What are the Barriers to E-Coding of Quality Clinical Data in Irish Hospitals from a Coder's Perspective?

Toyosi Atoyebi

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Declaration

I declare that the work described in this dissertation is, except where otherwise stated, entirely my own work, and has not been submitted as an exercise for a degree at this or any other university.

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Dedication

I dedicate this study to my Dad, Barrister Moses Akanmu Ayoade for giving me the foundation and teaching me never to give up on my dreams. (RIP)

Summary

The importance of data collection cannot be over emphasised. Lyndsay (2008) notes that "in a world where business units are becoming more self-sufficient and knowledgeable about managing their overall processes through the use of technology, it becomes more important to identify the value of data and its interaction".

Understanding how data interrelate only increases the ability of organisations to link information, track performance (for analysis of patterns and outcomes of care), and strategize more effectively. For instance, many organizations use different data for planning, trends analysis, and managing performance. Consequently, the value of data is only as good as its point of entry into the system. Data entry errors and processing inefficiencies are but a few causes of error-prone data that end up being used to drive an organization's decisions.

In the health sector as in businesses, data is the life-wire for decisions and further research. One of the most important means of gathering data in healthcare is clinical coding. The importance of clinical coding cannot therefore be over-stated as the process generates a critical mass of data needed for research and reimbursement among others.

Many Scholars like Lee *et al*., (2006) were of the opinion that data of high quality is a valuable asset that enables an organisation to strategize and a lack of data of high quality can become a costly problem for an organisation (Haug and Arlbjørn, 2010; Haug *et al*., 2011). Katz and Green (1997) also opined that quality data drives informed decisions and ground-breaking research. According to them, quality data plays an important role and is a cornerstone of performance improvement and management.

This research investigated the barriers to quality coding of clinical data.

It attempted answers to how these barriers can be eliminated or corrected and if indeed these barriers do impact the quality of coded data. Different studies have looked into quality of coded data but limited ones have actually studied if these barriers actually affected the quality of coded data.

This study noted that the clinical coders surveyed were of the same opinion about the barriers that affect quality coding of clinical data.

It also found out that coded data underpin informed decisions for monitoring the health of individuals and populations, as well as contributing to the analysis of the health system.

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ABBREVIATIONS

AHA – American Hospital Association

AHIMA – American Health Information Management Association

DRG – Diagnosis Related Group

CC – Clinical Coding

CCs - Clinical Coders

CEM – Centre for Enterprise Modernization

CIHI – Canadian Institute for Health Information

DRGs – Diagnosis-Related Groups

ESRI – Economic and Social Research Institute

EHR – Electronic Health Record

EPR – Electronic Patient Record

GPS – General Practitioner Services

HCAT – HIPE Coding Audit Toolkit

HIM – Health Information Management

HIMSS – Healthcare Information and Management Systems

HIPE – Hospital Inpatient Enquiry

HIQA – Health Information and Quality Authority

HRID- Health Research and Information Division

HSE – Health Services Executive

ICD – International Classification of Disease

ICT – Information and Communication Technology

IT – Information Technology

NCCH – National Centre for Classification in Health

NHS – National Health Services

NPRS – The National Perinatal Reporting System

PBHR – Paper based Health Record

PICQ – Patient Indicators of Clinical Quality

SCC – Society for Clinical Coders

UK – United Kingdom

WHO – World Health Organisation

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Over the past years, few businesses appreciated and acknowledged the problems with data quality (Haug and Arlbjørn, 2010). There were inadequate software in place and the existing ones then, were not integrated. As businesses grow and strive for excellence, data of high quality becomes cause for concern without high quality data, there will not be cost saving, risk reduction, regulatory compliance, business intelligence and growth potentials (Redman, 1996 and Eschinger, 2008 cited in Amalfi et. al, 2009).

Quality data plays an important role and is a cornerstone of performance improvement and management (Katz and Green, 1997). It is therefore obvious that no organisation can operate to its full potential without data and for any organisation to perform well and satisfy its customers, it must have quality data at hand at all times for good decision making and performance evaluation. Scott et al., (2007) posit that quality data is crucial for organisation or enterprise growth which indicates that quality data is the life-line of all businesses (Lindsey E, 2011).

In today's world, health care has been classified as an industry which provides services as a product to patients who are referred to as customers. Every customer wants satisfaction or benefit from a pro duct. For the healthcare industry to achieve this duty of satisfying its patient, policies, procedures and guidelines must exit. The

formation of these policies, procedures and guidelines are based on the data generated and collected within the health industry. Therefore, data collection in the healthcare industry should be on-going and be a meaningful tool for decision making (Katz and Green 1997; Dlugacz, 2006).

Katz and Green (1997) were of the opinion that data collection is the backbone of performance indicator and measurement and that the health care industry can easily be distracted with meaningless information. They suggest that to have quality data, it is necessary and crucial to identify, the data collector, the purpose of data collection and how the collected data can be used to improve performance.

The Hospital is a part of the health care industry which provides healthcare services to patient through accident and emergency, day-case procedures, inpatient stay and outpatient visit on a daily basis. Patient information collected at every point of care is recorded for different purposes. This patient information is then processed into a structured data through clinical coding and classification. This form of structured data collection analyses data about patient diagnosis and treatment. The main purpose for coding is to provide information for research and epidemiology, morbidity data and case-mix for funding (Robinson and Shepheard, 2004). Another purpose of coding clinical data according to Walker and Nicholson, 2009 is to support clinical audit, teaching, performance planning and resource allocation which are all paramount to determining what was done, when and how it was done. However, Robinson and Shepheard, (2004) stated that neither the quality of coded data nor its continuity has been questioned while Santos et al., (2008) on the other hand queried the organisational factors that affect quality clinical coding. The complexity of the

coding Information technology systems and clinical terminologies used in the process (ICD-10, SNOMED) according to De Lusignan, (2005) is another issue that affect the quality of coded clinical data. This could lead to miscoding (Cheng P et al., 2009).

In Irish hospitals, Clinical Coding started around 1971 with the formation of the Hospital Inpatient Enquiry (HIPE) scheme (Murphy et al., 2004). This scheme has been the source of national data on Inpatient discharges from acute general hospitals in Ireland and is referred to as the hospital activity data. On the other hand, the National Case-mix project which was a recommendation from the Commission on Health Funding was established in 1991 for the purpose of funding of hospitals based on its activities and the diagnosis related group (DRG) is used to determine the level of funding (HSE, 2008). The information used for the determinant of hospital activity is generated from coded data which are grouped into demographic, clinical and administrative data.

Presently, there are 120 hospitals involved in coding and case-mix in Ireland and over 200 coders and case-mix managers work on a full-time and part-time basis in these hospitals. These coders are trained by the HIPE & National Perinatal Reporting System (NPRS) Unit of The Economic and Social Research Institute (ESRI) and this training is an on-going one informed by guidelines published in *Coding Clinic* journal of the American Hospital Association (AHA), intermediate and advanced coding courses on ICD-10-CM and specialised workshops on specific area like Diabetes, Neoplasm and Obstetrics. The ESRI also issue national coding guidelines to all Irish hospitals involved in coding.

Since the purpose of coding clinical data according to (Robinson and Shepheard, 2004) and (Walker and Nicholson, 2009) is to support research, morbidity data, clinical audit, performance planning and resource allocation, this research investigated the barriers to coding of quality clinical data. It sought answers to how these barriers can be eliminated or corrected and if indeed these barriers do impact the quality of coded data.

1.2 Research Question

To this end, the study will answer the following research questions:

- What are clinical coders' perceptions of the barriers to e-coding of quality clinical data?
- How is the quality of coded data measured in Irish hospitals?

1.3 Significance and Aim of the Study

For any hospital to achieve quality of data, it is necessary for such hospital to identify the purpose and goals of data collection, the person who will collect the data and the barriers to collecting this data.

Clinical coding is a structured way of collecting patient data that is patient's demographic information, diagnosis and procedures within Irish hospitals. It is important to note that any challenges or barriers that clinical coders encounter in coding patient data could impact the quality and integrity of coded data thereby jeopardising the purpose for which coding is used for.

The findings of this research will establish what coding is and its importance within Irish hospitals. It will guide healthcare practitioners on the need for proper documentation of patient information and may be of benefit to all healthcare practitioners within Irish hospitals.

Apart from Irish hospitals, the findings of this research work may be of benefit to the healthcare industry and organisations who are engaged in the recording of structured data.

1.4 Scope of the Study

The research will be carried out within Irish hospitals. The scope of this study will be limited to 8 Irish hospitals in the Dublin region. This is going to be a mix of acute hospitals, maternity hospitals and children's hospital. The choice of the mix of these hospitals arises out of their specialty, size and length of involvement in clinical coding. Clinical coders and case-mix managers have been chosen because they code clinical data.

The Health Research and Information Division of the ESRI is the main governmental body that manages the data generated from clinical coding on behalf of the Health Service Executive (HSE).The main objective of the division is to ensure the availability of quality coded data to users at all times (The Economic and Social Research Institute 2011). Therefore, their contribution will be of great benefit to the study. The HSE is the governmental department that manages Irish hospitals.

1.5 Hypothesis

This study proposes the following hypothesis in other to measure the interrelatedness or disconnectedness between barriers to coding and quality of coded data. This relationship will be measured using the correlation coefficient statistical analysis.

H1: *There are barriers to coding clinical data, and these barriers affect the quality of coded data.*

1.6 Structure of Research

This research study is divided into five chapters.

Chapter 1: An overview of the research topic is presented in this chapter. It contains the introduction to the research, research question to be answered, significance and aim of the study as well as the scope of the study.

Chapter 2: This chapter contains theoretical framework and review of scholarly literature relevant to the study. This chapter is divided into two parts. The first part deals with the coding process and tools while the second part deals with data quality and the barriers to quality coding of clinical data.

Chapter 3: This chapter reviews relevant literature on data quality and its attributes in an attempt to explore the field of quality and coded data.

Chapter 4: This chapter focuses on and describes the research design and the instrument used for the study. It also deals with the sampling techniques, methods

of data collection, methods of data analysis as well as procedures for validity and reliability.

Chapter 5: It consists of the findings from the survey and analysis of these findings that is data analysis.

Chapter 6: This is the last chapter which presents detailed conclusion and recommendations provided from the findings of the study as well as the limitations of the study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A Literature review reshapes existing information on a subject area and contributes to new perspectives of professional practice and future research (Rumrill *et al*., 2010). It is also the identifying and analysis of academic material about a specific area or topic and the determination of the relevance of the study to the topic (Garrard, 2011). In view of the above, it was important for the researcher to look into and understand previous studies relevant to the topic and the research question. This will enable the researcher to use appropriate ideas and an insight into what has been done and the gaps that exist in these literatures.

This chapter is divided into two parts. The first part discusses "The Coding Process and Coding Tools. This part provides a review of literature on the Irish healthcare system and its adoption of clinical coding as well as clinical coding in America, Australia and Europe in general. It also presents the sources of information for coding with a review of Electronic Health Record (EHR) and Paper-Based Health Record (P-BHR). The coding tools used in Irish hospitals ICD-10 coding standard and the HIPE portal were also reviewed. The chapter also touches on the coding process, clinical coders as well as the barriers to quality coding of clinical data

The second part reviewed up to date literature on Data Quality (DQ Attributes), Quality in Coding and Data Quality in Health care.

The reviewed literatures in this chapter were scholarly publications collected from different databases via the Trinity College Library. The databases from which literature were sourced from are *EbscoHost, Google Scholar, Google books, Engineering village, Digital Library, Science Direct, ProQuest Dissertation.* The keywords used in searching for literature are *data quality, data attributes, data models, clinical coding, structured data, Electronic Health Record, Paper-based Health record, Barriers to data quality.* Various studies and papers were retrieved from the search but the most relevant papers to the study were reviewed by the researcher. The references from the papers reviewed were also checked for relevance to the study. In this study, data and information are used interchangeably except where it is specifically stated.

2.2 The E-Coding Process

The interpretation of clinical medical terminology in respect of a patient care such as symptoms, diagnoses, treatments and procedures in a way that is internationally recognised is referred to as clinical coding (Walker and Nicholson, 2009).

It is the translation of documented patient record into codes which usually occurs after a patient's contact with hospital care in line with coding rules and guidelines within a specified reporting time called deadline (Royal College of Physicians, 2007).

It is important for Clinical Coders (CCs) to code patient information correctly. Any miscoding can lead to misrepresentation of a patient care episode and an error in professional billing. Therefore, CCs must code what is either documented in the EHR and PBMR (Falen and Liberman, 2005; Walker and Nicholson, 2009 and Cheng *et al.*, 2009). This however means that coding starts at the point of clinical contact with a

patient and CCs rely solely on what is documented in patient medical records (Royal College of Physicians, 2007). Physicians are not used to coding standards and guidelines, it is then essential for clinical coders to equip themselves with the latest information and training needed for coding. In order to present a patient episode of care in standardised codes, CCs are required to review and analyse patient records in a careful and systematic way and code according to guidelines and conventions (Falen and Liberman, 2005).

2.2.1 Coding in Ireland.

The Beginning of the Irish healthcare industry dates back to the 19th century. The voluntary hospitals emerged in the eighteenth century with the aim of providing healthcare services for the poor who are sick and this has been the foundation of the modern Irish healthcare system (Madden, 2011).

The Irish Healthcare industry comprises both public and private institutions under which healthcare service provision is the responsibility of the health services executive (HSE), hospitals, general practitioner services (GPS), specialist bodies established under the Health(corporate Bodies) Act and registration bodies (Leahy and Wiley, 1998 & Madden, 2011).

The Irish hospitals since the eighteenth century have been receiving funding and assistance from the government and the amount of funding varies between hospitals (Meenan, 1995). Since 1989 (HSE, 2008), the Commission on Health Funding was established which in 1991 lead to the formation of the National case-mix project. Case-mix is based on the data generated from clinical coding. The computer-based health information system designed for the collection of clinical and administrative

data that shows hospital activities in Irish hospitals is referred to as the Hospital Inpatient Enquiry (HIPE). This was established in 1971 and since has been collecting and producing data on hospital discharges and morbidity in acute hospitals (Murphy *et al.*, 2004). The HIPE data is managed by the Economic Research and Social Institute in Ireland. Clinical coding data is called the HIPE data in Ireland. The HIPE data is use for epidemiology studies, quality assurance studies, market research, drug trials, planning and the measurement of activities in acute hospitals (Murphy *et al.*, 2004).

The coding process begins with the patient medical record ranging from discharge summary, nursing notes, consultation report, operating sheet, pre and post-operative reports and pathology reports either documented in the electronic form or paper-based form (ESRI, 2011). The ESRI (2011) propose that quality coding should take the following steps

1) Analyse – CCs must read patient medical record and be able to identify the principal diagnosis and procedures.

2) Locate – CCs must identify the main terms such as the symptoms and causes of patient hospital care on the ICD-10.

3) Select – CCs must select appropriate code from the alphabetical index of the ICD-10.

4) Check – CCs must ensure the most appropriate code is selected by checking with the instructions and notes that are attached to the codes.

5) Apply – CCs are to apply the Australian Coding Standards and the Irish Coding standards appropriately according to the guidelines.

With the above process, CCs are expected to make use of all the information in a patient's medical record to tell a story of a patient's diagnosis and procedure and this should be of high quality. The quality tools for ensuring quality in HIPE data are the HIPE edits and checker tools. The HIPE edits takes place at the point of input into the HIPE computer system called the HIPE portal and the HIPE checker tools is done at the hospital level for error correction and to improve quality (ESRI, 2011; Bramley and Reid, 2005). The coder's creed as highlighted by Prudames, (2009) in her report Sailing the Seven Cs' quoting the NCCH (1998) are **C**linical documentation, **C**ommunication with clinicians, **C**oding standards, **C**onventions, **C**lassification experience, **C**ommon sense and s**C**ience of medicine. Prudames (2009) posits that reliance on the coding creed will bring about quality in clinical coding.

In order to achieve quality in clinical coding, the ESRI propose the HIPE collection process shown in figure 1 below:

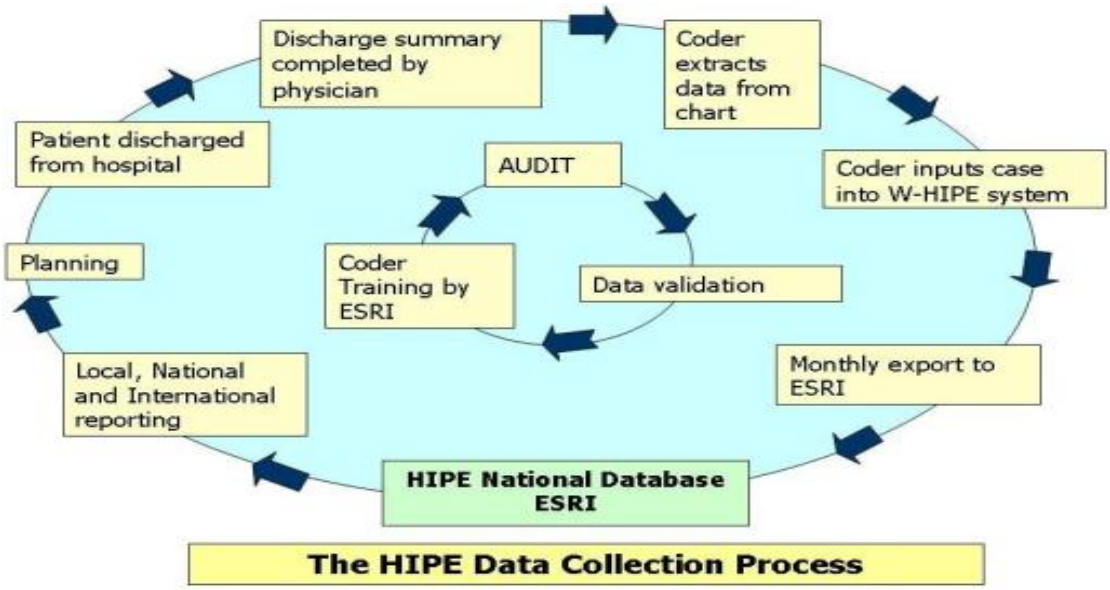


Figure 1 HIPE Data Collection Process

Source: http://www.esri.ie/health_information/hipe/

The diagram above indicates that the coding process is a circle that starts from patient's discharge from the hospital. Patient health care episodes are documented by physicians coders extract diagnosis and procedures and translate them into codes which are input to the HIPE Portal and transferred to the ESRI national database on a monthly basis. The ESRI on their own part audits of this data and validates so that it can be readily available for users for different purposes.

