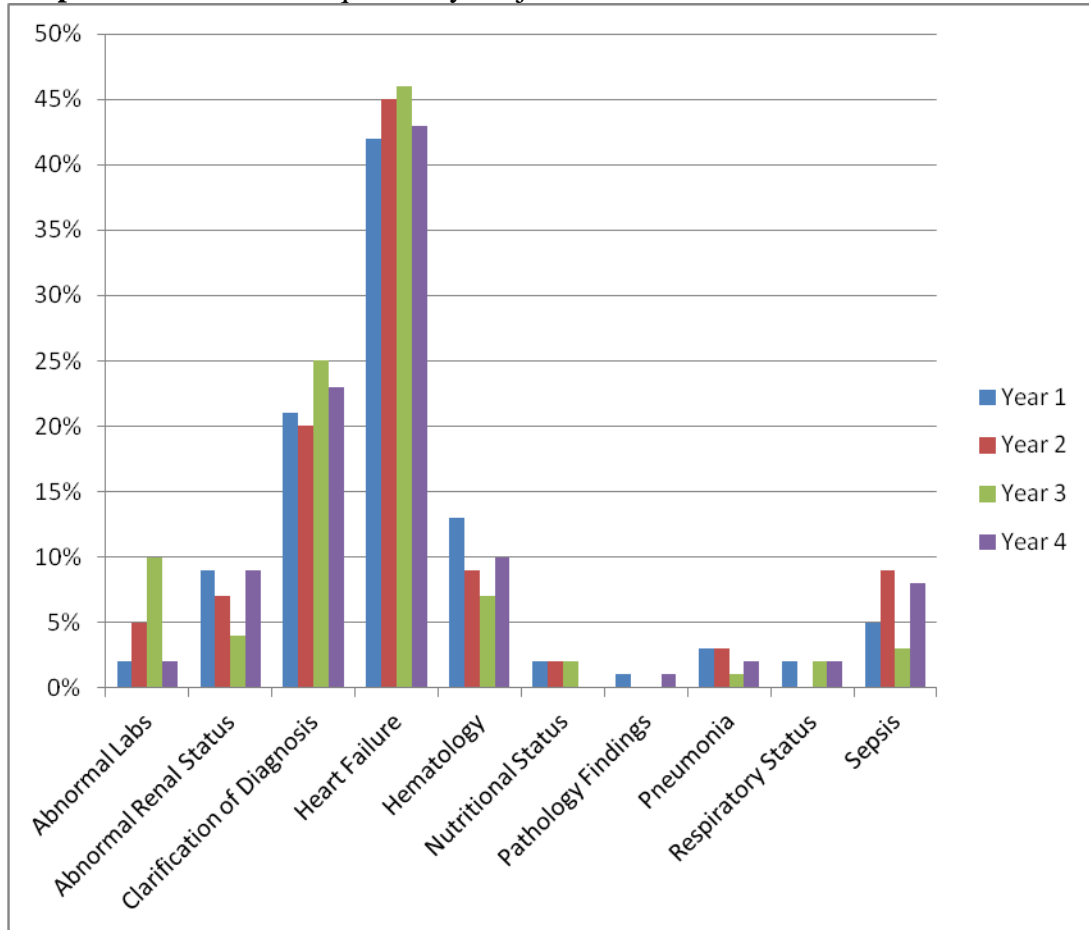
In the following section, results of descriptive statistical analysis will provide readers with a clear and numerical representation of the SIM model data set. In general, tables and figures will be used to show numerical and statistical observations within the data set, which is a critical requirement for further analyses. The next table shows the distribution of generated queries by subject matter. The ten most common subject matter contents approved by Hospital A in query formats are:

- Abnormal Labs
- Abnormal Renal Status
- Clarification of Diagnosis
- Heart Failure
- Hematology
- Nutritional Status
- Pathology Findings
- Pneumonia
- Respiratory Status

- Sepsis

The graph below shows the distribution of generated queries by subject matter for each year. Results show that ‘Heart Failure’ subject matter queries were the most queries asked by the CDI Specialists. The subject matter ‘Clarification of Diagnosis’ encompasses many aspects of documentation – clarification of acuity, type or severity of a diagnosis; differentiating a symptom from a diagnosis, among others. This subject matter occupied about average of 21% of the total queries.

Graph 1: Distribution of queries by subject matter



The CMI of a hospital reflects the diversity, clinical complexity and the need for resources among the target population groups for the hospital. The CMI value of a hospital can be used to adjust its average cost per patient (or per day) relative to the

adjusted average cost for other hospitals by dividing the average cost per patient (or day) by the hospital's calculated CMI. The adjusted average cost per patient would reflect the charges reported for the types of cases treated in that year. If a hospital has a CMI greater than 1.00, their adjusted cost per patient or per day will be lower and conversely if a hospital has a CMI less than 1.00, their adjusted cost will be higher.³⁷