2.2.2 Coding in Other Parts of the World

Clinical coding in Ireland is similar to that of other countries in Europe, America and Australia. The history of clinical coding in the United Kingdom is dated back to the

17th century and since then there have been different classification of diseases for clinical coding (Brox and Huston, 2004). In the UK, the National Health services (NHS) has the responsibility of maintaining and implementing quality in coding. The ICD-10 and OPCS-4 are the coding classification used in the UK. Incomplete patient record, inconsistent coding and management policies in terms of clinical coders training and accreditation are what the NHS believe can affect the quality of coded data (NHS, 2011). The NHS focus on the accuracy, consistency, timeliness and completeness as a way of accessing quality in coded data. Other measures employed by the NHS are presentations for non-coders (clinicians), clinical coders' professional development and improving management policies and procedures in the area of coding (NHS, 2012). Audit of coded data is carried out on a regular basis in order to achieve data quality and confidence (NHS, 2012).

On the other hand, coding in the United States is done by accredited coders. These coders are registered members of the Society for Clinical coders (SCC) and affiliated to the American Hospital Information Management Association (AHIMA). Coding guidelines are issued in *Coding Clinical* Journals by the American Hospital Association (AHA). The international classification of disease use in the United State is the ICD-9-CM (Murphy *et al*., 2004; Falen and Liberman, 2005) and there is a transition to the use of ICD-10 coding standard by 2014 to ensure quality of coded data both in the national and international region (Falen and Liberman, 2005; Carolan and Reitzel, 2011; Jarousse, 2012 and Centers for Medicare & Medicaid Services, 2012). Also, clinical coding (like in Ireland and the UK) is recognised for its key roles: reimbursement, health planning and research (Falen and Liberman, 2005).

In terms of professional qualification and control, the situation in Canada is similar to Ireland, the UK and the United States as Clinical coding in Canada is the responsibility of health record staff known as healthcare technicians, administrators and practitioners. There are over 1,200 coders in Canada. They gain their qualification from a college, university or training offered by the Canadian Healthcare Association (McKenzie *et al*., 2004).Coding in Canada is supported by The Canadian Institute for Health Information (CIHI) which ensures the provision of accurate and timely coded data. The CIHI has the responsibility for the management of coded data and quality is ensured through regular training of clinical coders and update of coding standards and guidelines (Murphy *et al*., 2004). The CIHI developed a data quality framework to ensure accuracy beginning with timely reporting of coded data in line with coding sets and rules. This quality also ensures comparability, usability and relevance. The frame work is reviewed every two years to ensure that it remains relevant and up to data (CIHI, 2007).

The Australian coding workforce is made up of about 1000 clinical coders. They attend courses organised by the National Centre for Classification in Health (NCCH) and the Health Information Management Association of Australia. The ICD-10-AM coding guideline is use in Australia. The auditing and coding measurement tool is developed by the NCCH and this is called the Patient Indicators of Coding Quality (PICQ). Quality checks of coded data are done at the hospital level (Murphy *et al*., 2004). Most of the CCs in Australia have HIM qualification and are trained in medical terminology, medical science, human anatomy and physiology. Distance training is

also given to practising coders and they are trained to code 'on the job'. There are very few CCs in Australia who do not have formal training (McKenzie *et al*., 2004).

Finland, Sweden, Norway, Denmark and Iceland are grouped together because of the relationship that exists between them in terms of geographical, economical and health policies. Clinicians carry out coding in these countries with the use of ICD-10 and local coding standards. Medical secretaries also engage in coding and improve their skills through training and courses. In order to guarantee quality, codes are signed off by clinicians (Murphy *et al*., 2004).

2.3 The E-Coding Tools

The main coding tool identified in various studies is the patient health record. The careful review of the patient health record is the beginning of clinical coding. No coding is complete without the patient health record. The patient health record can either be in electronic form or paper form (Falen and Liberman, 2005). The patient health record consists of both the administrative and clinical information. The patients name date of birth, sex, home address and insurance status are the administrative information while the laboratory test results, X-ray, operation sheet and nursing notes form the clinical information. The clinical information is the main information for coding while the administrative information enhances the accuracy of coded data. In a situation where this information is missing, there could be coding error (Falen and Liberman, 2005). Clinical coders interpret information from a patient's record in either electronic or paper form into acceptable and standardized codes (Heinze *et al*., 2001). The benefits of the EHR over the PBMR have been identified in different studies especially in the area of availability, consistency and

accuracy of patient health record (Hanson, 2006; Menachemi and Collum, 2011). The International classification of diseases (ICD) is the standards used for coding and this contributes largely to coding scheme (Murphy *et al*., 2004).

The following coding tools will be discussed in the next section of this chapter:

- The Electronic Health Record (EHR)
- The Paper-Based Health Record (PBHR)
- The International Classification of Diseases (ICD)
- The Electronic Coding Portal

2.3.1 The Electronic Health Record (EHR)

The EHR is the automation and electronic version of a patient health record. This allows for the presentation of up to date patient record in a standardised format in order to improve patient care and safety (HIQA, 2012 and Hanson, 2006). For the purpose of this study, the EHR refers to an aggregate of any electronic patient records (EPR) found in the hospital. The EHR includes patient's information ranging from demographic information to medical reports. The EHR is made up of patient health information that is generated by encounters with any healthcare services which includes patient demographics, diagnosis, medications, laboratory results and radiology reports" (Health Information and Management Systems Society (HIMSS, 2012). The EHR gives a complete patient health record and is also the integration of the administrative, patient information and clinical decision support functions of the

healthcare industry (Car *et al*., 2008; Duquenoy *et al*., 2008 and Robertson *et al*., 2010).

Studies have shown the various benefit of the EHR ranging from improvement in the delivery of healthcare, provision of accurate and complete patient medical record (Carter, 2008 and Jha *et al*., 2009). The need for a structured record to promote continuity of the patient record and to improve communication between the patient and the clinician was identified by Clarke and Lawton (2000). This will not only improve the standard in patient health record but also the entire coding process.

The justification for EHR within the health care industry was analysed in the Silicon report 1997 as reduction in the loss and duplication of patient medical information, availability of up to date as well as real time patient medical information. In the same vein, a complete record of patient encounter is assured through the integration of all healthcare application which forms the EHR leading to standardization in order to avoid medical error (CEM, 2006).

Felt-Lisk (2006), surveyed the types of healthcare application system used in hospitals and categorised it into E-prescribing, electronic clinical notes, electronic Lab orders, electronic imaging system and electronic alert system. The survey found that 80% responded that the use of healthcare applications has contributed to quality healthcare improvement in their hospitals. Cater (2008) also highlighted the types of information technology applications that are in place in hospitals with their functions below.

Table 1 Hospital Information Technology Applications

System Type	Function
Master Patient Index	Registration and assignment of hospital numbers
Pharmacy Information System	Drug information, billing and dispensing
Radiology Information System	Appointment scheduling, billing and reporting
Picture Archiving System	Presentation and Storage of radiology images
Nursing Information System	Nursing documentation and care planning
Hospital Information System	Linked to other departments in the hospital and manages census (admissions, discharge and transfers).
Chart Management/ Medical Records System	Manages paper records and aids statistical reporting for clinical coding and health statistics.
Practice Management System	Outpatient system for managing clinical information for business related issues.
Laboratory Information System	Manages laboratory test and reports. It is linked with pathology, microbiology and blood bank.
Source: carter J. (2008) p.4	

Health information systems are designed to support decision making by generating accurate and complete data as well as standardising medical terminology that is acceptable for clinical coding (Clark and Lawton, 2000; Carter, 2008). The EHR has contributed to the transformation of healthcare system from paper-based system to a computerised system that enables patient information to be stored electronically, reduces patient information error and allows for the availability of patient data

(Menachemi and Collum, 2011). In a study carried out by McKenzie *et al.*, (2003), in Australia, they posit that there might be improvement in coding functions with the introduction of EHRs in hospitals. They found out from managers and coders that the introduction of EHR will bring about better documentation and availability of patient information, reduce the issue of data quality and increase computing skills amongst clinical coders. They concluded that the benefits of EHR to clinical coding will lead to availability of information that will improve coding turnaround time and improve data quality (McKenzie *et al.*, 2003).

2.3.2 Paper-based Health Record

The Paper-based Health Record (PBHR) is the documentation of patient healthcare information in paper form referred to as a medical chart. This is a traditional way of documenting patient information. Various studies have shown that there are many disadvantages associated with the PBHR. These are incomplete and inconsistent documentation and lack of flexibility. The accessibility to the PBMR could also be difficult and might not be available at the point of patient care. All these are said to have impact on quality healthcare delivery (Roukema *et al.*, 2006 and Hanson, 2006). On the part of CC, studies have shown that documentation of patient record is one of the main issues that affect coding (McKenzie, *et al.*, 2003; De Lusignan, 2005; Bajaj et *al.*, 2007; Walker and Nicholson, 2009; Cheng *et al.*, 2011). Many issues associated with PBMR from these studies are incomplete documentation, missing patient information, improper record layout, and illegible clinician writing. All these go a long way to affect the accuracy in clinical coding (Cheng *et al.*, 2009).

2.3.3 The International Classification of Diseases (ICD)

The ICD is the International Classification of Diseases. It is globally used for the statistical classification of mortality and morbidity health problems. It is the main tool for healthcare diagnosis, management and reimbursement. The ICD was first adopted and put to use in 1893 by the International Statistical Institute and has been revised regularly to meet research and development in healthcare. The ICD current version is the 10th version that is used in nearly over hundred countries (World Health Organisation, WHO 2012). The ICD defines all health conditions which includes symptoms, injuries or and health disorder. For the purpose of quality, the ICD groups healthcare information into a standard form for easy storage, retrieval and analysis. This standardization also allow for health information sharing and comparison between and within hospitals, regions and countries (WHO, 2012). In Ireland, the Australian Modification is used for clinical coding alongside the Irish Coding Standards (ESRI, 2004). Ronning (2011) posits that quality of data reporting and healthcare management is improved through the use of ICD-10 as well as enhancement in the implementation and functionality of the EHR.

2.3.4 The Electronic Coding Portal

The electronic coding system is called the HIPE portal coding system. This is the ICT system use for the collection of HIPE data in Irish hospitals and it is essential to the collection of data The HIPE portal came into use in the mid 2011 in replacement of the Windows HIPE software. The differences between the two systems are numerous and in order to achieve quality and more secured data, the Health Research and Information Division (HRID) in the ESRI developed the HIPE portal. The

HIPE portal uses a web browser interface and the Microsoft SQL server for the database compared to the Windows HIPE software that was installed manually on the computer systems and uses Microsoft Access.

Upgrades and backups of the HIPE portal are carried out by the HRID IT in compliance with each hospital policy. As part of data quality attributes, the HIPE portal is secured through the use of authorised IP address and access via the use of password. Transmission of data from Irish hospitals to the ESRI is secured and encrypted by the portal (HRID, 2010). Audit is carried out through the HIPE Coding Audit Toolkit (HCAT).

2.4 Who are Clinical Coders?

Clinical coders are healthcare professionals who have the sole responsibility of analysing a patient health record, assigning the appropriate ICD-10 codes inputting these codes into the appropriate information technology systems. CCs are also involved in data quality checks and contributing to issues relating to CCs (McKenzie *et al*., 2004). Johns (2000) is of the opinion that CCs should be more involved in the development of health classification and vocabulary development as well as health care research, data quality and payment management in healthcare (Scichilone, 1999). McKenzie *et al*., (2003) highlighting the AHIMA suggested that CCs should be 'clinical data specialists' who will be involved in software design, management and audit. They concluded that CCs can be go between medical teams and information technology (IT) personnel due to their experience and understanding of healthcare classification systems. However, for CCs to perform these functions and maintain high coding skills, they need to be knowledgeable of clinical medicine and

information technology (Robinson and Shepheard, 2004). Studies carried out on the workforce of CCs shows that there are shortages of CCs and most CCs are administrative workers who are trained on the job. This shortage was attributed to the non-accreditation of CCs (Kieke, 2001; Stegman, 2003; Bramley and Reid, 2003). Murphy (2010) was of the opinion that accredited coder qualification will bring about appropriate coder training that will improve the quality of coded data and make CC a professional skill. Accreditation of other professions in the healthcare industry brings about accountability and this is said to be passed on to CCs in order to foster accountability, standard and confidence for quality improvement (Mulaik, 2002). Mulaik (2002) suggested that accrediting clinical coders should be part of the compliance plan of all healthcare organisations in order to ensure data protection and accuracy of data on the part of clinical coders.

In a study carried out by AHIMA as highlighted by Mulaik, (2002), they found out that CCs in some hospitals have no credentials. This is not a good idea if quality of coded data is to be maintained.

In order to maintain quality, Prince and Robinson (2011), suggested key factors that a coder must possess. These are

1) Culture of learning and self-improvement both internal and external.

2) Appropriate communication between coder and doctors as well as between coders and coders.

3) Up to date clinical knowledge and information.

4) Ability to make accurate and informed decision while coding.

5) Financial knowledge of DRGs.

6) Competence to know when to audit and be audited by third party.

7) Quality management practice that involves accurate analysis, reporting and implementation of audit results.

8) Support and collaboration from clinicians and hospital management.

9) Information technology skills

All these factors will go a long way to improve healthcare value and patient care. They also likened CC to a form of art called CUBISM pioneered by Picasso in the 18th century which involves the act of breaking up an object, analysing it and re-assembling it into a meaningful form. In order for CCs to be able to incorporate this act into coding practice, they must possess the key factors highlighted above.

2.5 Barriers to Clinical Coding

Following their study on clinical coding, Santos *et al*., (2008) identify various factors, which they referred to as barriers. These errors affect smooth running of the healthcare system thereby leading to inaccurate statistical figures on hospital morbidity (Santos *et al*., 2008). Various studies have identified different types of barriers to coding of clinical data. These barriers were heighted as contributors to coding errors thereby affecting the quality of data generated from coding (Robinson and Shepheard, 2004; De Lusignan, 2005; Bajaj *et al*., 2007; Santos *et al*., 2008; Cheng *et al*., 2009; McKenzie *et al*., 2009; Walker and Nicholson, 2009). In a study

carried out by (Bajaj *et al*., 2007 and Cheng *et al*., 2009), poor documentation in patient medical record is one of the factors that lead to miscoding thereby leaving CCs with the option of assuming what clinicians want to document. Accurate documentation contributes to accurate clinical coding and accurate documentation relies on the clinician by recording patient diagnosis and procedures clearly. The patient Medical record is a medical tool and the accurate timely completion is the sole responsibility of the clinicians (Walker and Nicholson, 2009). Studies have shown that source document in healthcare is health record documentation and this is vital to coding (Robinson, K and Shepheard, J, 2004). CCs face the challenges of incomplete and insufficient documentation, missing medical charts/ records, coding deadlines and inadequate training (Price, E and Robinson, K 2011). In a study carried out by Santos *et al*., (2008), they categorised these barriers as organisational factors affecting quality of coded data. These are inadequate resources, incomplete documentation, strict deadlines, inconsistency in communication, large volume of coding, hospital speciality, geographical location, lack of management support availability of quality control measures and the layout of the coding departments.

In the analysis of the study carried out by Uzkuraitis, *et al*., (2010), they categorised the barriers into inconsistencies across various coding sites (that is hospitals) and coder training and education as having a major impact on the quality of coded data. Workforce plan, multitasking and deadline compliance are what Santos *et al*., (2008) described as factors that affect quality of clinical coding. They also posit that accessibility of CCs to coding managers and clinicians are also limiting factors to quality of coded data. In the study carried out by Hennessy et al., (2010), there was a

decrease in the number of diagnosis coded and this they attributed to shortage of coders.

2.6 Summary

This chapter reviewed and compared the coding process in Ireland, the United Kingdom, United States of America, Canada, Australia and the European countries of Norway, Denmark, Finland, Sweden and Iceland and drew the conclusion that quality standards are paramount in driving quality healthcare delivery. Continuous training of coders, audit of coded data and regular update of standards and guidelines around data quality featured prominently in those countries.

The review equally discussed who clinical coders are and highlighted key qualities a coder must possess which include a culture of learning and self-improvement; quality management practice, ability to make informed decisions while coding and excellent communication skills.

The literature review identified the following barriers:

- Poor documentation of patient medical record (Patient Chart)
- Inadequate coder training and layout of the coding departments
- Unrealistic coding deadlines
- Organisational inadequacies and limited human resources
- Geographical location and hospital speciality
- Inconsistency in communication
- Large volume of coding
- Lack of adequate quality control measures.