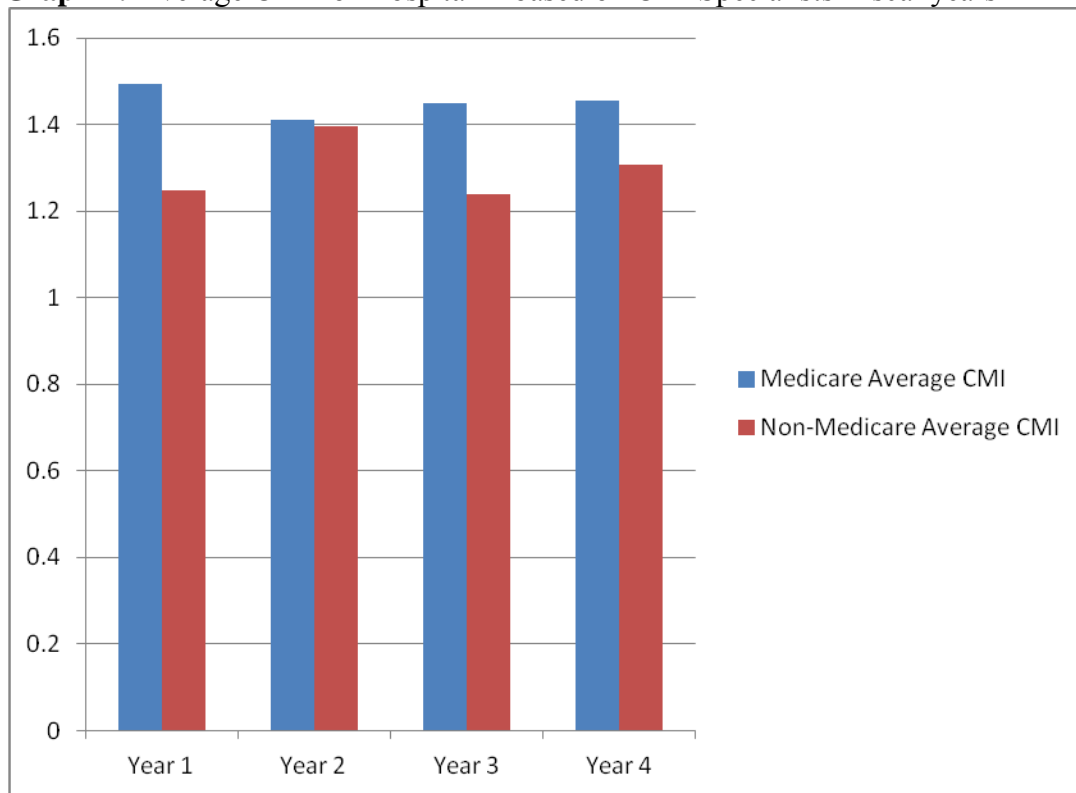
Patients are assigned to one of over 700 MS-DRGs based on the principal and secondary diagnoses, age, procedures performed, the presence of major co-morbidity and/or complications, discharge status, and gender. Each MS-DRG has a numeric relative weight reflecting the national “average hospital resource consumption” by patients for that MS-DRG, relative to the national “average hospital resource consumption” of all patients. The case mix index of a hospital per month or year is then calculated by dividing the sum of the MS-DRG relative weight of all patients discharged within that month or year by the total number of those patients.²⁷

The graph 2 below outlines the average yearly CMI obtained from all the cases reviewed by the CDI Specialists monthly over four years. Table 11 shows the Medicare and Non-Medicare groups.

Table 11: Average CMI for Hospital A based on CDI Specialists’ fiscal years

	Medicare Average CMI	Non-Medicare Average CMI
Year 1	1.4939	1.2466
Year 2	1.4117	1.3975
Year 3	1.4506	1.2387
Year 4	1.4553	1.3059

Graph 2: Average CMI for Hospital A based on CDI Specialists' fiscal years

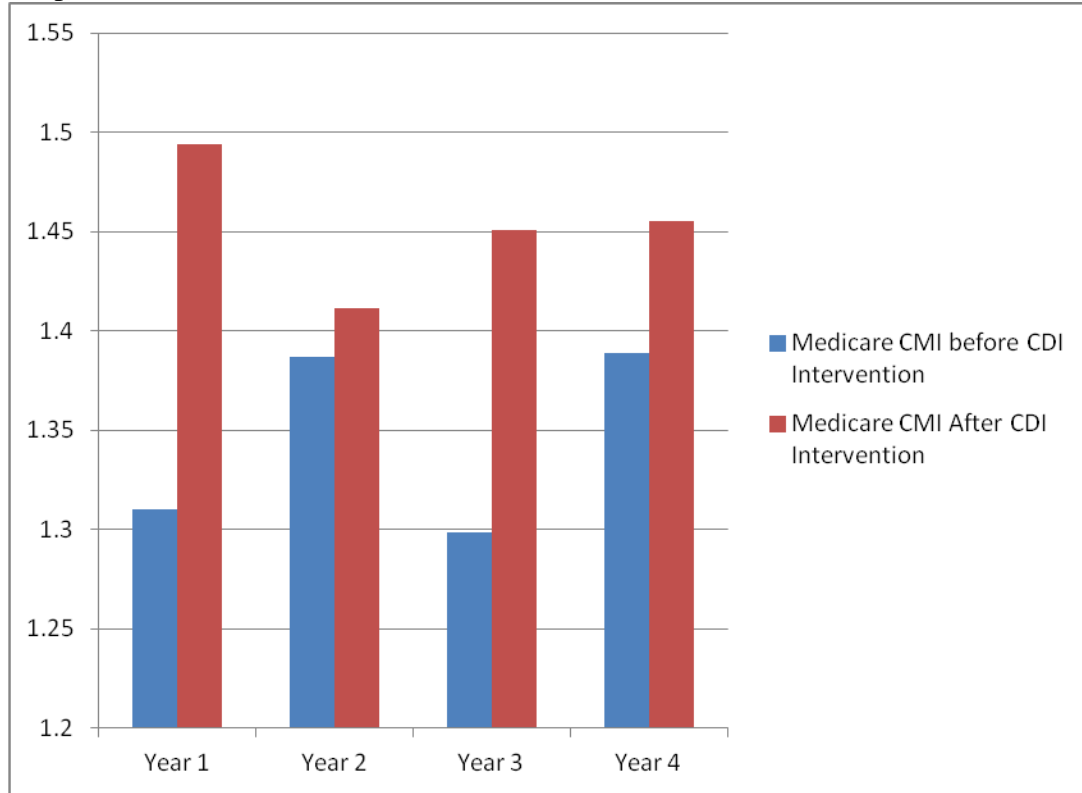


The CMI before the implementation of the CDI program for Hospital A was obtained and compared with the data in Table 11. Information contained in Table 12, Graphs 3 and 4 show the comparison and improvement in CMI for the Medicare and non-Medicare insurance payors.