Chapter 3
Data Quality

3.1 What is Data Quality

Data is described as the foundation of information and knowledge (Schuurman and Balka, 2009). People use the information generated from data on a regular basis to make decisions and carry out activities that make businesses and services exist (Mc Gilvary, 2008). Data is an asset that is controlled and used by an organisation to create value and wealth as well as enable an organisation to make decisions in order to move in the right direction (Loshin, 2011 and Cantin, 2011). Lee *et al*., (2006) emphasised the importance of Data Quality (DQ) to organisations. They were of the opinion that DQ is a valuable asset that increases customer satisfaction, improves revenue and profit, and can be used as a competitive advantage with competitors. On the other hand, Cantin (2011) defines DQ as the relationship between data requirements and its attribute of completeness, accuracy, and availability. Good data is the back bone of all management decision irrespective of the business activities and bad data can make a company collapse (Lindsey, 2011).

Various studies have underscored the huge significance of data on any type of business (Wang, R and Strong, D, 1996; Haug *et al*., 2011 and Cantin, 2011). Redman (1996); Haug and Arlbjørn (2010); Haug and Liempd (2011) posits that poor data is a global problem that affects all aspect of the economy irrespective of the type of business while the effect of poor data as described by Batini and Scannapieco, (2006) is not linked to the cause of poor data. Poor data Crosby (1984) and Olson (2003) is the non-satisfaction by the end user with the data for its intended use. Data must be able to satisfy its intended use before it can be classified as having quality (Oslon,

2003). For data to serve this purpose, it must be accurate, timely, relevant, complete, understood, trusted, consistent and current (Wang *et al*., 1992; Oslon, 2003; McGilvray, 2008 and HIQA, 2011). Studies have also shown that data quality cannot be defined, measure or manage without understanding the attributes and dimensions of quality data (Wang *et al*., 1992, McGilvray, 2008).

3.1.1 Data Quality Attributes

Data of high quality is identified when compared with a set of models. These models are referred to as attributes or dimensions. The measurement of data quality is based on these models (HIQA, 2011). Various studies have identified these attributes with different interpretations (Pipino *et al*., 2002 and HIQA, 2011).

Wang *et al*., (1992) and Pipino *et al*., (2002) were of the opinion that it is difficult to define data quality attributes. Pipino *et al*., (2002), divided the attributes into subjective and objective assessment based on simple ratio, minimum and maximum operation and weighted average while Wang *et al*., (1992), define the attributes from three angles which are information systems success, user satisfaction, accounting and auditing. On the other hand, Cantin (2011) proposed that data quality metrics should be used to measure the dimensions of data quality in order to determine the quality of a data. These are completeness and correctness. Wang *et al*., (1992) define these attributes as quality parameters which indicate how a data user defines the quality of data at hand. The parameters are used to define measure, analyse, manage and determine data quality (McGilvery, 2008). Twelve dimensions were identified by McGilvery (2008). On the other hand, Cantin (2011) was of the opinion that two out of these dimensions which are completeness and

correctness are used in strategic and operational management of data quality while Redman (1996) was of the opinion that accuracy, completeness, consistency and relevance are the major dimension and criteria that determines data quality. For the healthcare industry, Lorence (2003) believes that timeliness is the main data quality dimension because data generated in the healthcare setting has a life span. To Lorence (2003), a timely data is an accurate data and since the data generated in the coding process is linked to payment, coded data must satisfy the criteria of being timely. Earlier said, it is difficult to define data quality dimensions and in order for any organisation to define and fit these dimension into their data quality activities, Pipino *et al*., (2002) divided the dimension into three quality metrics. These are:

1) **Simple Ratio**: DQ is achieved when the actual outcome measures with the expected outcome. This indicates data free-of-error, completeness, consistency, concise representation, and relevance.

2) **Min or Max Operation**: these are quality indicators. This is the minimum or maximum quality indicator a data can possess. Minimum quality indicators are believability and appropriateness while timeliness and accessibility are the maximum quality indicators. A minimum indicators is used were there are aggregates of data quality indicators while the maximum is useful in a complex situation where DQ is to be determined.

3) **Weighted Average**: this can be used in place of the min and max operator. This is used where there is a rating of the quality indicators to determine DQ.

This comprises of as many DQ indicators as possible and is rated based on the understanding of these DQ indicators.

Intrinsic, contextual, representation and accessibility are what Wang and Strong (1996) identified as attributes of data. Intrinsic DQ indicates that data has a right to be accurate at all times while contextual DQ is the ability to consider data in the context for which it is required for. These are relevance, timeliness, complete and appropriateness. Data must be secured but accessible to the authorised user this is the role information technology plays in data quality. Data must be easy to understand, interpreted and presented in a concise and consistent way. These dimensions or attributes Lindsey (2011), enables an organisation to fix any error that occurs in data. The various attributes identified in the research are explained further in Table 2

Table 2 Data Quality Attributes/Dimensions

Accuracy/ Free of error
Accurate data are said to be data that are correct and come from a genuine or valid source. Accuracy of data is determined by the decision or reason for the data. Literatures have shown that accuracy is one of the main definitions of DQ which is described with correctness and unambiguity (Pipino *et al*., HIQA 2011; Blake and Mangiameli, 2011; Haug and Arlbjørn, 2011). In order to define accuracy, the following questions are to be asked. “Are the values of the data correct? What is the level of confidence of users in these values?” (Cantin, 2011). Being able to compare what is recorded or documented with the actual value is what Ballou and Pazer, (1985) as well as Lindsey, (2011) referred to as accuracy attribute of data.

Timeliness
This is the time frame expected for data collection. Lorence (2003) posit that data have a life cycle and span of its own. Data must be available at the time of decision making and up to date for the task it is required for Pipino *et.al*, (2002) and HIQA, (2011). Timeliness is one dimension Lorence (2003) identified should be an attribute of data quality in healthcare setting since timeliness is easily determined (Ballous and Pazer, 1985).
Consistency
This deals with the presentation of data. It addresses the uniformity in data collection and presentation and that the data reflects the real world situation (Wang and Wang, 1996 and Ballous and Pazer, 2003).
Re-usability and Value- added
This is the extent that data are used or reused for the same purpose and it provides benefit for its use (Pipino *et al*., 2002 and HIQA, 2011).
Reliability
This is the consistent collection of data overtime. This is link to the source of the data. This attributes makes data credible and believable (Pipino *et al*., 2002 and HIQA, 2011).
Objectivity
This determines if the data at hand is unambiguous and reflects what it is needed for (HIQA, 2011) and if the source of the data is reputable (Wang and Strong, 1996 and Pipino *et al*., 2002).
Accessibility
The extent to which data can be reached or retrieved as and when required (Wang and Strong, 1996).

Understandable
This is the extent to which data is meaningful to the user or can the user understand what the data is trying to represent (Pipino *et.al*, 2002).
Interpretability
The extent to which data is presented in a language, format or symbols that users can understand (Wang and Strong, 1996; Pipino *et.al*, 2002 and HIQA, 2011)
Credibility
Believability is another word that is use for credibility. This determines the extent to which is a true representation of what it is meant to represent (*Pipino et al*., 2002).
Completeness
This is the extent to which data collected matches the actual set data value (Ballous and Pazer, 1985; Pipino *et al*., 2002 and HIQA, 2011). Completeness of data is determined if all the required and necessary information needed are available. If this is not, the quality of the data is to be questioned Lindsey, (2011) and this is referred to as a *null value* Batini *et al*., (2009).
Relevance
This is the extent to which data meets the requirement for decision making or task at hand (Wang and Strong, 1996; Pipino *et al*., 2002 and HIQA, 2011). Once there is a change in situation and circumstances, data has to be reviewed so that it can meet usage requirement (HIQA, 2011).
Concise
This is the extent to which data meets condition of brevity in form and comprehensiveness/completeness in scope of the presentation of the data (Pipino *et al*., 2002).

Coherence
This is the extent to which data can be compared with other data at the same time or at different time. There must be the use of standard forms or classification in order to achieve coherence (HIQA, 2011).

3.1.2 Quality and Coded Data

The use of coded data varies from administrative, clinical and economic activities (ESRI 2011). It enables the planning of healthcare services required within a community. It gives an insight into the development of clinical guidelines and best care practise in the treatment of patients which is the main focus of any healthcare practitioner (Falen T and Liberman A 2005). Coded data also forms the bases of hospital and professional reimbursement. This brought about the formation of case mix and DRGs. Case-mix is formed in order to be able to compare hospital activities and costs to measure productivity and assess quality. Case-mix based their activities on coded data (HSE 2008). The users of coded data vary from hospitals, healthcare practitioners, government, professional associations, researchers, epidemiologist, media, students and the general public. These users make use of coded data for different purposes and at different times (WHO 2010).

Without quality in coded data, healthcare practitioners will not be able to make decisions that will be beneficial to patient care. Various studies have shown that coding is not error free and therefore the quality of coded data should be top on the agenda of hospital management (Santos *et al.*, 2008 and Haliasos *et al.*, 2010).

The Economic and Social Research Institute (ESRI), manages coded data on behalf of the Health Service Executive (HSE). Figure 2 shows the 5 roles ESRI plays (data

classification, software provision, data capture, data accessibility and data validation) in order to promote and provide timely accurate data.

Figure 2 The ESRI roles to promote quality coded data

Source: http://www.esri.ie/health_information/

3.2 Data Quality in Healthcare

Quality in healthcare is defined as

> *''Doing the right thing right consistently to ensure the best possible clinical outcome for patients, satisfaction for customers, retention of talented staff and a good financial performance.''(Leahy A in Joyce and Mac Auliffe, 1998).*

Decision making and management in health care is improved by data of high quality. The impact of data of high quality is more pronounced in the area of patient care, healthcare finances, clinical decision support and pathways as well as in the sharing

of health care information. Many healthcare organisations are now working on having data of high quality. The development of information technology systems and their implementation within the health system should be in collaboration with data quality teams that will be involved in the training of data collectors for example clinical coders (CCs) in order to reduce error at the point of collection (keer *et al*., 2008). Data quality in the health care system is recognised as part of total quality management for service improvement. The key element for decision making and performance measurement is the data generated from the healthcare system. Therefore, data as a product within the healthcare industry has since been incorporated into quality information management programmes to improve patient care and healthcare management (Wang *et al*., 1998; Juran and Godfrey, 1999).

3.3 Summary

Following a review of existing studies on the topic, data is described as the foundation of information and knowledge. Quality data is determined by data quality attributes or the indicator it possesses. These are accuracy, timeliness, consistency, re-usability, objectivity, accessibility, understandable, interpretability, credibility, completeness, relevance, concise and coherence. Data is said to be fit for an intended use in operations, decision-making and planning when those attributes are not missing.

Data quality is central to healthcare planning and management. In fact, coded data is at the heart of hospital and professional reimbursement.

CHAPTER 4

METHODOLOGY

4.1 Introduction

The chapter describes the research methodology used in the study. This shows the work plan of how the researcher described, explained and predicted phenomena about the work (Rajasekar *et al*., 2006). It focuses on and describes the design employed in the study. The study attempts an investigation of the barriers to quality coding of clinical data in Irish hospitals. Methodology is the manner in which a researcher investigates an issue or a problem and this must be appropriate in order to answer the research questions (Devlin, 2008). The researcher identified that the study is a social research because it is investigating causes and explanation as well as peoples experiences (Flick, 2011). As a social research, the researcher's belief system adopted in the research was the positivist approach. The positivist unlike the anti-positivist is based on the observation and understanding of human behaviour which emphasis on objectivity of research, making use of quantitative analysis, survey and experimentation techniques (Dash, 2005). Dash (2005) was also of the opinion that the positivist theory separates the researcher from the study for an independent conclusion to be achieved. Kumar (2011) divided research beliefs into paradigms which he called the systematic and scientific belief while the second paradigm is ethnographic or naturalistic belief. However, Kumar (2011) was of the opinion that irrespective of the belief or paradigm adopted by a researcher, objectivity must be maintained and bias control during the study and at the end. The objective of this study is to identify the barriers to quality coding of clinical data and to find out if

these barriers impact the quality of coded data. In order for the study to achieve this, the researcher has to be objective and remove all bias. The positivist paradigm have being criticised by scholars because of lack of interaction between researcher and research participants but that each paradigm has its own purpose in research (Kumar, 2011, Hennink *et al*., 2011). Since the findings of the study could contribute to the improvement of coding activities in Irish hospitals, the researcher adopted the positivist paradigm in the study because of its interpretative and experimental approach as well as its objective nature. This chapter will therefore discuss the research approach, research methods and the design used by the researcher as well as the development of hypothesis tested in the study

4.2 Research Approach

Since the researcher has adopted the positivist paradigm as the belief in the study, the approach to achieving this belief was the next step to be determined. The two main research approaches to a study is qualitative and quantitative. Quantitative approach has the ability to explore and measure people's views, attitudes and perception about an issue. It quantifies and measures responses in numerical form (Flick, 2011; Remler and Van Ryzin, 2011). Qualitative approach produces structured data that are reliable while quantitative research is an unstructured and open methodology that describes variables through observation, historical content analysis or focus group discussion (Kumar, 2011 and Hennink *et al*., 2011). However, scholars argued that quantitative approach is rigid narrow focus and employs large sample size while qualitative is known for its flexibility and able to draw conclusion

form a small sample size while quantitative focuses on testing of hypothesis, qualitative is intuitive, descriptive and naming phenomenon (Kumar, 2011).

Since the study aims at identifying barriers to coding and testing the relationship between these barriers and quality of coded data, the study adopted the quantitative approach. This is will enable the researcher to identify these barriers and able to test the hypothesis formulated in the study using numerical and statistical methods and able to reach a generalised conclusion that can be used by people and in places. The qualitative approach was not adopted because of its characteristic of describing a phenomenon and using small sample size (Thomas, 2003 and Kumar, 2011).

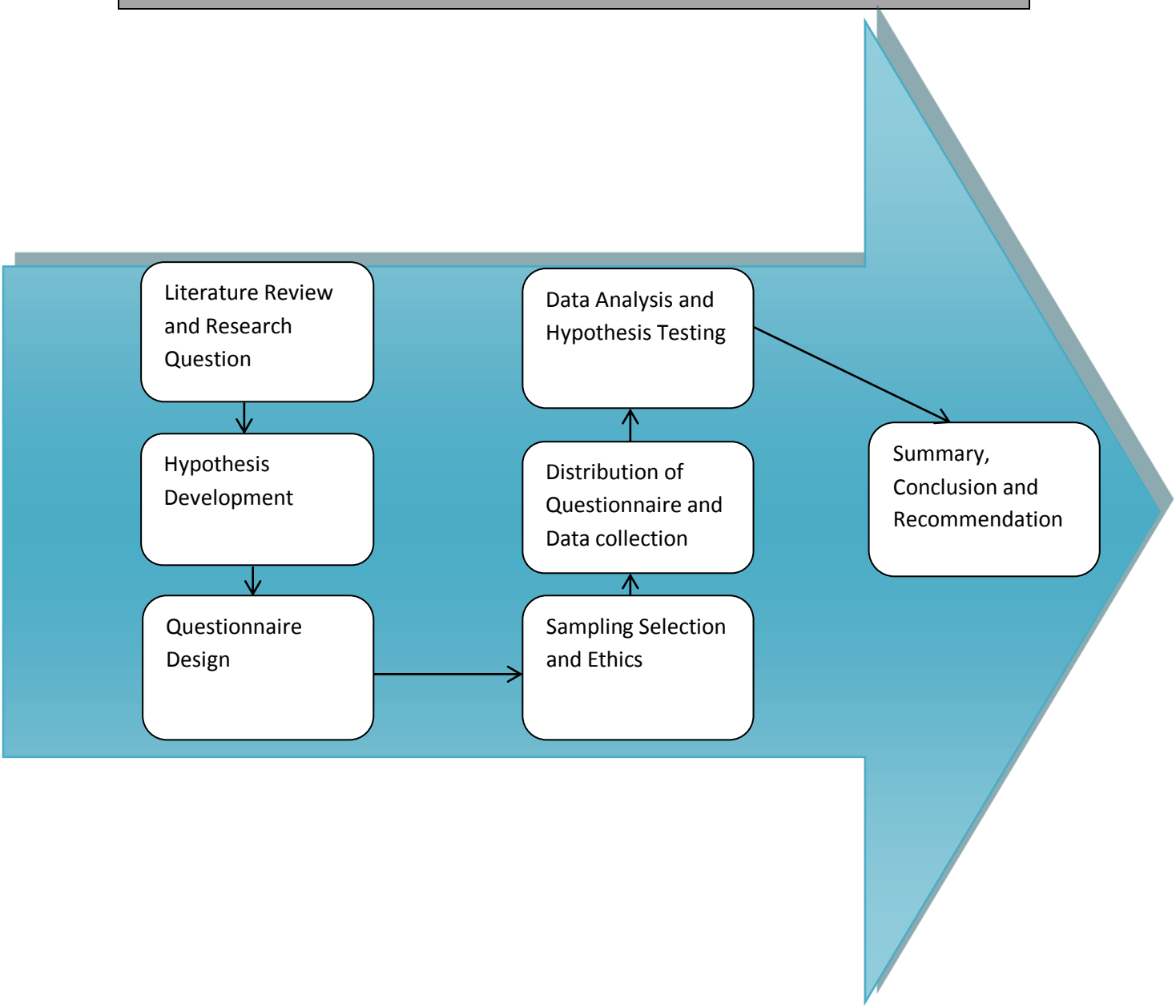
4.3 Research Methods and Design

The research method used in research is the one that best fits the research when information cannot be obtained using other means (Fowler, 2002). Since the researcher has chosen the positivist belief and quantitative approach in this study, it is best and in the interest of reaching a conclusion to choose the appropriate method that can be used to gather data for further analysis in the study. To this end, the researcher chose the survey method because survey is a method of collecting large volume of data from a large people over a period of time. It is also for the purpose of collecting information from the people that are described in the study (McNeill, 1985; Fowler, 2002 and Thomas, 2003). The study is about investigating the barriers to quality e-coding of clinical data from a coder's perspective. The information collected in the form of data is used to measure the relationship between barriers to coding and quality of coded data. Scholars have shown that the

survey is the most appropriate research method of collecting data in healthcare research since most healthcare research usually measures relationship between variables for example patients income and hospitalization experience or the relationship between smoking and cancer (McNeill, 1985). Questionnaire was used by the researcher to collect data from clinical coders on their views and opinion on the barriers to quality coding of clinical data. The questionnaire contained both open-ended and close-ended questions. Data collected were numerical in nature and used for the statistical analysis in the study. The barriers to quality coding of clinical data were identified and this responses formed the variables that was used to measure the relationship between barriers to coding and quality of coded data.

The research design is the plan layout by the researcher on how to go about carrying out the research in order to reach a conclusion (Welman and Kruger, 2001). Before the researcher started the research process, a plan was laid out so that the study will not go outside its scope. This was also important to adhere to because of the time the researcher had to complete the research. The research process and plan is shown in figure 3

Figure 3 Research Process



4.4 Literature Review and Research Question

Literature review is important to any research study. Scholars have noted that it is the basis of a research and give room for the identification of gaps or areas for further studies (Welman and Kruger, 2001; Kumar, 2005). Literature review Kumar (2005) enables the researcher to establish and understand what has being done and what the study proposes to do. The literature review in this study enabled the researcher to identify the barriers to quality e-coding as well as data quality attributes developed by various scholars. Literature reviewed formed the basis of the research question and hypothesis that was tested in this study.

Furthermore, the step by step review of literature also broadens the researcher's knowledge on the core role of clinical coders in the development of healthcare information technology and the importance of clinical coding in healthcare management.

4.5 Hypothesis Development

Hypothesis formulation enables the researcher to identify the area of focus in the study (Kumar, 2005). Findings from the literature formed the basis for hypothesis development in this study. The hypothesis developed was simply constructed for achieving objectivity in the study and to find out if there is any relationship between barriers to coding and quality of coded data. The hypothesis developed is as follows

H1: *There are barriers to coding clinical data, and these barriers affect the quality of coded data.*

4.6 Questionnaire Design

The questionnaire is an important part of data collection process. The questionnaire is designed for the primary purpose of gathering data from a research sample. It is also designed so that the most appropriate and accurate data is collected in order to achieve the purpose of the study (Brace, 2008). To this end, the researcher designed the questionnaire from findings identified in literature review. Robinson and Shepheard, 2004; De Lusignan, 2005; Santos *et al.*, 2008; Cheng *et al*., 2009; Price and Robinson, 2011 in their study and article all surveyed the barriers to coding using the survey technique and questionnaire. The questionnaire was designed solely for this study. For validity purposes, a pilot of the questionnaire was carried out amongst clinical coders before final distribution of the questionnaire. A sample of the questionnaire is found in the appendix page 90.

4.7 Sampling and Ethics

Criteria for sampling were based on the topic of investigation. The target population selected for this study were clinical coders. There are about one hundred (100) clinical coders in Irish hospitals but because of the limitations encountered by the researcher, the study population was limited to clinical coders in hospitals in the Dublin area. There are different numbers of clinical coders in the hospitals this was as a result of the speciality and size of each hospital that was sampled. Ten (11) hospitals were sampled and this is made up of Children, Acute and Maternity Hospitals. All the clinical coders in these hospitals were invited to participate in the study. The sample size was sixty (60) clinical coders within hospital in the Dublin area. After identifying the sample and target population, it became imperative that

ethics procedure in these hospitals has to be followed. The researcher applied for ethics from Trinity College, Dublin and in the hospitals that the questionnaires were distributed and ethical requirement was fulfilled. A standard application form was used to apply for ethics in the hospitals. The researcher attended the ethics committee meeting of one of the hospital that was sampled. See ethics application form in appendix D and E. The researcher provided an information sheet and a consent form for the participants (clinical coders) and an information sheet for HIPE/ case-mix managers who were the gate keepers during the study. The HIPE/ case-mix managers are the head of the HIPE department in Irish hospitals. They distributed the questionnaire amongst the sample population. However, the researcher was told that there was no need for participants to sign consent form that an implied consent was enough for the study. Therefore, the researcher reworded the consent form to indicate an implied consent from participants. The researcher contacted the HIPE/case-mix manager before the questionnaire was sent to them for onward distribution amongst the clinical coders.

4.8 Data Collection

The actual data collection took place when the researcher forwarded the number of questionnaires required in each hospital that was sampled to the HIPE/case-mix managers. The HIPE/case-mix managers served as gate keepers between the researcher and the participants. They distributed the questionnaire amongst the clinical coders in their department. The completed questionnaires were returned to the researcher in a stamped envelope with the mailing address provided by the researcher. Sixty (60) participants were invited to participate in the study which

served as the initial sample for the study out of which forty-two (42) completed questionnaire were returned to the researcher. Therefore, the final analysis was based on forty-two (42) completed questionnaires which formed seventy per cent (70%) of the initial population. The completed questionnaires were returned via post, the data collection process took about four (4) weeks to complete.

4.9 Data Analysis and Hypothesis Testing

The questionnaire is made up of questions that have both barrier indicator and quality indicator. The responses to these two indicators formed the data used to answer the research question and test the hypothesis. Responses were calculated on frequency basis reflecting the number of respondents that answered a particular question in favour of a particular option. The data gathered from the questionnaire was coded and exported onto the Microsoft Excel work sheet. Formula was inserted to generate the frequency and calculate the percentage of the number of respondents. The information from the spread sheet was used for the statistical analysis. A descriptive statistical data analysis was done by presenting the data in graphical form.

The hypothesis is tested using the Pearson correlation coefficient. This is used to measure the relationships between two or more variables which could be dependent or independent variables. The independent variable in this study is *barriers* while the dependent variable is *quality*. The T-test was also used to ascertain the statistical significance of coders' perception of both coding barriers and data quality attributes.

The data for testing these variables is selected from the questionnaire which forms both the barrier indicator and quality indicator.

r= correlation

x= barriers

y= quality

The relationship between these two variables would either be positive, negative or no relationship. A zero (0) value indicate that there is no association between the two variables and a value greater than zero (0) indicates a positive relationship. That is as one variable increases so the other. A value less than zero (0) indicate a negative relationship. That is as the value of one increases, the value of the other decreases.

Findings from the data collected from participants were fully discussed in the next chapter of the study. The researcher was able to draw conclusion from these findings. Recommendation was proposes and the area for further studies identified.

4.10 Limitations and Sampling Error

The study focuses on finding out what the barriers to clinical coding are with the aim to finding out how to minimise these barriers. The researcher took time and effort to ensure that errors are minimised. Errors can occur at any stage during a research. The researcher took painstaking effort to ensure that these errors do not jeopardize the purpose of the study. Sampling error, coverage error, non-response error and measurement error are some of the errors that occur during a research survey

(Weisberg, 2005). The researcher ensured that the measurement error was minimised by piloting the questionnaire before final distribution. The intended population was sampled and this dealt with the coverage error. The sampling error occurred as a result of time limitation to carry out the research. The researcher had no control over the return of questionnaire which is the non-response error but the researcher followed up through mails and telephone calls to the HIPE/case-mix manager to ensure completed questionnaires are returned. The study is limited by the research approach used in the study. Although the survey approach has its own advantages, the disadvantages are the limitation encountered in the study. The survey is time consuming this is what limited the researcher to carry out the research within the Dublin region. It is difficult to measure if the response to the questionnaire is the true intention of the participants.

CHAPTER 5

DATA ANALYSIS

5.1 Introduction

In this chapter, the data collected during the study from clinical coders are critically analysed and discussed. This analysis will help the researcher to identify the barriers to quality coding of clinical data as well as measure the relationship between barriers to coding and quality of coded data.

The research questions at the beginning of the study are as follows:

1) *What are clinical coder's perceptions of the barriers to e-coding of quality clinical data?*

2) *How is the quality of coded data measured in Irish hospitals?*

The hypothesis proposed is

H1) *There are barriers to coding of clinical data and these barriers affect the quality of coded data.*

The descriptive statistical analysis was used by the researcher in analysing responses to the questionnaire. The chapter is divided into two parts, the demographic analysis and the other part is analysis of the data gathered from the participants. A total number of sixty (60) questionnaires were distributed. A total number of forty-two (42) questionnaires were returned. This formed seventy per cent (70%) of the total respondent. Responses to the questionnaire were calculated on frequency basis and presented in both tabular and graphs. The analysis the responses was done using

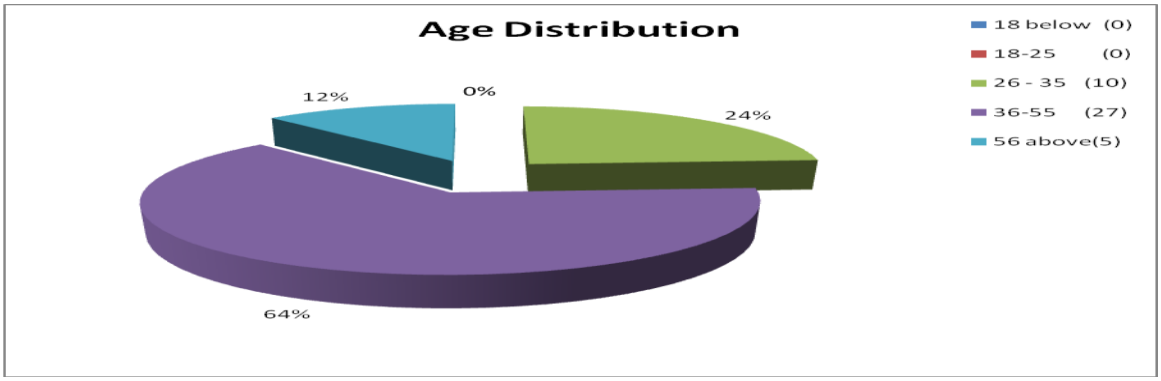
Microsoft excel. The relationship between barriers to coded data and quality of coded data is measured using the Pearson correlation coefficient statistical analysis. A T-test was carried out to ascertain the statistical significance of coders' perception of both coding barriers and data quality attributes. The variables used for this analysis was taken from the responses to barrier and data quality attribute questions in the questionnaire.

5.2 Descriptive statistics

The demographic data is the first analysis done by the researcher. This will give background information about the participant. This data contains information from age, gender, level of education and coding experience. The responses are coded for easy statistical analysis.

5.2.1 Demographic Analysis

Figure 4 Age Distribution



64% (27) of the respondents in figure 4 are between the ages of 36-55, 24% (10) are between ages 26-35 while, 12% (5) are above age 56. No respondent is 18years and below. This shows that all the respondents are qualified to participate in the research because they fall within the approved working age.

Figure 5 Gender Distribution

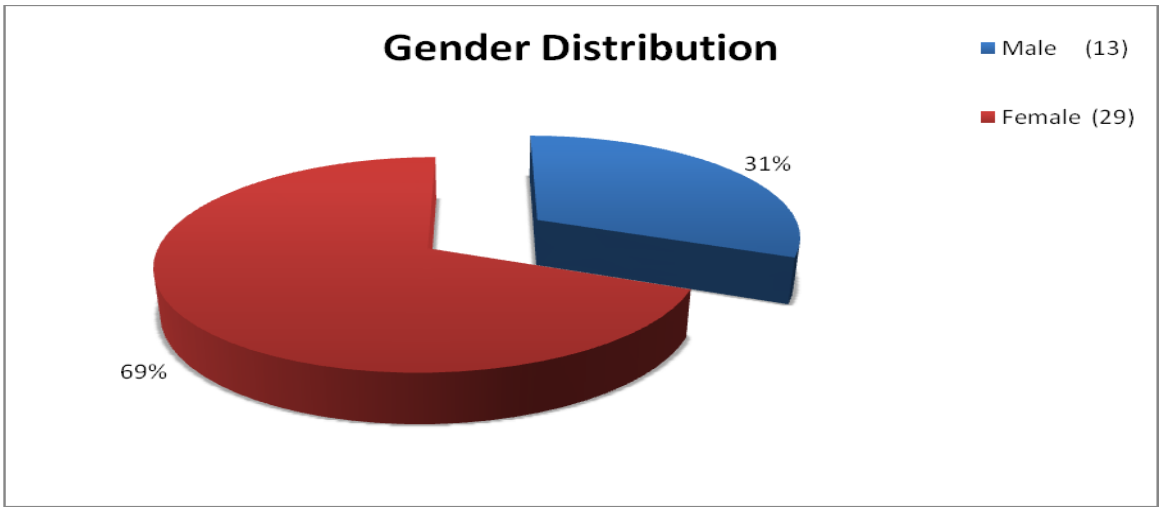


Figure 5 shows that the respondents are made up of both male and female were more female 69% (29) participated in the study than male 31% (13).

Figure 6 Educational Qualification

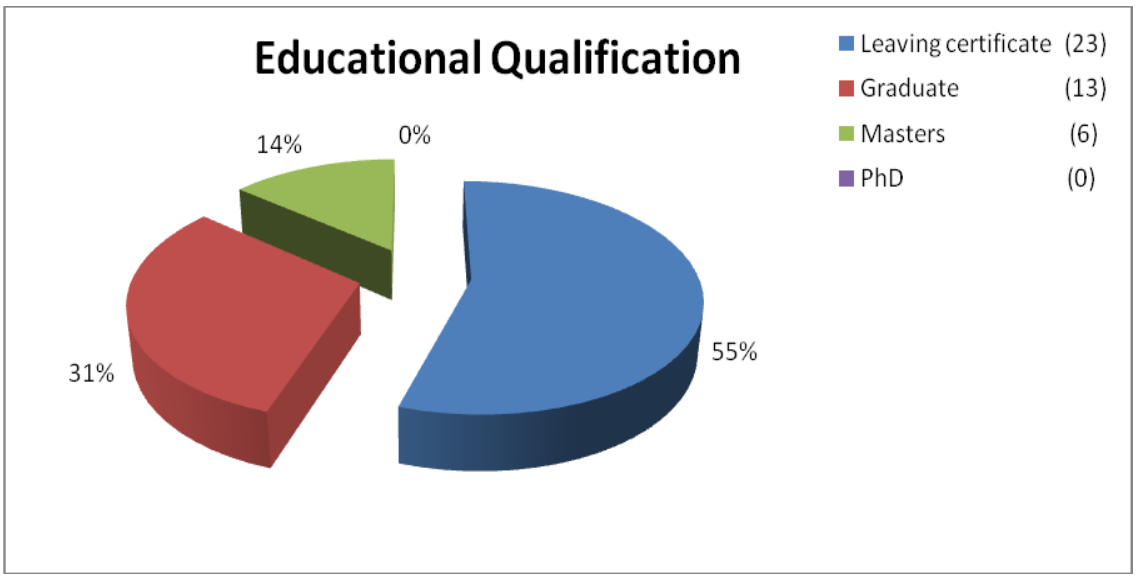


Figure 6 show that clinical coders have different educational qualifications. This indicates that they have had formal education and this will enhance easy understanding of the study. 55% (23) have leaving certificate which is basic requirement for employment, 31% (13) are graduates, and 14% (6) have additional Master's degree while there was no participant with PhD qualification.

Figure 7 Coding Experience

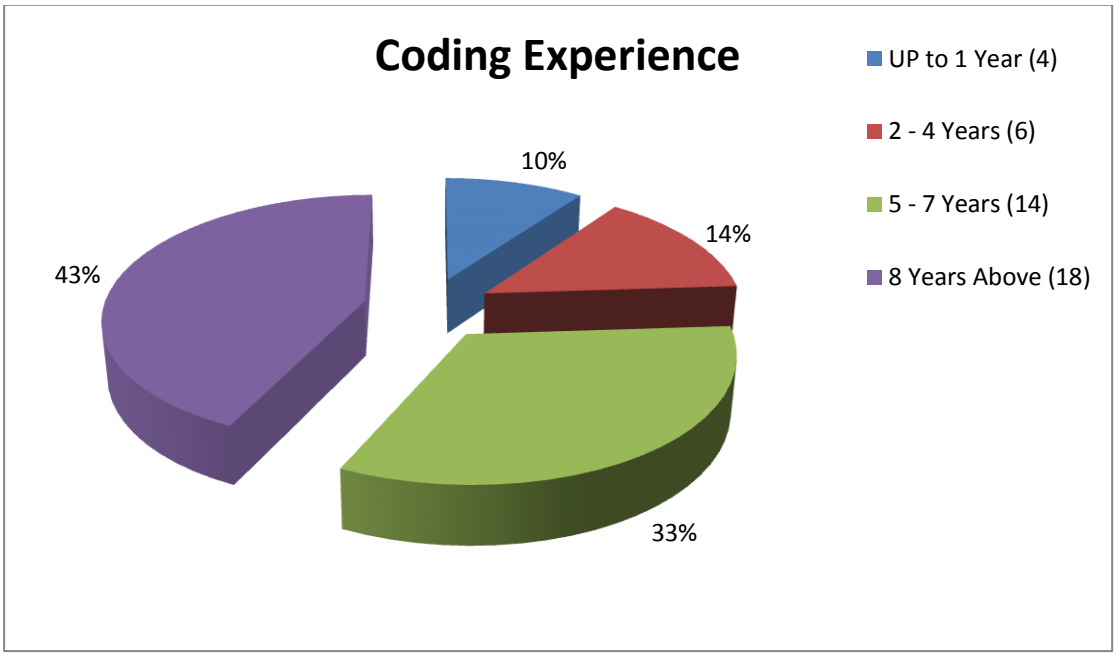


Figure 7 shows that 43% (18) of the respondents have more than 8 years coding, 14% (6) have between 2 and 4 years coding experience, 33% (14) have between 5 and 7 years coding experience while 10% (4) have up to 1 year coding experience. This could be a contributing factor to the level of barriers experienced by the clinical coders.