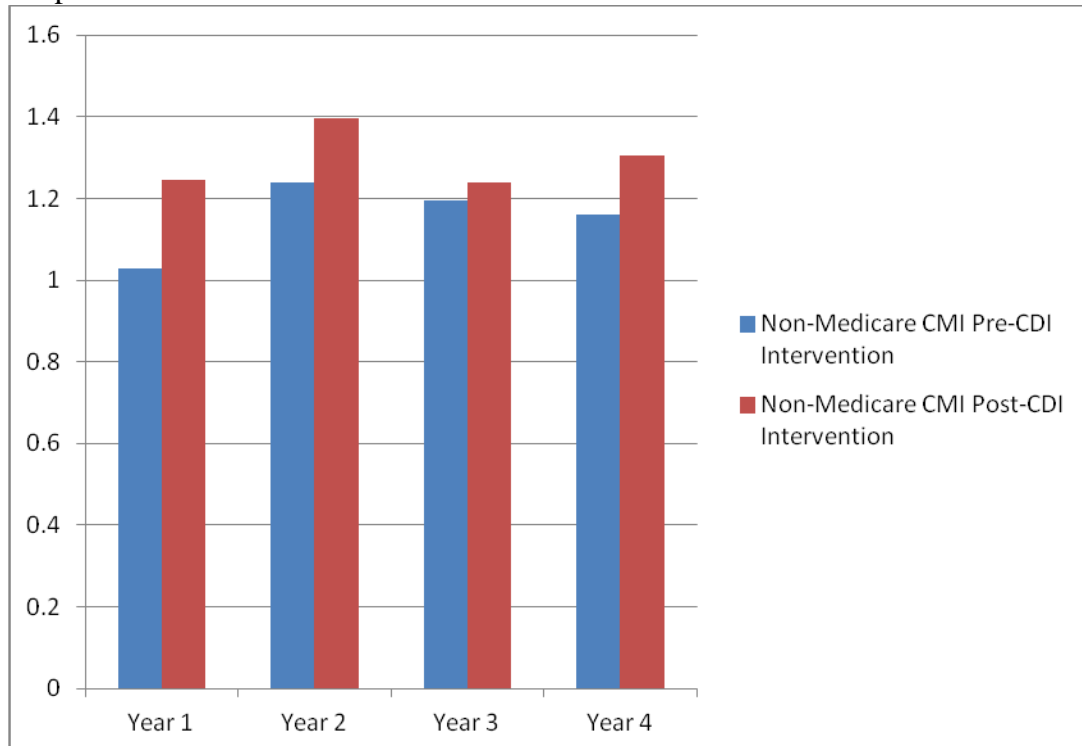
Table 12: Comparing the CMI before and after the CDI program implementation

	Pre-CDI program		Post-CDI program	
	Medicare	Non-Medicare	Medicare	Non-Medicare
Year 1	1.3105	1.0296	1.4939	1.2466
Year 2	1.3872	1.2400	1.4117	1.3975
Year 3	1.2984	1.1938	1.4506	1.2387
Year 4	1.3887	1.1599	1.4553	1.3059

Graph 3: CMI Medicare Group Comparison before and after CDI Intervention for Hospital A



Graph 4: CMI Non-Medicare Group Comparison before and after CDI Intervention for Hospital A



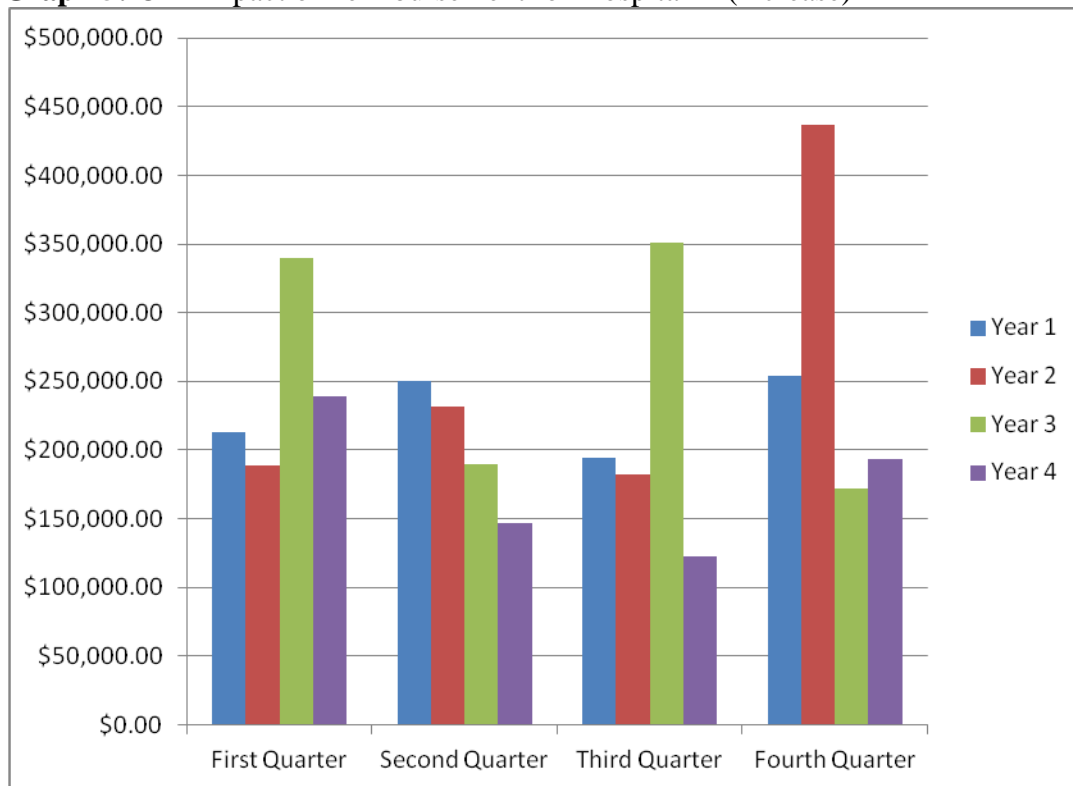
The results support the hypothesis that hospital A's metrics and profile were positively impacted by the CDI program and intervention. Therefore, obtaining better and more accurate documentation concurrently during a patient's admission was one of the factors that helped improve the CMI of the hospital and reflected the severity of illness while justifying the resources utilized by the hospital in treating the patient.

There was a clear, positive impact and increase in the reimbursement received by Hospital A over the four years during CDI intervention as shown in Table 13 and graph 5. The total increase in hospital A's reimbursement in the first CDI fiscal year was \$911,821.33; the second year was \$1,039,053.86; the third year was \$1,051,517.08; and the fourth year was \$702,236.03. It should be explained that the monetary impact noted above were just from the data tracked by input into the CDI SIM model. As Physicians learned how to document better, the non-tracked but nonetheless positive CDI impact on reimbursement paid to the hospital was reported to be higher.

Table 13: Increase in reimbursement for Hospital A due to CDI Intervention

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Year 1	\$212,804.85	\$250,368.97	\$194,500.52	\$254,146.99
Year 2	\$188,816.29	\$231,234.78	\$182,318.76	\$436,684.03
Year 3	\$339,390.33	\$189,525.66	\$350,560.26	\$172,040.83
Year 4	\$238,919.97	\$146,718.82	\$122,892.71	\$193,704.53

Graph 5: CDI impact on reimbursement for Hospital A (increase)



4.2 Results of MS-DRG Severity Level Analysis

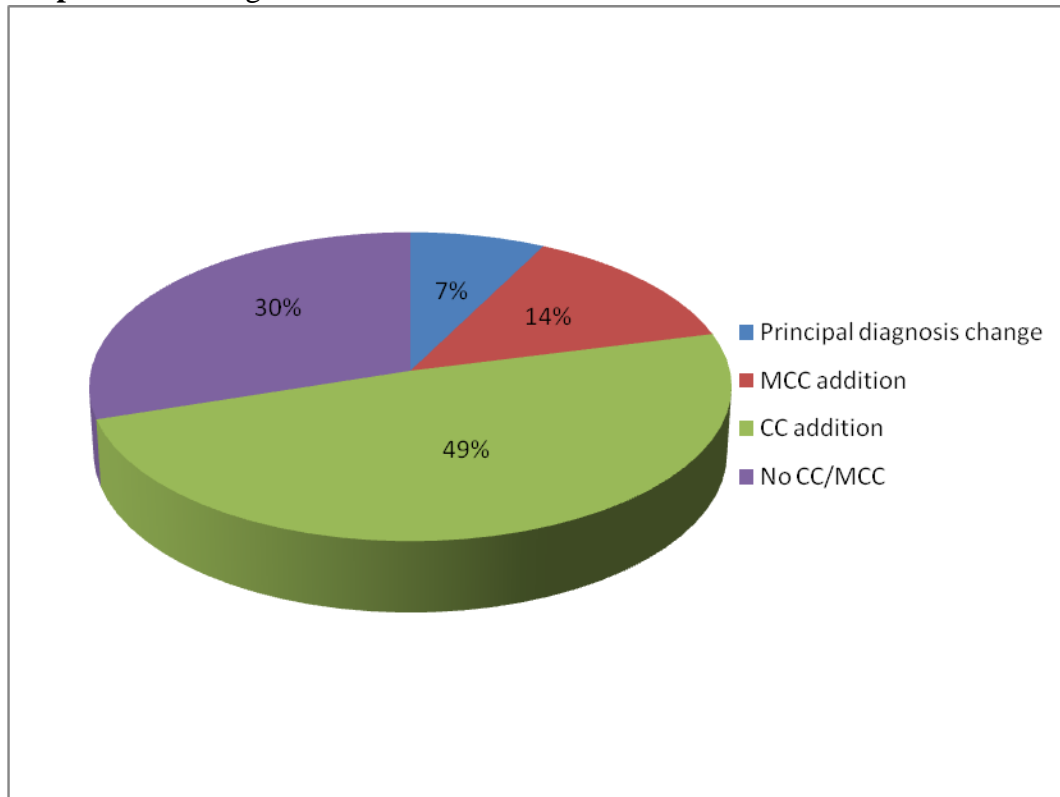
This section will describe the results of the MS-DRG severity level analysis introduced earlier. Data in the next tables and graphs will depict statistical observations of the MCCs and CCs obtained by the direct intervention of the CDI Specialists and input into the data set using the SIM model. Table 14 shows the overall frequencies and percentages of the principal diagnoses changes, MCC and CC additions obtained by the CDI Specialists through Physician responses to queries. Data in table 3 shows that a total of 23,709 records were reviewed by the CDI Specialists and data input into the SIM model, while each record was tracked to coding completion and finalization. Out of these, 4,882 CDI queries were generated. Of these queries, 367 resulted in principal diagnosis (Pdx) changes, 660 resulted in MCC additions, 2,391

resulted in CC additions, and 1,464 resulted in no additions or change to the original MS-DRG. As explained earlier, the MS-DRG system was developed and implemented as a standard used to make one bundled payment to hospitals for each inpatient encounter. The three levels of the MS-DRG system determine the relative weight for each patient visit. The MS-DRG with MCC reflects the highest severity level of illness and usually, has the highest relative weight. This shows that the patient is severely ill and more intensive resources used are justified. The MS-DRG with CC reflects the higher severity level of illness, with its corresponding higher relative weight, also justifying the intensity of the resources used. The last MS-DRG level is MS-DRG without CC or MCC. This carries a low relative weight and assumes that the resources utilized in treating the patient will not be high. According to the analysis scheme used, the results in Table 14 and Graph 6 show that 48.98% of the total generated queries added more CCs to the patient's coded record.

Table 14: Aggregate Distribution of MS-DRG levels percentages over four years

MS-DRG level analysis	Frequency	Percentage
Principal diagnosis change	367	7.52
MCC addition	660	13.52
CC addition	2391	48.98
No effect	1464	29.99
Total	4882	100.01%

Graph 6: Percentage distribution of MS-DRG levels in the SIM model data set



The reimbursement to any hospital based on the MS-DRG level of analysis is dependent on the relative weight obtained by capturing any MCC or CC the patient may have. The higher the relative weight is, the higher the reimbursement to the hospital. It is therefore, of utmost importance that any and all secondary diagnoses present during any inpatient admission be captured, so that the accurate MS-DRG level will be achieved. It is worthy to note that with the addition of MCC or CC to any record, the patient's severity of illness is positively impacted and increases.