5.2.2 Research Question 1

What is clinical coder's perception of the barriers to e- coding of quality clinical data?

Figure 8 Understanding Data Quality

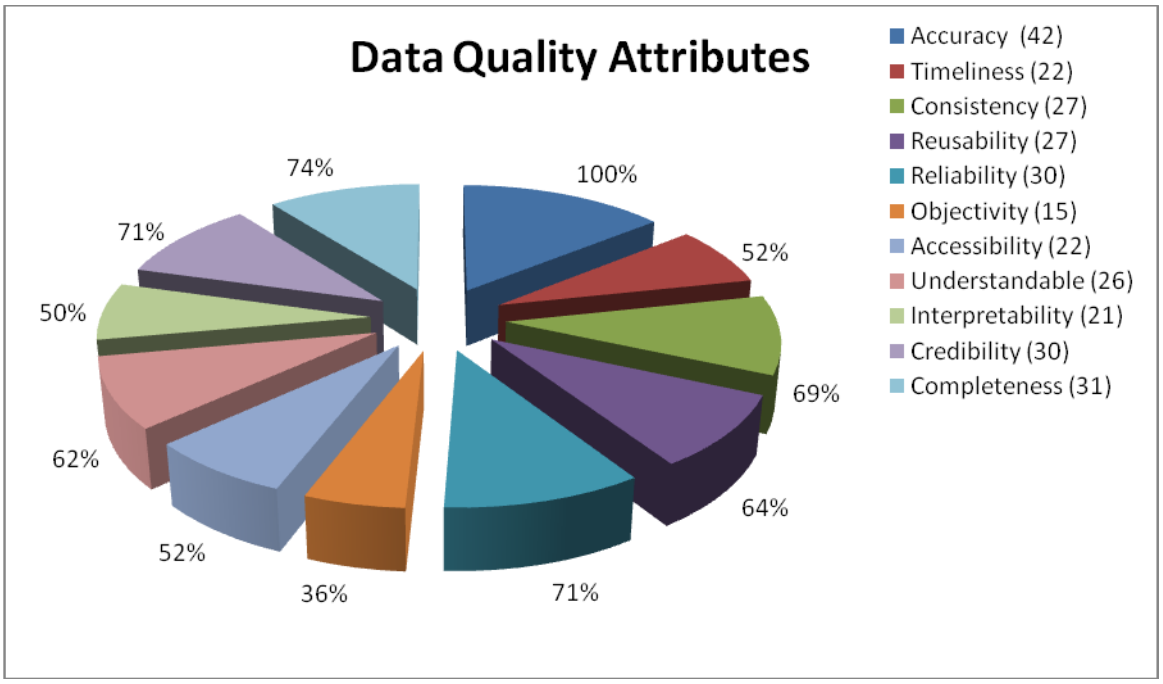
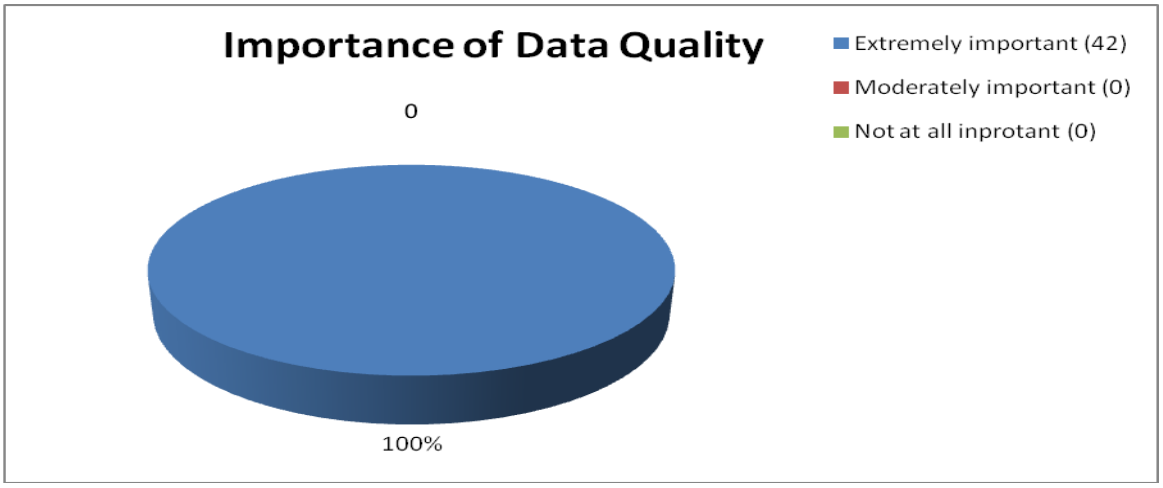


Figure 8 represents clinical coders understanding of what data quality attributes are. 100% (42) of the respondents are of the opinion that data has to be accurate, 74% (31) indicated that data has to be complete, 71%(30;30) were of the opinion that data has to be reliable and credible while 36% (15) indicated that objectivity is an attribute of quality data.

Figure 9 Importance of Data Quality



As presented in figure 9, 100% (42) of clinical coders understand that quality data is important in health care system.

Figure 10 Are there Barriers?

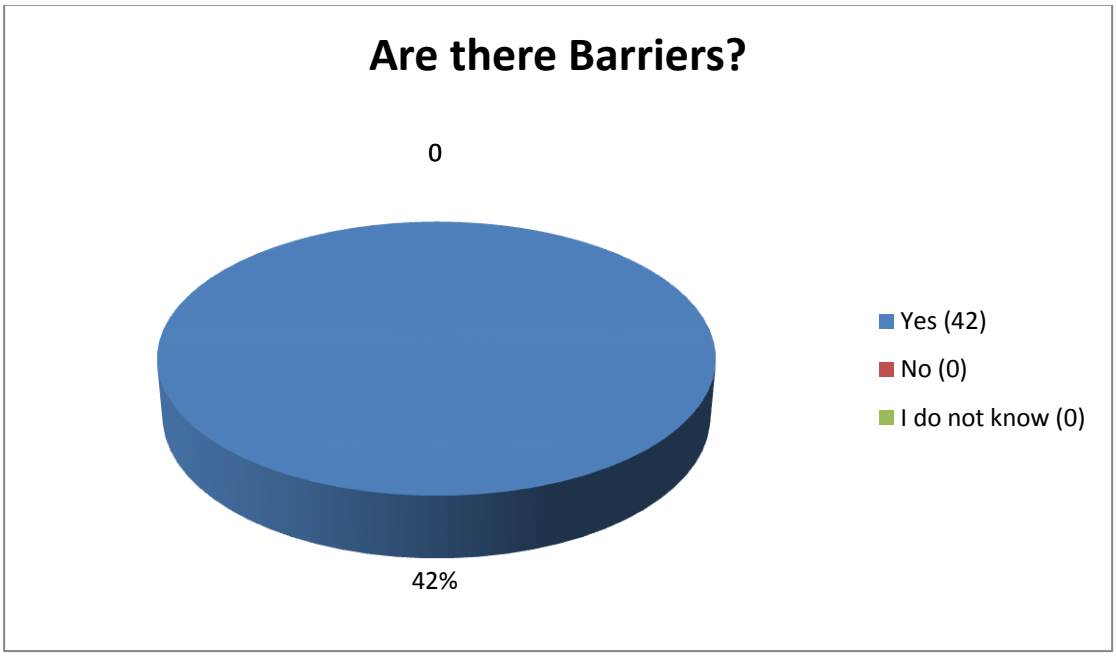


Figure 10 reveals that 100%(42) of the respondents are of the opinion that there are barriers to clinical coding.

Table 3 What are the Barriers to coding quality clinical data?

42 (100%) Clinical coders in figure 10 were of the opinion that there are barriers to coding of quality clinical data. All the respondents are able to state the number of barriers they encounter and what these barriers are.

Table 3

No of barriers	No of respondents	percenatge
1	4	10
2	2	5
3	8	19
4	6	14
5	8	19
6	6	14
7	8	19
28	42	100

Table 3 shows the number of barriers (28) to coding of quality clinical data. The 42 (100%) of the coders were able to mention between 3 to 7 barriers affecting coding

of quality clinical data. More so, the following barriers were stated by clinical coders has the main concern for coding of quality clinical data.

- Insufficient electronic health record.
- Incomplete documentation.
- Lack of communication between clinical coders and clinicians.
- Inadequate clinical coder's training.
- Illegible consultants writing.
- Lack of understanding of what coding is about by other hospital staff members.
- Shortage of clinical coders.
- Increase in coding work flow.
- Unrealistic deadlines.
- Abbreviation of patient information in patient medical record.
- Coders taking up other administrative responsibilities.

Figure 11 Barrier Occurrence

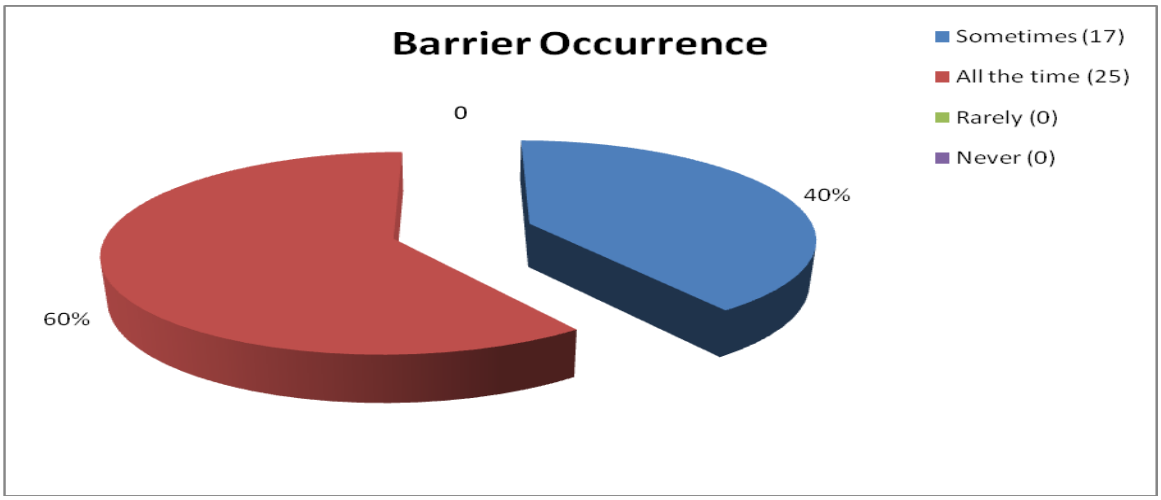
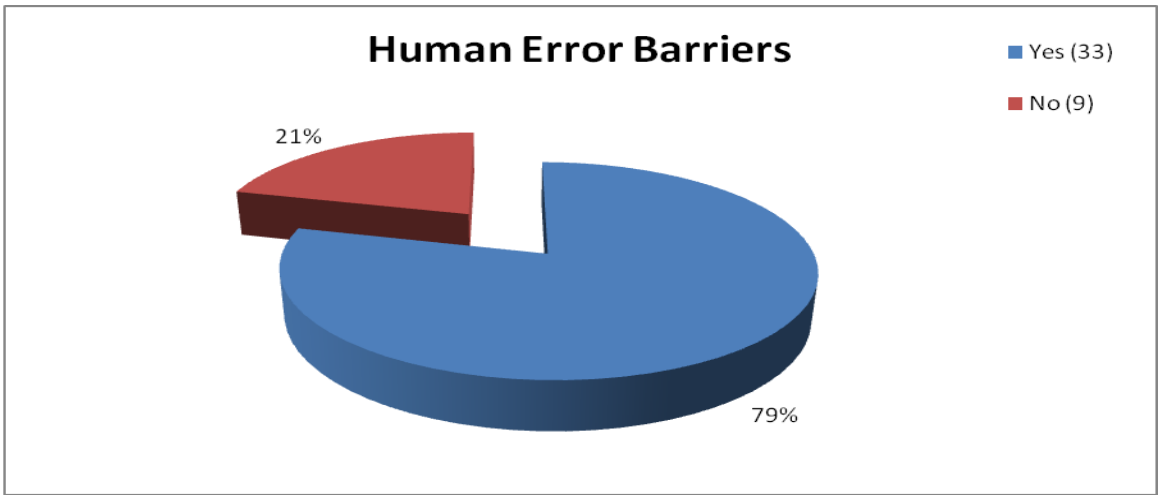


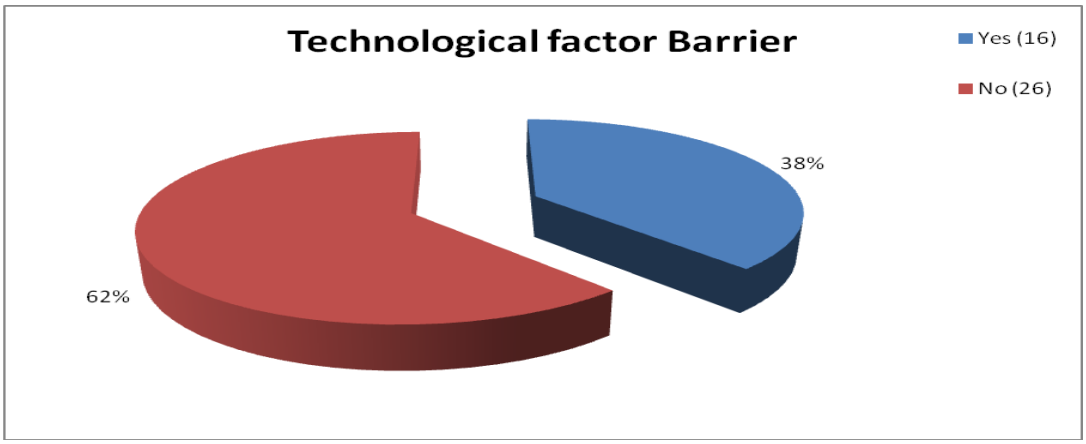
Figure 11 shows the level of occurrence of these barriers. 60% (25) of clinical coders are of the opinion that these barriers occur all the time while 40% (17) stated that these barriers occur sometimes.

Figure 12 Human Factor Barriers



In figure 12, 79% (33) of the respondents were of the opinion that the barriers are a result of human error which they identified with illegible physicians writing and incomplete documentation of patient health record. 21% (9) stated that the barriers are not linked to human error.

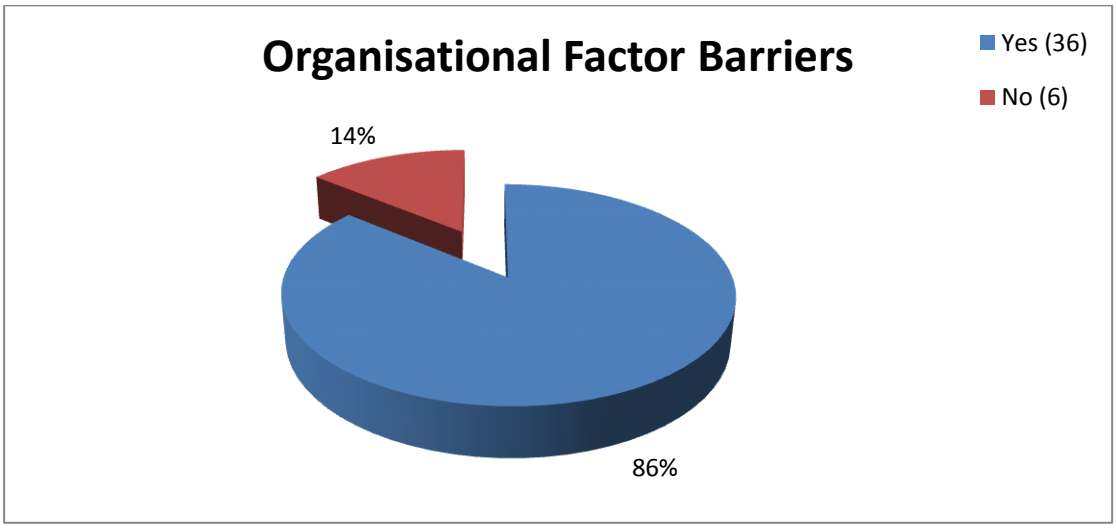
Figure 13 Technological Factor Barriers



In figure 13, 62% (26) of the respondents were of the opinion that the barriers are not as a result of technological factors while 38% (16) stated that the barriers are associated with technological factors. This indicates participants are familiar with the

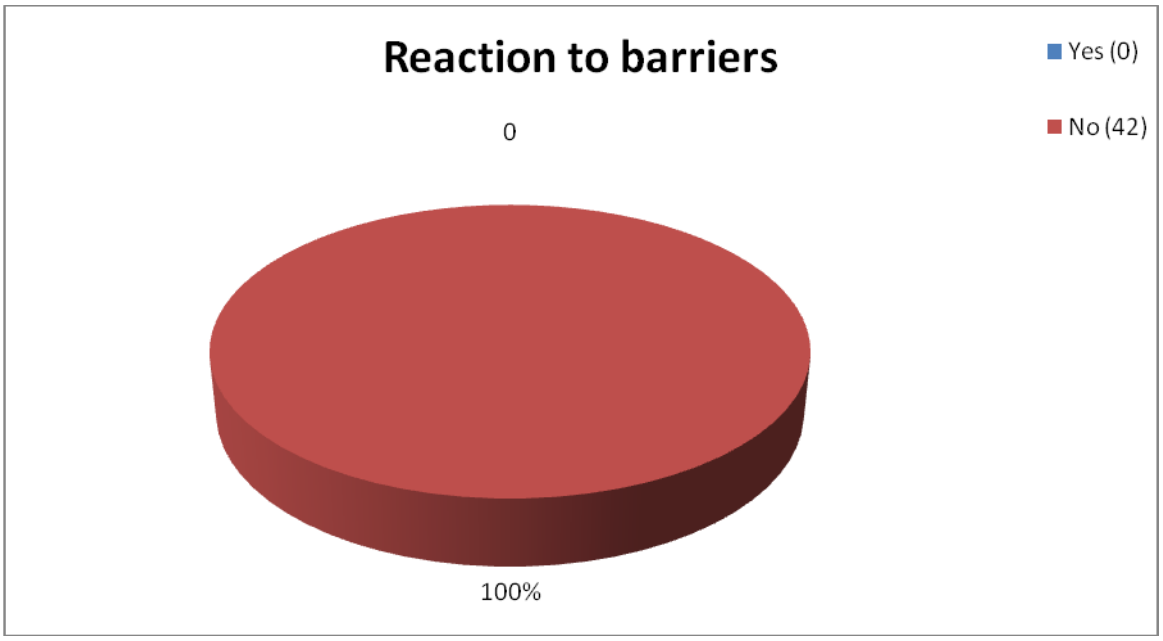
Information technology device and programme linked to coding in their respective hospitals. Although, studies have shown that pace of change in IT which requires skill can affect the quality of coded data (De Lusignan, 2005).