4.3 Results of APR-DRG Severity Level Analysis

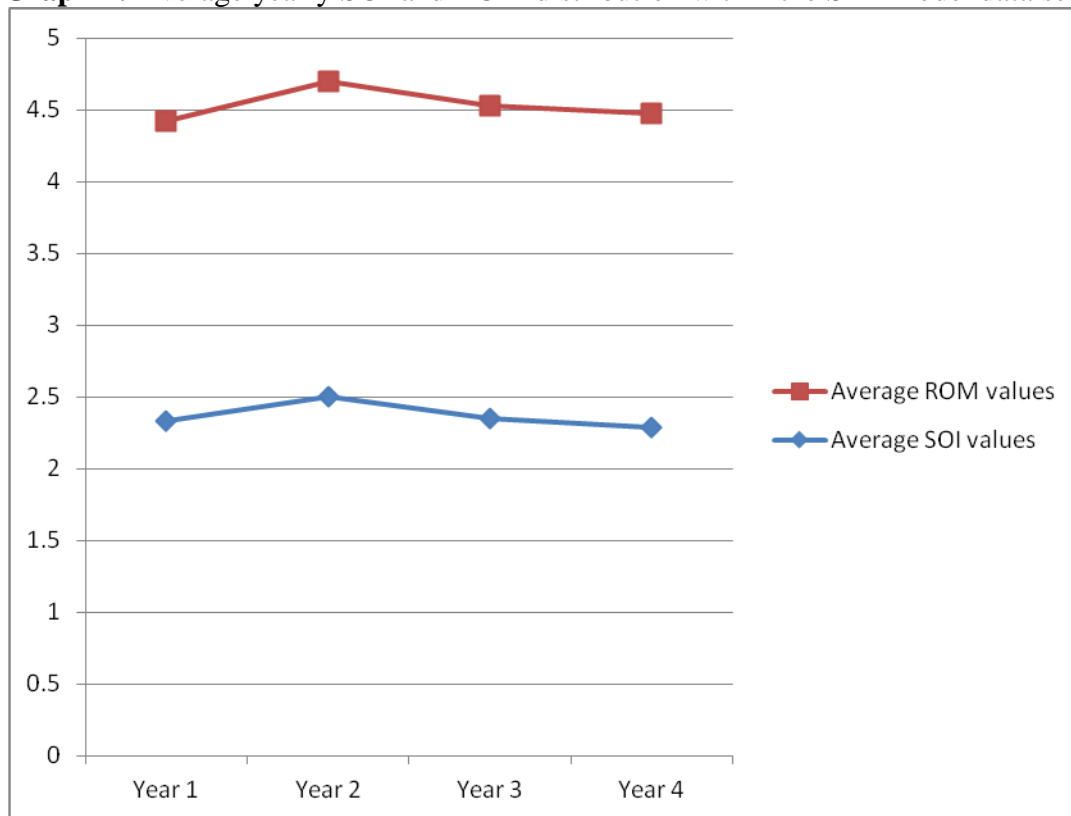
Finally, results of APR-DRG level analysis are used to show the distribution of the SOI and ROM within the SIM model data set. Every APR-DRG classification has a base DRG, severity of illness (SOI), and risk of mortality (ROM). It has been explained previously that the SOI shows how severe a patient's physiological functions have deteriorated, while the ROM explains the likelihood of that patient dying depending on the type and location of body organ dysfunction, the pathophysiology, the intensity of damage done to that organ or part of the body, and finally the aggregate complexity of the body, organ or system deterioration.

Tables 9 and 10 show the monthly distribution of SOI and ROM values within the SIM model data set over the four years. The next Table 15 and Graph 7 will be used to show the average yearly SOI and ROM values of the coded records within the SIM model dataset.

Table 15: Average SOI and ROM values within the SIM model data set over four years

APR-DRG level analysis	Average SOI values	Average ROM values
Year 1	2.33	2.09
Year 2	2.50	2.20
Year 3	2.35	2.18
Year 4	2.29	2.18

Graph 7: Average yearly SOI and ROM distribution within the SIM model data set



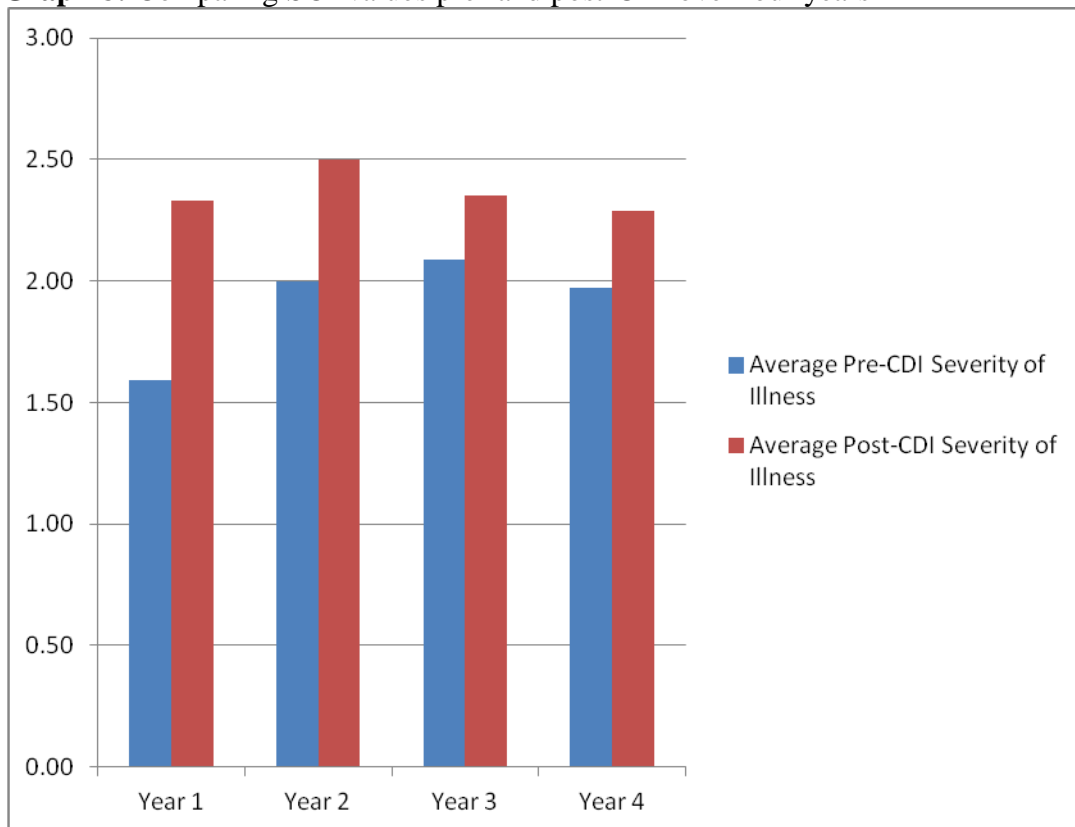
As previously explained, the SOI and ROM values are categorized from one through four; one is mild, two is moderate, three is major and four is severe. The higher the number is, the higher the reimbursement to the hospital. Also, the hospital's profile will depict that the hospital treats and cares for very ill patients. This assessment will encourage consumers to visit the hospital when they are sick, because they have the confidence that they will be treated successfully, and their health interests taken care of within the best capacity by the hospital.

The pre-CDI SOI and ROM values for Hospital A were obtained and compared to the corresponding post-CDI values. Table 16, Graphs 8 and 9 show these comparisons in clearer details.

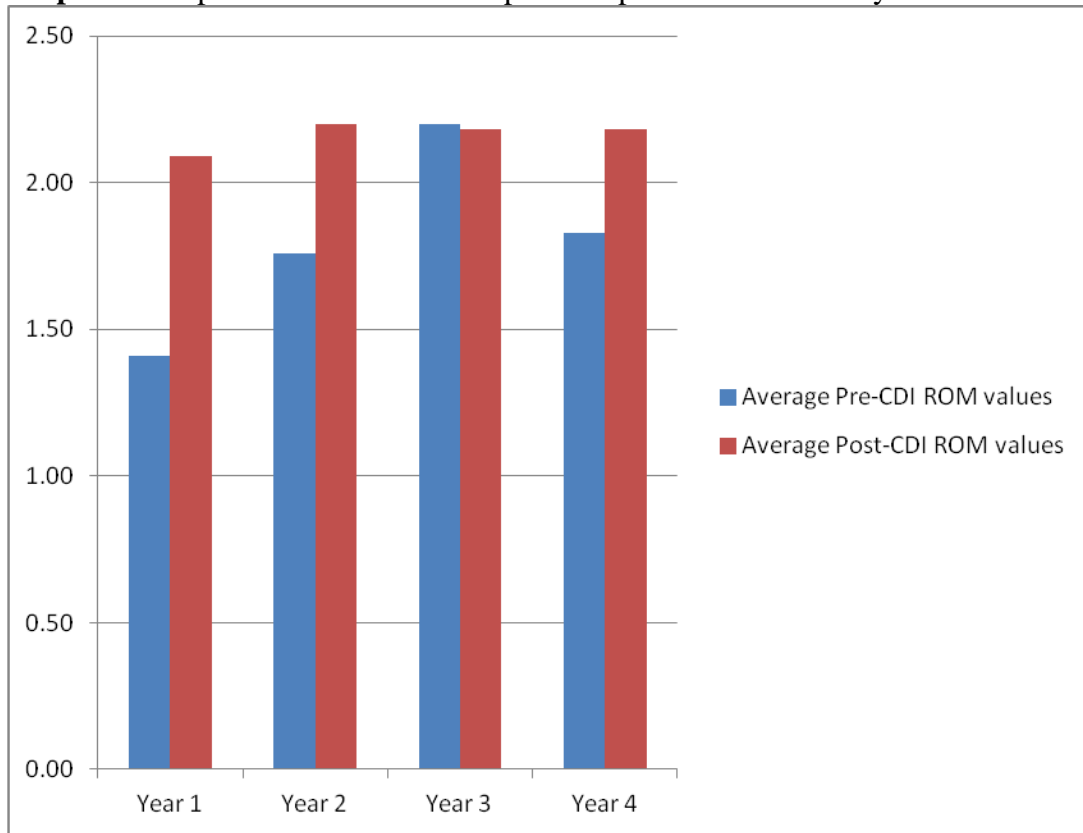
Table 16: Comparison of SOI and ROM values pre-and post-CDI

	Pre-CDI program		Post-CDI program	
	SOI	ROM	SOI	ROM
Year 1	1.59	1.41	2.33	2.09
Year 2	2.00	1.76	2.50	2.20
Year 3	2.09	2.20	2.35	2.18
Year 4	1.97	1.83	2.29	2.18

Graph 8: Comparing SOI values pre- and post-CDI over four years



Graph 9: Comparison of ROM values pre- and post-CDI over four years



CHAPTER V

DISCUSSIONS AND LIMITATIONS

The study results of the SIM model dataset analyses have revealed that hospital metrics are positively impacted with the implementation and intervention of the CDI program. Consequently, the hypotheses outlined in the analyses provided consistent insights that have aided in depicting statistical observations and descriptions indicative of the acuity of the cases handled and treated by Hospital A.

With the implementation of the CDI program, concurrent medical record reviews became possible whereby the CDI Specialists were able to exhaustively review the physical and electronic patient records to determine the accuracy and veracity of the documentation by the Physicians. If satisfied that the chart contained and met all documentation requirements, no queries needed to be generated. However, if a chart was deemed incomplete in terms of documentation of diagnoses or treatment, the CDI Specialist would generate a query for clarification by the Physician. Figure 15 below shows a sample query generated by the CDI SIM model to obtain more specificity about a congestive heart failure diagnosis.

Figure 15: Sample CHF query template generated by the SIM model

DOCUMENTATION CLARIFICATION

Dr.....

Clarification of your documentation is required for compliance and to better reflect the severity of illness and intensity of treatment of your patient.

Indicators present

Location in the medical record

- | | |
|--|-------|
| <input type="checkbox"/> Diagnosis of CHF and/or history of CHF | _____ |
| <input type="checkbox"/> BNP greater than 200 | _____ |
| <input type="checkbox"/> Imaging Finding of Pulmonary Edema /Pleural Effusions | _____ |
| <input type="checkbox"/> Vascular Congestion | _____ |
| <input type="checkbox"/> Fluid/Volume Overload | _____ |
| <input type="checkbox"/> Pitting edema | _____ |
| <input type="checkbox"/> LVEF under 40% (Indicative of Systolic Heart Failure) | _____ |
| <input type="checkbox"/> E _f over 40% (Indicative of Diastolic Heart Failure) | _____ |
| <input type="checkbox"/> Dyspnea / Orthopnea / Paroxysmal Nocturnal Dyspnea | _____ |
| <input type="checkbox"/> Abnormal Heart Sounds – Apex Beat / Murmurs | _____ |
| <input type="checkbox"/> Abnormal lung sounds | _____ |
| <input type="checkbox"/> Right Heart Catheterization findings | _____ |
| <input type="checkbox"/> Other | _____ |

Treatment Provided:

Based on your medical judgment of the clinical indicators outlined above, are you treating this patient for a known or suspected:

- | | | | |
|---|-----------------------------------|------------------------------------|-----------------------------------|
| <input type="checkbox"/> Acute CHF | <input type="checkbox"/> Systolic | <input type="checkbox"/> Diastolic | <input type="checkbox"/> Combined |
| <input type="checkbox"/> Chronic CHF | <input type="checkbox"/> Systolic | <input type="checkbox"/> Diastolic | <input type="checkbox"/> Combined |
| <input type="checkbox"/> Ac/Chronic CHF | <input type="checkbox"/> Systolic | <input type="checkbox"/> Diastolic | <input type="checkbox"/> Combined |
| <input type="checkbox"/> Other, please indicate _____ | | | |

If agreed, please document within the medical record, date, time and sign.

In responding to this query, please exercise your independent professional judgment. The fact that a question is asked does not imply that any particular answer is desired or expected.

Thank you for your clarification.