Figure 14 Organisational factor Barriers



86% (36) of respondents in figure 14 were of the opinion that the barriers are a result of organisational and logistic factors while 14 % (6) disagreed. These from previous studies are identified as geographical that the locality of the hospital, hospital specialty, structure of the coding unit and data quality policies (Santos *et al.*, 2008).

Figure 15 Reaction to Barriers



100% (42) of the respondents in figure 15 indicated that they do not ignore these barriers when they occur. This shows that they are concerned about achieving quality.

Question 7 Why do you not ignore these barriers?

All the respondents indicated in figure 5.2 say that they do not ignore the barriers due to the following reasons:

- To achieve quality attributes of data.
- To ensure hospital is reimbursed accordingly.
- To ensure such barriers do not occur again.
- To complete the coding process.

Figure 16 Experience Sharing

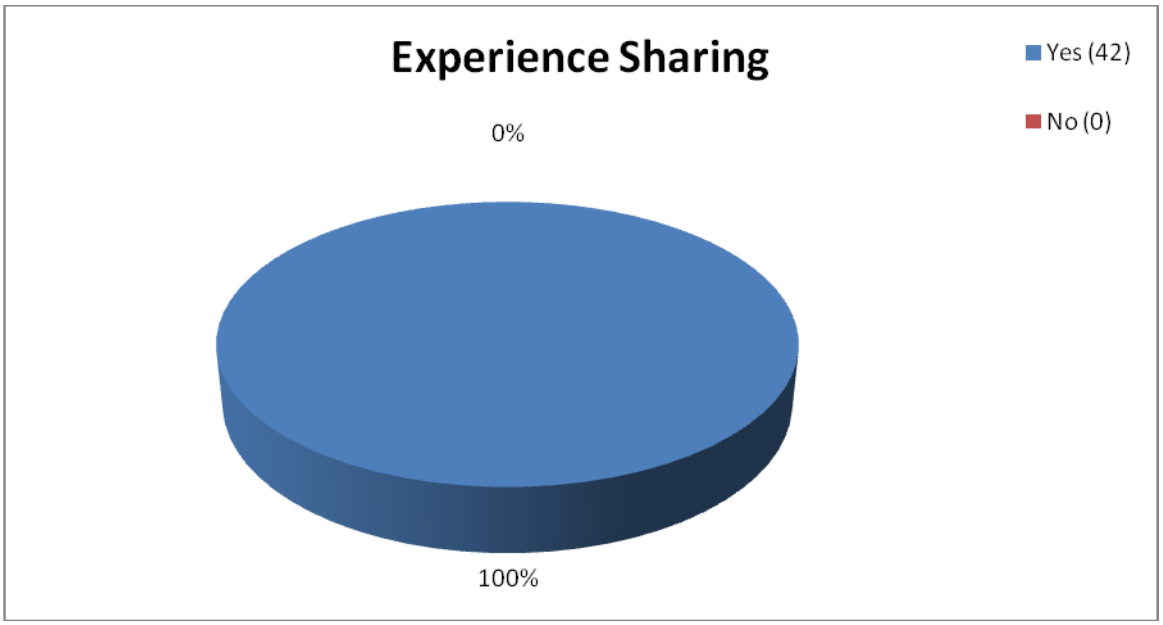


Figure 16 show that 100% (42) that is all the respondents share their experience of these barriers with other clinical coders. This shows that clinical coders are interested in overcoming these barriers in order to achieve quality of coded data. This is what Prince and Robinson, 2011 refer to as coder-coder communication either formally or informally.

Figure 17 Coders Reaction to Barriers

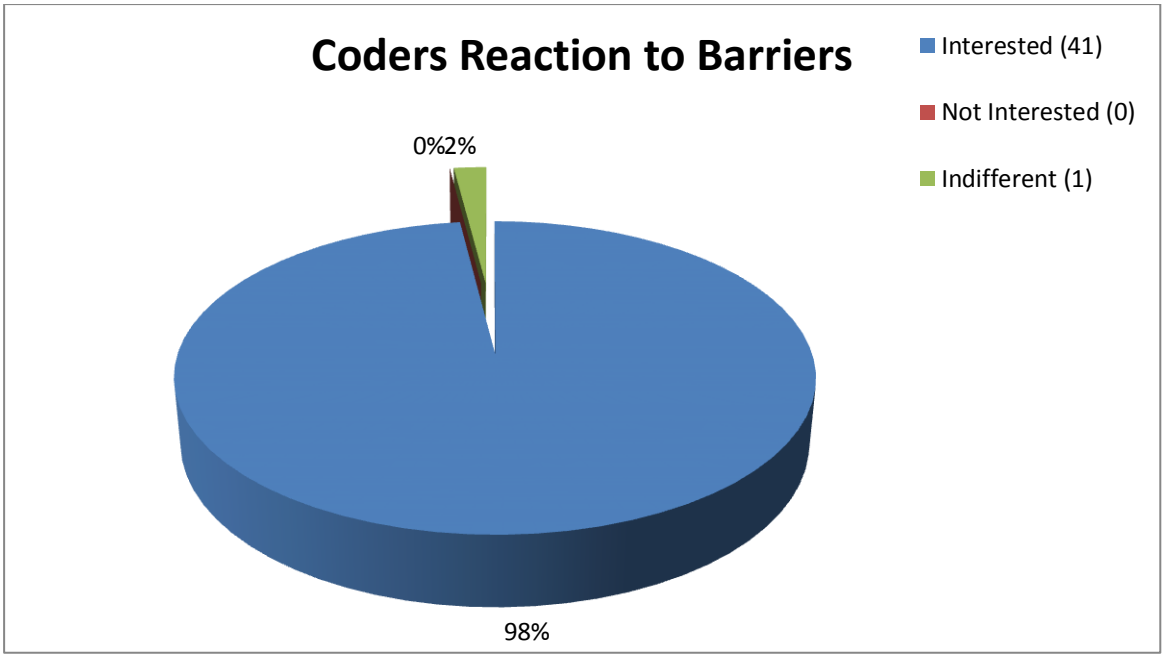
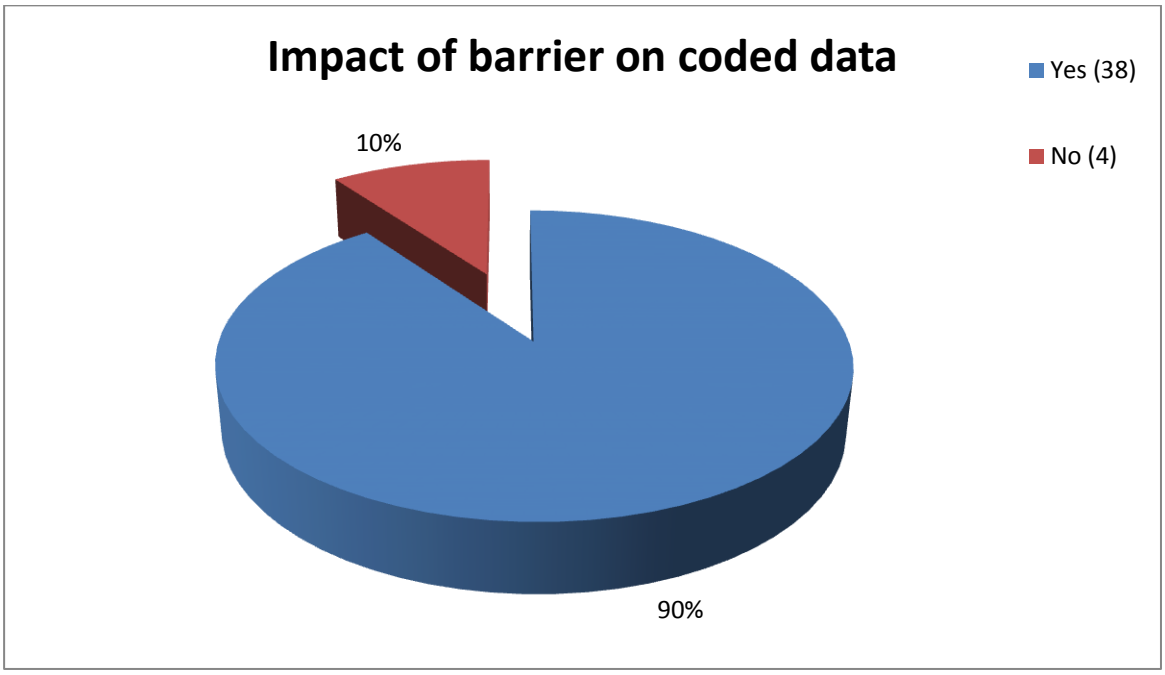


Figure 17 shows that 98% (41) of clinical coders are interested in discussing the barriers in order to improve their coding process and quality of coded data. Only 2% (1) are indifferent about discussing these barriers.

Figure 18 Impact of Barriers on Coded Data



From clinical coder's point of view, these barriers impact the quality of coded data with 90% (38) agreeing while 10% (4) indicated that it does not impact the quality of coded data in figure 18.

However, the respondents who indicated No, did not state why these barriers do not impact the quality of coded data.

Figure 19 Effect of Barriers on Quality of Coded data

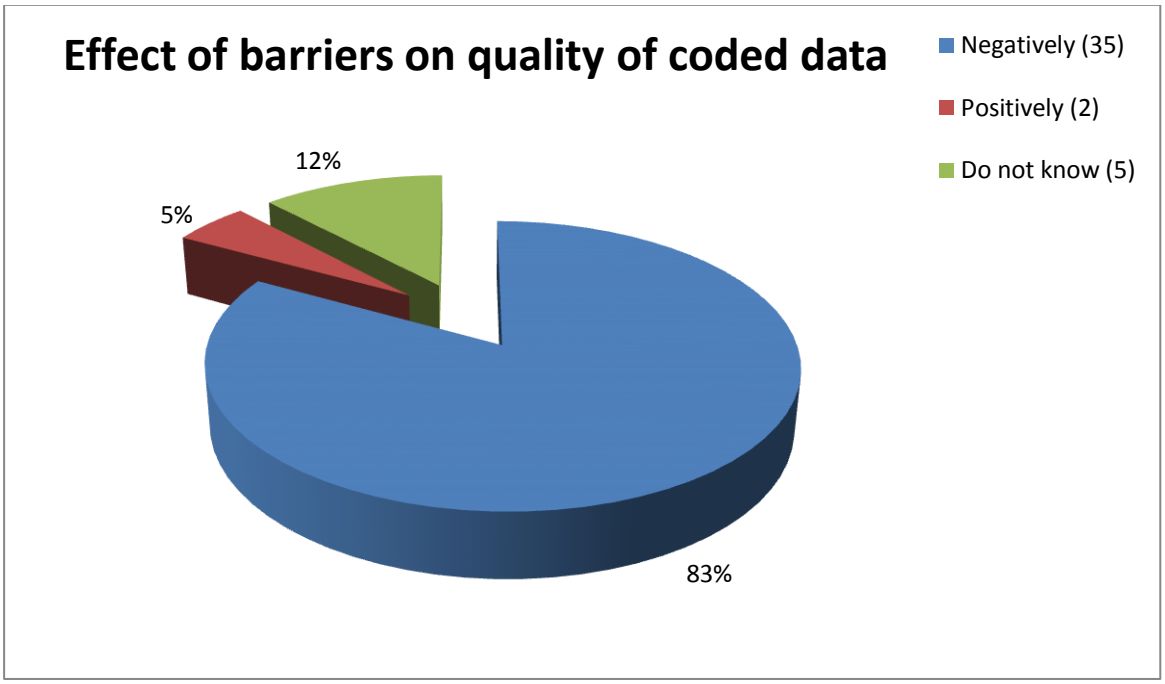
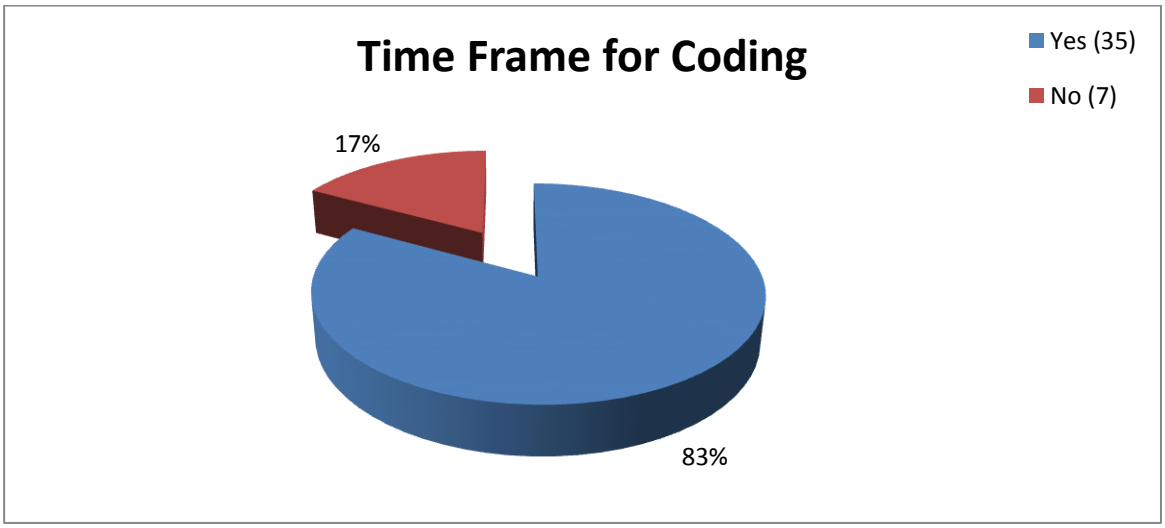


Figure 19 show that these barriers have a negative effect on the quality of coded data with 83% (35) of respondents indicating this while 5% (2) indicated that it does have positive effect on the quality of coded data. 12% (5) could not say whether it does or does not.

Figure 20 Coding Time Frame



83% (35) of the respondents in figure 20 are of the opinion that there is a time frame for coding clinical data while 17% (7) indicated that there is no time frame that clinical data are coded as they are received.

Figure 21 Effect of Barriers on coding Time Frame

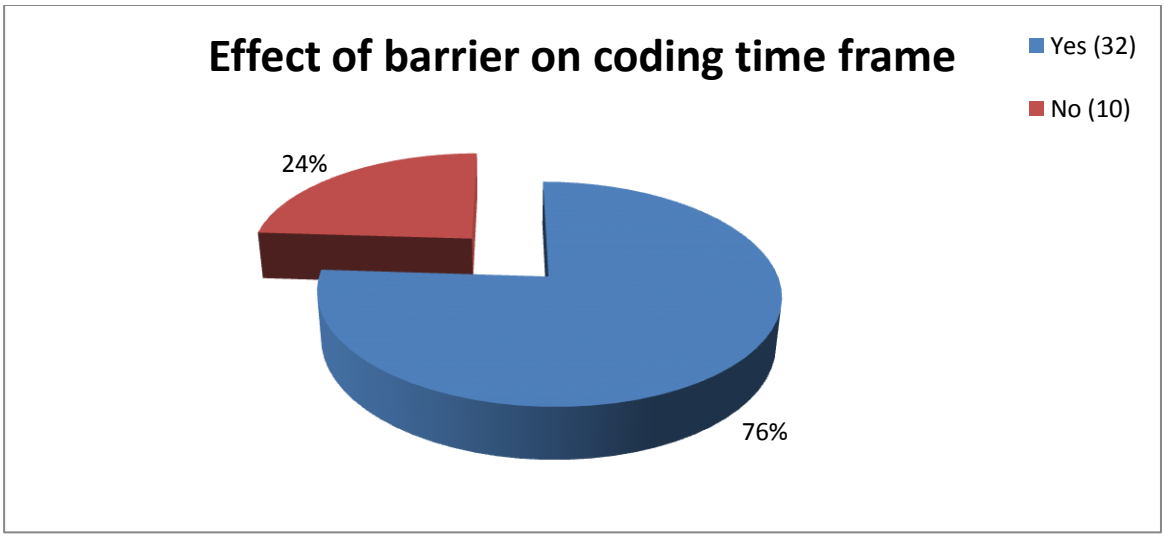


Figure 21 shows that 76% (32) of respondent are of the view that these barriers affect the time they have to code patient health record and 24% (10) were of the opinion that the barriers do not affect coding time.

Question 14 How do these barriers affect the time frame?

When participants were asked how these barriers affect the time frame for coding, 30 of these participants which form 71% of the respondents gave their views which are summarised as follows:

- Coding process is slowed down.
- Coding is not done real-time and there is always a backlog of patient health record to code.