Thank you,
CDI/Coding Team

CDI SPECIALIST/CODER SIGNATURE

Responses to these queries are usually mandatory for the Physicians, and have to be done in a timely manner while the patient is admitted. This helps the continuity of care be streamlined and transparent. After the patient gets discharged, the record gets coded by the coding Specialist, who abstracts all the medical diagnoses noted by the Physician, converting them to numerical codes using the ICD-9-CM coding system.

These data collected from each chart or record represent the summary that is used to convey the story of a patient's particular visit to the hospital. This same data serves to show the severity of illness and risk of mortality data using the APR-DRG classification, and also the complexity of care and disease conditions using the MS-DRG classification. Values and the level of classification of the APR-DRG and MS-DRG analyses help determine what the reimbursement for each inpatient visit will be.

Next, variations among Hospital A's data pre-CDI intervention were compared to data obtained post-CDI intervention. Analyses and results clearly show that all the hospital's metrics were positively impacted with the implementation and intervention of the CDI program. The Physicians also greatly benefited from this practice because available public data showed that the Physicians treated and cared for patients with serious illnesses of varying degrees.

A patient would feel more confident having a Primary Care Physician whom is believed to always successfully treat very seriously sick persons. This knowledge about the Physicians come from the public online data available to the consumers, and is available for public view and consumption.

Over the last decade, the need for better documentation has become paramount. If a treatment given or service rendered by the Physician is not written anywhere in the

record, that treatment or service did not happen at all. Now, the rules have become such that if the treatment or service is also documented inaccurately, the said treatment or service is regarded as non-existent. For example, if a MD does not document the site of a pressure ulcer which a patient has, then the stage of the ulcer (if noted by the wound care Nurse) will not be coded by the Coding Specialist. If the MD does document it, but forgets to denote if present on admission, the hospital may get penalized for that diagnosis if coded in the patient's record since it may be assumed that the patient developed a pressure ulcer during admission in that hospital, reflecting inadequacy of care. However, if the MD documents the site and stage of the ulcer, and denotes the present-on-admission indicator, documentation will be complete, reimbursement will be accurate, data reporting will be precise, SOI and ROM will be accurately reported, and the utilization of resources will be well justified.

It is the responsibility of the CDI Specialist to review the chart completely and decipher where any gaps in documentation exist, then query the applicable Physician to obtain the necessary and needed complete and accurate documentation.

5.1 Impact of SIM CDI model on Hospital Profile data

Generally, all existing CDI models have the capability to run the basic analyses required to obtain or compare a hospital's quality metrics. The most important and obvious metrics required by most facilities are the LOS, CMI, SOI, ROM and reimbursement computation.

The SIM model is a very simple and custom-designed CDI model that runs in the Windows operating systems environment. Microsoft Access 2003 was used as the basic structure for its design, to allow for flexibility and versatility since most hospitals

still rely heavily on older and more stable operating systems. Comprehensive data are entered in the user interface, these data are stored in tables and used for all sorts of analysis. Queries were developed to perform analyses as needed. The ensuing reports may be viewed in the same environment or may be imported back in to Microsoft Excel environment and used for more analyses. All the above mentioned hospital metrics are necessary for data reporting.

Everything is affected by concurrent accurate documentation, from the time of admission through discharge of the patient. Positive resonance occurs from the time the chart is coded through depository into the hospital's data bank. Since all required hospital metrics can be computed or obtained through the SIM model, this means that extensive resources or budgets are not necessarily required to automate the CDI process.

Most information or parameters contained in the model can be designed by in-house Computer programming personnel to suit the specific needs of the hospital based on its target population. Maintenance of the model is also very easy when developed by in-house personnel because layers of protocols required by the existing popular models are readily eliminated, the hospital may request and obtain prompt modification to the existing structure of the model to mold to its changing technology, population or services.

For example, Hospital A may decide to incorporate a new department – Mother and Baby - as part of the cases to be reviewed over some period of time to assess if there is need for improved documentation by the Obstetricians. The fields required for data input are somewhat different from the general population already being reviewed.

It will be much easier to modify data fields in the SIM model since it was designed by in-house personnel, to reflect the new request made by Hospital A.

The argument then centers on why a smaller facility would give up implementing a CDI program due to inability to purchase the automated software needed, or why the facility would decide not to automate its CDI program when the cost to hire and keep personnel needed would equal a fraction of the cost to purchase one of the popular existing models.

5.2 Study Limitations

While this study generated important results, there are some limitations that need to be highlighted and discussed. First, the SIM model does not have any Computer Assisted Coding software embedded inside it to help ease the coding process for CDI Specialists. The CDI Specialist has to open the CAC in another window, code the chart and then return to the SIM model environment to input the codes and DRGs obtained. Second, the SIM model does not have the capability to use NLP to input or suggest new words for user interaction or generating automated queries. In other words, it has no intelligence, it is simply and purely a software used to input patient data from a record, albeit comprehensively. Third, very complex statistical analyses like multiple regression analyses, would have to be done in another bigger analytical environment since the capability has not yet been developed in the SIM model. Fourth, the SIM model's reporting capability may only be viewed one report at a time in a structural mode. It does not have an interactive dashboard that can pull all required reports together in one place for a single, colorful view. However, information obtained from its data set may be used

extensively to perform the same and every kind of required analyses, depending on the needs of the facility. Multiple reports may then be developed from the results and displayed. Fifth, although multiple users are able to input data into the SIM model at the same time, the model does not have internet capability and may not be opened from anywhere, except in computers where it has been installed or from a specified shared drive in any computer network, where it resides. Due to its online incapability, electronic queries may not be sent to Providers when necessary. Instead, the queries are generated as reports, and may be emailed to the Physician as an attachment in an email or printed and inserted into the patient's chart so that the Physician will view and respond to it, when doing daily visit or rounding for the intended patient.