- There is always pressure towards meeting the deadline and target set by ESRI and Department of health.

- Time is being wasted in trying to obtains others opinion about a patient health record.

- The issue of achieving data quality attributes is questionable.

Question 15 What specialty do you code?

From the responses to the above question, it was noted that all the clinical coders' surveyed do code more than one speciality and these they attributed to shortage of clinical coders (Stegman, 2003).

Figure 22 Source of Coding

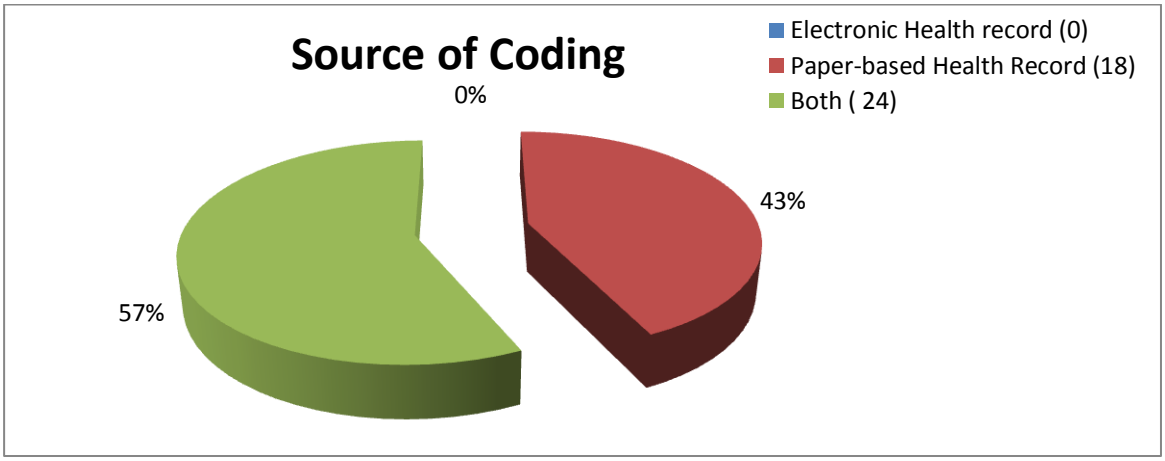


Figure 22 indicates that 57% (24) of the respondents' code from both EHR and PBHR while 43% (18) code from PBHR alone. No respondent indicated that they only code from EHR. This shows that Irish hospitals have not completely move to the use of EHR. This indicates the reason for poor documentation especially in the area of data legibility (Duarte *et al.*, 2010). Accessibility and availability of information for coding are also a key reason why EHR should be adopted (McKenzie *et al.*, 2003).

Figure 23 Use of Coding Standard

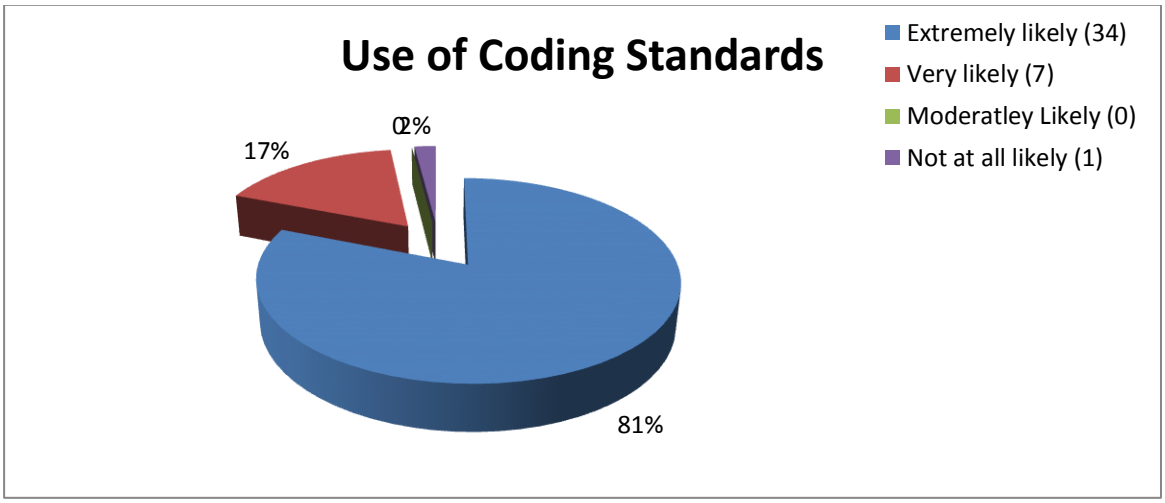


Figure 23 indicates that 81% (34) of respondents will apply coding standards when coding clinical data, while 17% (7) are not sure if they will apply coding standard while 2% (1) indicated that they will not apply coding standard.

Figure 24 Attendance of Coding Workshop

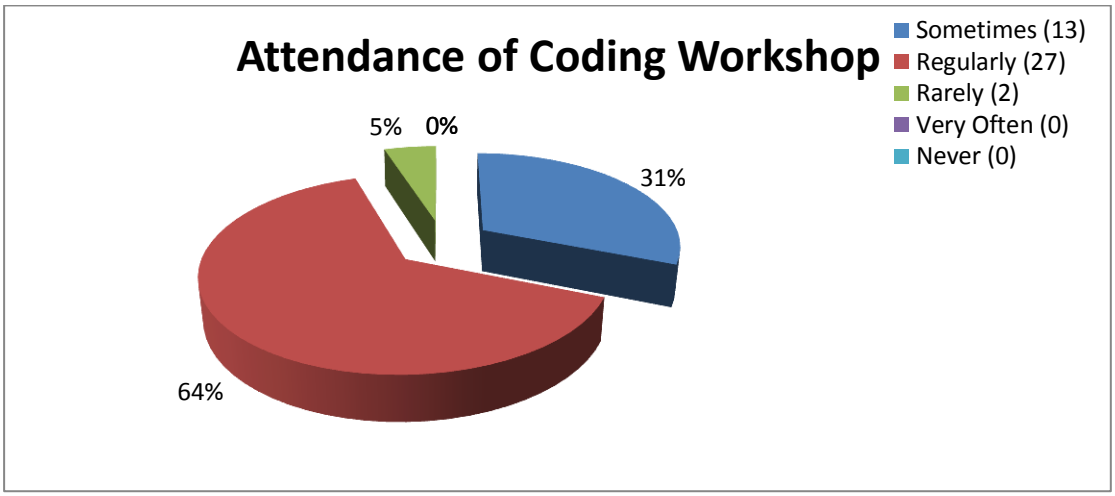
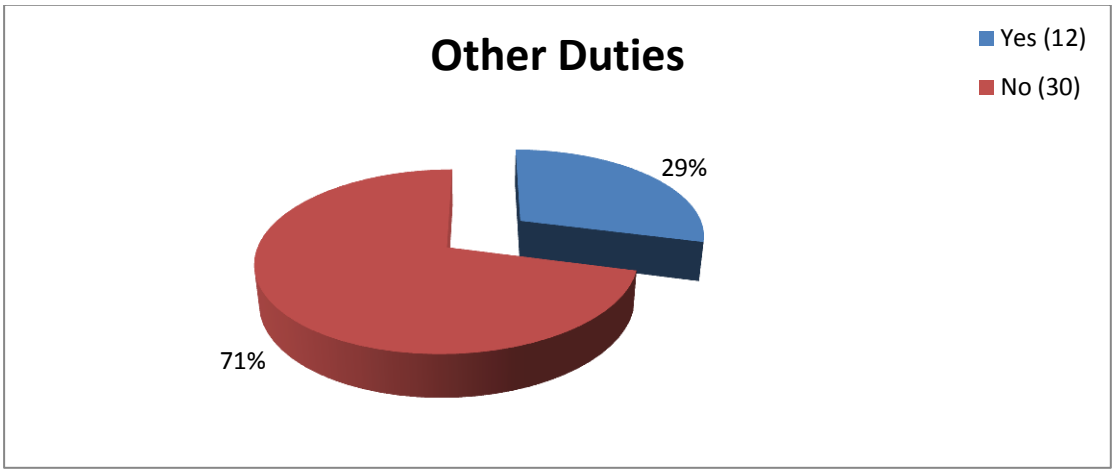


Figure 24 shows that 31% (13) of the respondents sometimes attend coding workshop while 64% (27) attend regularly and 5% (2) rarely attend coding workshop. Although the number of the respondents that rarely attend is small, studies have shown that there should be on-going training and accreditation of clinical coders (Mc Kenzie, K 2004, Bramley, M and Reid, b 2005, and Murphy, D 2010).

Figure 25 Other Duties

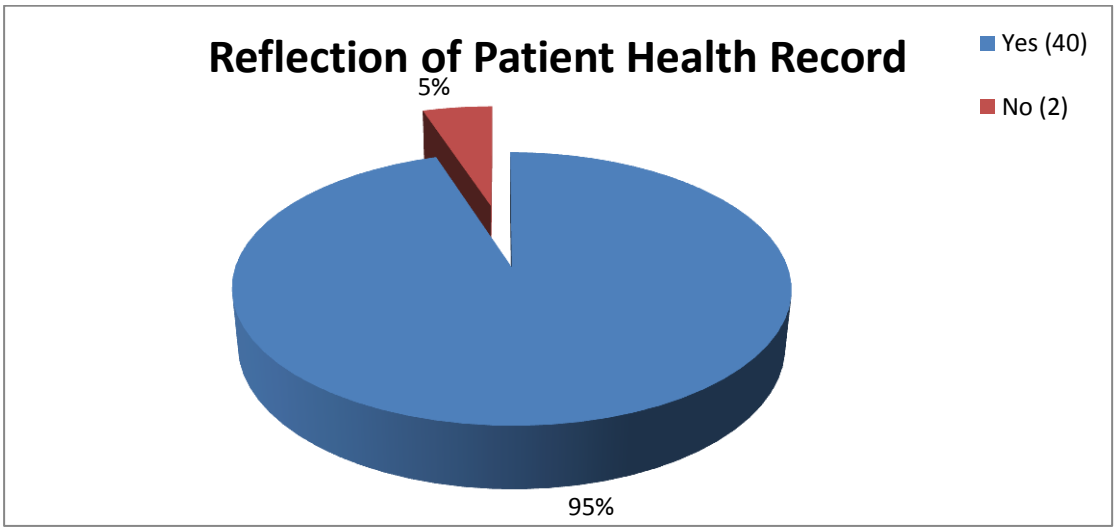


Although 71% (30) of the respondents indicate in figure 25 that they do not do other duties apart from coding, 29% (12) indicate that they do other duties.

Question 20

29% of the respondents in figure 25 who indicated that they do other duties within the hospital stated these duties as other administrative hospital duties like duties within the Information technology, finance and medical record departments.

Figure 26 Reflection of Patient Health Record



In figure 26, 95% (40) of the respondents indicated that coded data reflect the actual information about a patient health record while 5% (2) were of the opinion that it does not. This could be as a result of the barriers that impact coding quality clinical data.

Figure 27 Coding System

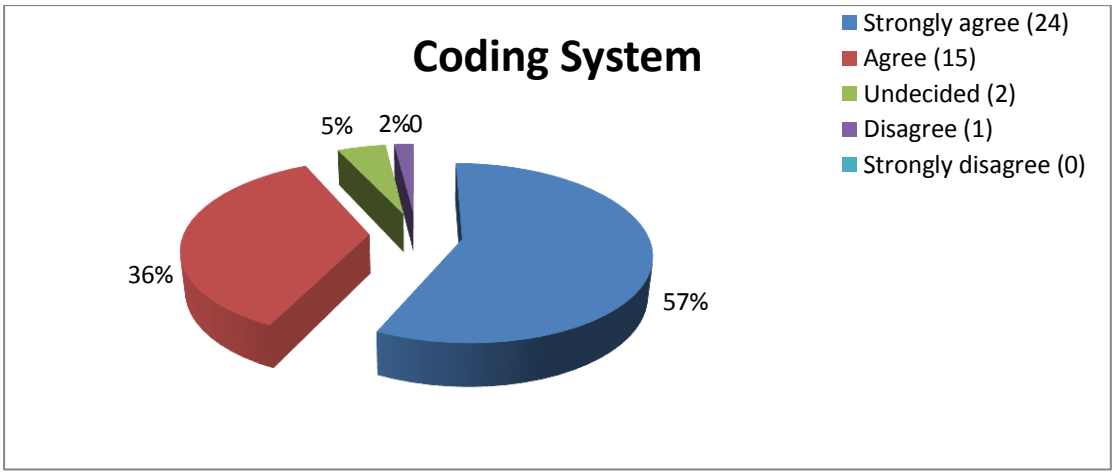
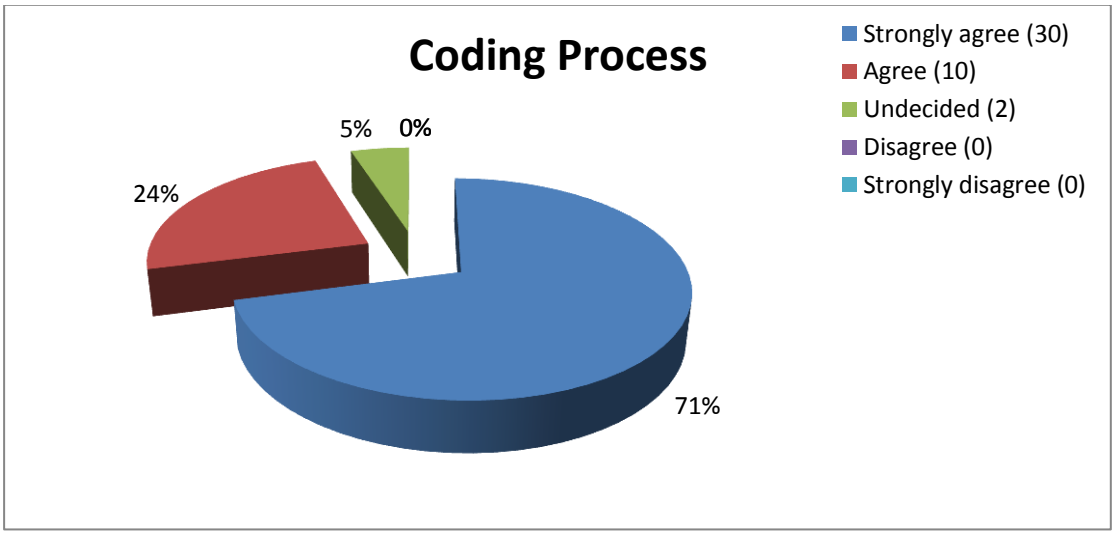


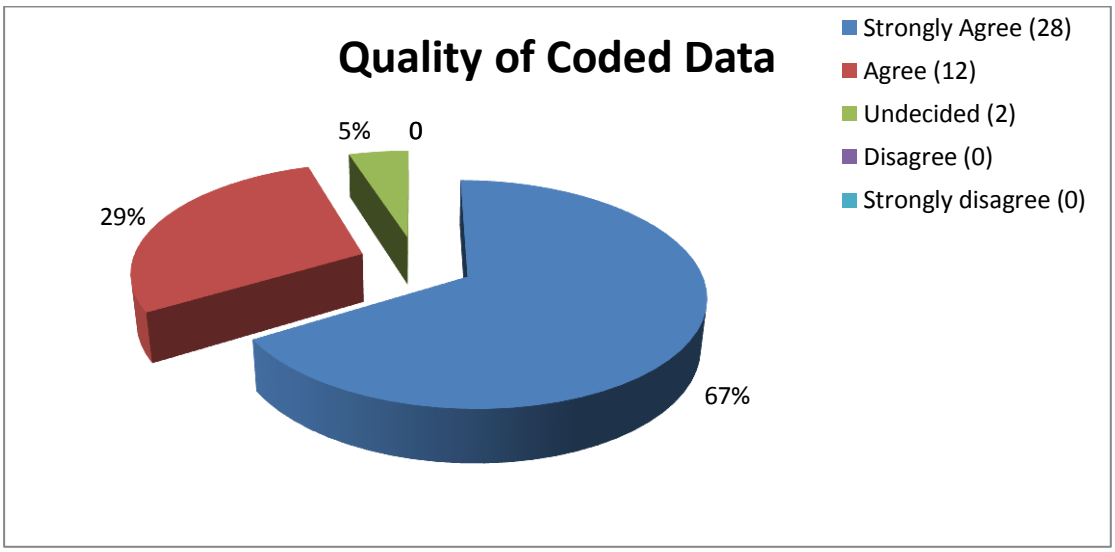
Figure 27 reveals that 57% (24) of the respondents strongly agree that the coding system used improves the quality of coded data while 36% (15) merely agree, 5% (2) were undecided and 2% (1) disagree. The coding system in place in Irish hospitals has quality checker in place and the HCAT in order to guarantee quality of coded data (ESRI, 2012).

Figure 28 Coding Process



In figure 28, 71% (30) of the respondents strongly agree that coding process will improve if the barriers to coding are identified, 24% (10) agreed while 5% (2) are undecided.

Figure 29 Quality of Coded Data



In figure 29, 67% (28) of respondents strongly agree that identifying the barriers to clinical coding will improve the quality of coded data while 29% (12) agreed and 5% (2) were undecided about this.

Question 25: What suggestions do you have for eliminating barriers to quality coding of clinical data?