CHAPTER VI

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Recent changes in Medicare coding requirements have caused hospitals to suffer from lost revenues, penalties and forfeiture of reimbursements due to inadequate documentation.¹³ The role of CDI programs continues to evolve, driven mainly by a focus on improving quality care, reimbursement, and reporting. CDI is the consistent improvement not only in the “document” but also in the information processing and management processes in a clinical situation.⁵² CDI programs require Physicians, Nurses, Pharmacists, and health information specialists to work together because CDI includes various care processes such as medical procedures, nursing care, laboratory work, and rehabilitation.⁵³

The success of future CDI programs will need to integrate people, processes and technology in order to provide the specificity of documentation required by ICD-10, the Meaningful Use as well as other quality care initiatives. Healthcare facilities should continuously improve clinical documentation by investing in CDI programs, having training and process improvements that build a strong foundation as well as support best practices stand in order to gain significant improvements today and prepare themselves for tomorrow’s challenges.⁷

Accurate clinical documentation cannot be understated, and is no longer a low-level priority for healthcare facilities today. It is a vital component to patient care, physician satisfaction, and revenue cycle strategies. CDI specialists, along with clinical care providers and administration, must contribute to organizational success and ensure the

right information is available at the right time. Since 1928, AHIMA has recognized that clinical data and information is a critical resource needed for efficacious healthcare.³⁹ Health Information Management professionals strive to ensure that healthcare information used during patient care is valid, accurate, complete, trustworthy, and timely. But, current healthcare industry pressures are demanding change. Hospitals and providers must improve clinical documentation in preparation for the expanded scope of clinical data beyond a single patient encounter to a comprehensive data set comprising the entire continuum of care, a concept that will become monumental with the specificity required with the impending implementation of ICD-10 coding classification system in October 2015.

As healthcare reform moves quickly towards quality-driven reimbursement, organizations and providers will have to continue to justify care plans and treatment options as well as successfully demonstrate quality outcomes and patient safety. Consistent, complete, and accurate documentation is the key to the economic health of the organization and a key indicator of physician quality. Organizations and providers need to be able to use automated, intuitive tools to successfully implement new technology, new federal requirements, and specific strategic initiatives without comprising patient care.^{42, 48, 51}

All quality metrics for any hospital are inter-linked to each other. However, the single and most important thing that connects all of them is documentation. Everything starts with, and is affected by the quality of documentation present in the patient's record. The more complete and accurate the documentation, the better all metrics will be, and the better the hospital's revenue. The importance of a good and effective CDI program

cannot be understated. A good program becomes the mainstay of a hospital, helping to link and connect all aspects of care delivered to every patient during admission.

The ICD-10-CM coding system will be implemented in the United States of America starting October, 2015. This system spans across many areas in the healthcare industry (figure 16). The medical record is the only source used to code any patient visit or encounter.

Figure 16: ICD-10 global impact on the healthcare industry (source: ACDIS quarterly meeting, 2013)

Finance	Clinical Systems	External Reporting	HIM/Registration	Support Systems
<ul style="list-style-type: none"> • DRG grouper • System logic and edits • Billing systems • Claim submission systems • Compliance systems • Conversion methodologies • Cost accounting systems • Provider profiling systems 	<ul style="list-style-type: none"> • Clinical protocols • Medical necessity software • Disease management systems • Decision support systems • Clinical systems – EMR • Pharmacy systems • Ancillary test ordering systems 	<ul style="list-style-type: none"> • Managed Care Reporting System (HEDIS) • Patient assessment data (e.g. Oasis, MDS) • PI, QA, UM • Disease management registries • State & other government reporting systems 	<ul style="list-style-type: none"> • Encoding software • Abstracting systems • Medical record abstracting • Registration & scheduling systems • Medical necessity edits • Beneficiary software 	<ul style="list-style-type: none"> • Quality Management • Risk Management • Physician credentialing • Case Management • Discharge planning systems • Case Mix Systems

As the healthcare industry heads toward the implementation of ICD-10-CM, CDI Specialists must get ready for even greater interaction with Physicians to identify and learn the required level of documentation specificity that ICD-10-CM entails. The amount of coding knowledge and education expected from the CDI Specialists will increase because of the degree of specificity involved in the ICD-10-CM platform. Many healthcare organizations used the delay in the implementation of the ICD-10-CM to seriously educate their CDI Specialists about the new system and improve their expertise. In-depth education about the anatomy and physiology of the human body is also very necessary to understand the specificity mandated by the new ICD-10-CM system.

Although CACs are currently being updated to reflect the new upcoming coding system, basic knowledge of coding is required for any CDI Specialist to be very effective and efficient in their job functions. CDI software systems with NLP and CAC capabilities have to be upgraded to reflect all the components of the ICD-10-CM coding language and guidelines.

In terms of recommendations, incorporating multiple report display capabilities on one screen may be explored so that comparison of various attributes can be easily visualized. However, the more complex the software gets, the higher and more intensive the cost.

The software's operating ability depends on the compatibility of the operating system. It was designed solely in the Windows XP operating environment, and may not be compatible with other operating systems. Hospital's personnel may try to expand its platform to include other operating systems that are used by the hospital.

The software has no artificial intelligence or ability to auto-suggest diagnoses or generate queries. Query templates were part of the design process, and the CDI Specialist filled them out as needed. As in-house personnel gains more efficiency and confidence in the capability of the model, its NLP capacities may be explored or designed to suit the facility's specific target population.

In conclusion, documentation by any Physician is very subjective. Healthcare systems require an approach to clinical documentation that is consistent with overall and continuous improvement in order to achieve an accurate and complete patient medical record. An effective clinical documentation improvement program avoids any and all noncompliant practices that may subject it to fraud suspicion and subsequent audit.

According to a study conducted by Asakura and Ordal in 2012, it was suggested that if clinicians were provided with standardized definitions of disease conditions and specific criteria necessary to meet these conditions, better accuracy and consistency in documentation practice would be achieved.⁶⁰ For example, if 20 percent of all patients admitted into a hospital met a preapproved definition for acute respiratory failure, all of these patients should have this condition documented in their charts instead of ‘respiratory distress’, ‘shortness of breath’, or ‘hyperventilation’. The study determined that building a compliant clinical documentation improvement program that ensures the accuracy of documentation requires four steps:

- Develop a short list of the most common under- or inaccurately documented diagnoses
- Develop a definition and specific criteria for each condition listed, if not already existing
- Enlist the assistance of the Medical Director of each specialty area to educate Physicians regarding these definitions and criteria
- Measure and manage Physician documentation performance, to ensure that hospital-approved definitions for the listed diagnoses are met.

With this practice, it is proposed that Physicians will document diagnoses accurately the first time, without the need to amend their documentation later in response to a CDI query. Lesser queries will be asked, the accurate DRG will be obtained, SOI and ROM will be accurately reflected, and CDI Specialists will focus more on educating Physicians and reviewing more charts. This may be a new and sustainable focus for

the direction of CDI, to promote efficiency and achieve better documentation practice by Physicians.

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