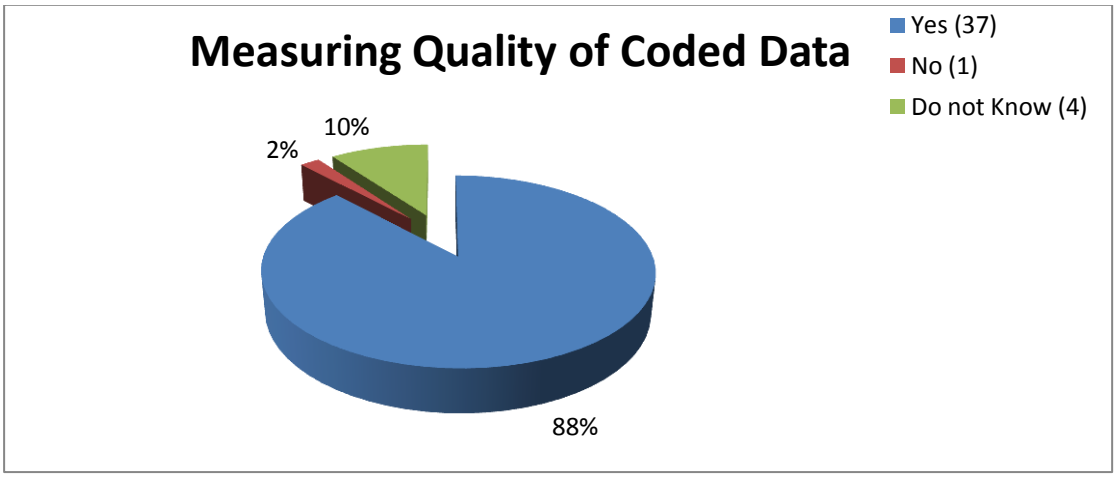
Majority of the respondents gave various suggestions on how to eliminate the barriers to coding quality clinical data. There suggestions are as follows:

- Adoption of Electronic Health record.
- Creating awareness amongst other hospital staff of what clinical coding is and its importance.
- Making patient medical chart available to clinical coders since coding is done mainly from paper-based medical record.
- Legible writing in patient's charts and making diagnosis clear.
- Increase in clinical coders and regular training.
- Medical terminologies should be included in clinical coder's training.
- Clinical coders should carry out only coding duties.
- Clinical coders to be part of the clinical team and communication between the team should be encouraged.
- Deadline time frame should be increased.

5.2.3 Research Question 2

How is quality of coded data measured in Irish Hospitals?

Figure 30 Measuring Quality of Coded Data



88% (37) of the respondents indicate that the quality of coded data is measured in their hospital. 2% (1) of the respondents indicated that coded data is not measure in their hospital while 10% (4) do not know if the quality of coded data is measure.

When asked how the quality of coded data is measured, 37 (88%) of the respondents stated that quality of coded data is measured by case-mix managers through the quality checker that is on the HIPE coding system (HCAT) and the ESRI (ESRI, 2012).

5.2.4 Hypothesis Testing

H1: There are barriers to quality coding of clinical data and these barriers affect the quality of coded data.

The hypothesis was tested using the Pearson Correlation Coefficient. This is to establish if there is a relationship between the two variable of which are *barriers* and *quality.*

The data for testing the hypothesis is selected from the questionnaire. The number of barriers to coding of quality clinical data and the number of data quality attributes

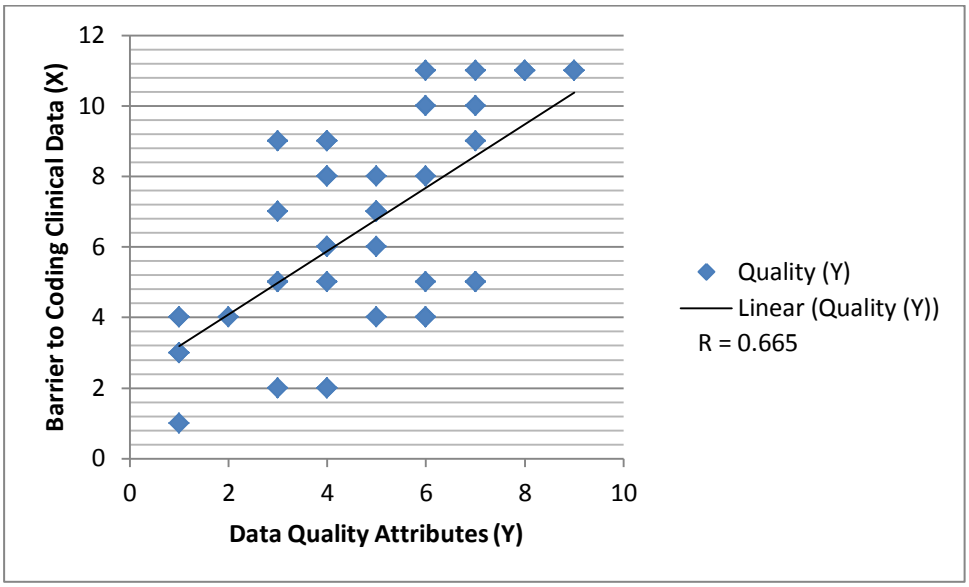
selected by the respondents were used to measure the relationship between barriers to coding clinical data and quality of clinical data.

Table 4 below shows that the information gathered from the data analysed, support the hypothesis that there is a relationship between barriers to coding clinical data and quality of coded data. The correlation between the two variables is 0.66 which shows a relationship between the two variables. The data in itself shows that the lower the barriers identified, the higher the quality attributes indicated while the lower the quality attributes indicated, the higher the barriers identified.

Table 4 Hypothesis Testing (Correlation Coefficient)

Subject	Barrier (X)	Quality (Y)
1	4	6
2	1	3
3	4	8
4	2	4
5	6	4
6	3	5
7	9	11
8	5	7
9	4	5
10	6	5
11	5	6
12	7	5
13	9	11
14	4	9
15	5	7
16	4	6
17	3	9
18	4	2
19	1	1
20	1	4
21	1	4
22	5	4
23	3	2
24	8	11
25	3	7
26	1	3
27	5	7
28	5	8
29	7	9
30	6	11
31	6	10
32	7	10
33	4	8
34	4	2
35	8	11
36	5	7
37	4	9
38	7	5
39	6	8
40	7	11
41	6	4
42	3	5
Total	**198**	**274**
Correlation	**0.664669412**	

Figure 31 Plot of Barriers and Quality Attributes



The correlation in figure 31 shows that clinical coders understand what barriers to clinical coding are. This was indicated in their response. Figure 31 also show that clinical coders understand what data quality is and how it applies to clinical coding. Also, since the data analysed indicate a relationship between barriers to coding clinical data and quality of coded data, it is therefore, imperative to state that these barriers have impact on the quality of coded data and that the hypothesis formulated by this study is found to be true.

A two-tailed T-test was also carried out in order to ascertain the statistical significance of the difference between coder's perception of coding barriers and data quality attributes. The T-test null hypothesis (H_0) is $\mu 1 \neq \mu 2$. This means that the average score for coding barriers is not equal to the average score for data quality attributes. The probability of rejecting the null hypothesis is set at significance level 0.1. Table 5 shows the comparison between coding barriers and data quality attributes.

Table 5 T-test

	Coders (N)	Mean	Std. Deviation	Std. Error
Coding Barriers	42	4.7143	2.1301	0.095
Data Quality Attributes	42	6.5238	2.8880	0.210

The table above shows that coders awarded higher score for data quality attributes (6.52) than coding barriers. This underlines the high importance coders give to data quality. However, the average score for coding barriers is (4.71) this indicates that coding barriers are also of concern to coders.

The probability of error is 0.1712 which is greater than the level of significance. The P-value = 0.1712<0.10 which indicates that we cannot reject the null hypothesis. The calculation is shown in appendix F.

CHAPTER 6

SUMMARY CONCLUSION and RECOMMENDATION

6.1 Summary

This research was aimed at identifying the barriers to coding of quality clinical data from a coder's perspective. It also touches on the effect of data quality barriers on achieving quality data. The study was carried out amongst clinical coders in Irish hospitals.

The first chapter of this research effort gave an introductory background to the study. It gave a brief analysis of what data quality is all about and what coded data is and is used for. Equally included was the statement of the problem in which the research questions were stated as follows:

- What are clinical coders' perceptions of the barriers to e-coding of quality clinical data?
- How is quality of coded data measured in Irish hospitals?

This chapter also contains the proposed hypothesis

- *There are barriers to coding clinical data and these barriers affect the quality of clinical data.*

The significance of the study, purpose of the study, the scope of the study and study rationale are all highlighted in chapter one.

Chapter two contains the theoretical framework, and review of relevant literature on data quality, international coding, coding tools, clinical coder's role as well as the

barriers to coding clinical data. These provided answers to the research questions raised by the study.

A total of 60 questionnaires were distributed amongst clinical coders but 42 questionnaires were returned duly completed. Responses to these questionnaires were coded and analysed to answer the research questions.

The major findings of the study are as follows:

- Data quality is paramount to all businesses and services.
- Many industries irrespective of the product or services they provide do not pay attention to data quality and that there are no means of measuring data quality.
- To have data quality, there must be data quality attribute associated with it.
- Healthcare services are now embracing data of high quality because of its use to measure services, reimbursement and determine key performance indicators (KPI).
- There are various barriers to coding of quality clinical data.
- Clinical coders identified these barriers have a great impact on the quality of coded data.
- Adoption of electronic health record is one of the ways identified as reducing barriers to coding of clinical data.

- Clinical coders should be part of the team in developing electronic health record.
- Clinical coders should be part of the medical teams.
- Clinical coder's do other duties outside clinical coding.
- There should be on-going training for clinical coders irrespective of their experience.
- Clinical coders training should involve learning medical terminologies.
- Although coded data are measured in Irish hospitals, clinical coders are not involved in measuring quality of coded data.

In addition, the study shows that barriers and quality go hand in hand. That is, the higher the barrier, the lower the quality and vice versa. It is also pertinent to note that the suggestions given by clinical coders for overcoming these barriers should be put in place in order to achieve quality.

6.2 Conclusion

Following from a review of previous studies and analysis of data gathered from the survey, the researcher was able to reach a conclusion, provide answers to the two research questions and also test the research hypothesis. Although, there are not enough studies and statistics available to ascertain if barriers to coding actually affect the quality of coded data (Santos *et al*., 2004), it is shown from the study that clinical coders can identify what the barriers to clinical coding are and also understand what data quality represents.

Based on the findings of this study, it is clear that there is a relationship between barrier to coding clinical data and quality of coded data. In order words, one depends on the other and to achieve data quality, the barriers must be either eliminated or minimised.

To a great extent, it is instructive to note that information technology has its own role to play in the achievement of data quality. The information technology used in the hospitals which, is the electronic health record has a major role to play in the area of clinical coding. Since coding is about patient record, coding should be done from the EHR. This will reduce ambiguity, minimise coding errors and ensure that coding is done real-time. Where there are no EHR in place, health record documentation standards should be enforced at all levels.

The hospitals should ensure and encourage communication between clinicians and clinical coders at all times. Where new clinicians are brought on board, they should be made aware of coding guidelines and policies existing in the hospitals.

Finally, the best way to analyse and understand the quality of coded data is still open to research, it should be noted and accepted that quality plays an important and dominant role when it comes to data irrespective of organisation, sector or industry.

6.3 Recommendation

Following the findings from the study, the researcher hereby recommends among other things, a complete introduction and widespread adoption of the Electronic Health Record. This will provide more standardised and structured patient

information that is required for clinical coding (Walker and Nicholson, 2009, and Mc Kenzie, 2003).

The researcher also recommends the working together of clinicians and clinical coders this will have the desired effect on the accuracy and completeness of coded data (Harry *et al*., 2006).

It is instructive to note that coding errors affect the operational and financial management of healthcare industries (Santos *et al*., 2008). There is therefore the need for relevant health regulatory bodies to ensure a stronger coordination and monitoring of the coding process.

Given that the clinical coding process is a complex task, it is recommended that coders be part of the medical team and that clinicians and other healthcare workers be made aware of what coding is and its importance. This will go a long way to reduce the barriers that affect clinical coding.

It is also recommended that training for clinical coders should not be about coding guidelines alone but also learning medical terminologies since clinical coders are administrative personnel that need to get familiar with clinical terminologies. Rather than clinical coders being engaged in order duties, delegating them solely to clinical coding will go a long way in improving quality in coded data.

The study noted that a few (10%) of clinical coders claimed that they are not aware of how coded data is measured in their respective hospitals. It is therefore recommended that clinical coders should be more involved in the measuring of

coded data at hospital levels this will facilitate ownership on the part of all clinical coders which in the long term improve the quality of coded data.

The information technology (IT) in use in the hospitals should be made user friendly while regular trainings should be held to address any inadequacies.

The researcher is of the opinion that if the above recommendations are implemented, the quality of coded data will be enhanced.

6.4 Future Research

The research is aimed at exploring coder's perception of the barriers to quality coding of clinical data. However, there is still room for future studies to measure the impact of information technology on the coding process. It will be interesting to find out in the immediate future coder's perception of the coding process in Irish hospitals. This future research should also explain the reasons behind coder's perception of the coding process in Irish hospitals. This may be done through survey, interview and observation.

6.5 Limitations

It is noted that this study is descriptive in nature and only described the barriers to coding of quality clinical data from coder's point of view. There was no investigation into the reason why they identified these barriers. The study was only carried out within the Dublin area hospitals and not within the whole Irish hospitals. The study did not also include case-mix managers who are the Heads of the Coding departments. There might have being more findings if they were included in the

study. Since the study covered 70% of the study population, it is assumed that the findings might be the same if the entire Irish hospitals were surveyed.

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Appendix A: Questionnaire

QUESTIONNAIRE

This questionnaire is designed to gather information that will identify the barriers to quality coding of clinical data in Irish hospitals. This is purely for research purpose. This research is completely anonymous and confidential. Kindly fill in your responses and tick appropriate boxes. Please return completed questionnaire in the stamped and addressed envelope provided by the researcher.

Thank you for your feedback.

Section A

1) What do you understand by data quality? **(multiple answers allowed)**
   a) Accuracy ☐
   b) Timeliness ☐
   c) Consistency ☐
   d) Reusability ☐
   e) Reliability ☐
   f) Objectivity ☐
   g) Accessibility ☐
   h) Understandable ☐
   i) Interpretability ☐
   j) Credible ☐
   k) Completeness ☐

   Others

   _____

   _____

2) How important is data quality to healthcare delivery? **(please TICK one option only)**

Extremely Important	Moderately Important	Not at all Important

3) Are there barriers to quality coding of clinical data?
   Yes ☐ No ☐ I do not know ☐

4) If YES, what are these barriers? **(List as many as you can)**

a) _____
b) _____
c) _____
d) _____
e) _____
f) _____
g) _____
h) _____
i) _____
j) _____

5) To what extent do these barriers occur? **(Please TICK one option)**

Sometimes	All the time	Rarely	Never

5a) Are these barriers a result of human error?

Yes ☐ No ☐

5b) Are these barriers a result of technological factors?

Yes ☐ No ☐

5c) Are these barriers as a result of organisational and logistical factors?

Yes ☐ No ☐

6) Do you ignore these barriers when they occur?

Yes ☐ No ☐

7) If YES to question 6, say why

_____

_____

If NO to question 6, say why not

_____

_____

8) Do you share your experience of these barriers with other coders?

Yes ☐ No ☐

9) How will you describe coder's reaction to sharing of this experience?

Interested ☐ Not interested ☐ Indifferent ☐

10) Do these barriers impact quality of coded data?

Yes ☐ No ☐

11) If YES to question 10, how does this impact quality of coded data?

Negatively ☐ Positively ☐ Do not know ☐

If NO to question 10, say why not

_____

_____

12) Is there a time frame for coding patient record?

Yes ☐ No ☐

13) Do these barriers affect the time frame for coding?

Yes ☐ No ☐

14) If YES to question 13, how does it affect the time frame?

_____

_____

15) What speciality do you code?

_____

_____

16) From which type of patient medical record do you code from?

Electronic Patient Record (EHR) ☐

Paper-based Patient Record (Chart) ☐

Both (EHR and Chart) ☐

17) How likely are you to apply coding standards to your work? **(please TICK one option only)**

Extremely likely	Very likely	Moderately likely	Not at all likely

18) How will you rate your attendance of coding training and workshop? **(please TICK one option only)**

Sometimes	Regularly	Rarely	Very often	Never

19) Do you do any other duties in the hospital apart from Coding?

Yes ☐ No ☐

20) If YES to question 19, what other duties do you do?

_____

_____

21) Do coded data reflect actual patient health record?

Yes ☐ No ☐

What is your level of agreement with these statements? (Please TICK one option only)

22) Coding system guarantees quality data collection from coding**.**

Strongly Agree	Agree	Undecided	Disagree	Strongly disagree

23) Identifying these barriers improve coding process and time.

Strongly Agree	Agree	Undecided	Disagree	Strongly disagree

24) Identifying these barriers improves the quality of coded data.

Strongly Agree	Agree	Undecided	Disagree	Strongly disagree

25) Do you have any suggestions for eliminating barriers to quality coding of clinical data?

_____

_____

_____

_____

_____

26) Is the quality of coded data measured within your hospital?

Yes ☐ No ☐

27) If YES to question 26, how is the quality of coded data measured within your hospital and who measures it?

_____

_____

_____

_____

_____

If NO to question 26, why is it not measured and where is it measured?

_____

_____

_____

_____

SECTION B

Demographic

28) **Age**: Under 18 ☐
18-25 ☐
26-35 ☐
36-55 ☐
56 above ☐

29) **Gender**:
Male ☐ Female ☐

30) **What is your highest level of educational qualification?**
Leaving certificate ☐
Graduate ☐
Masters ☐
PhD ☐

31) **What is your coding experience?**

Up to 1 year ☐

2-4years ☐

5-7 years ☐

8 years above ☐

Appendix B: Participant Information Sheet

Participant Information Sheet

The Study Title:

What are the Barriers to quality coding of clinical data in Irish Hospitals from a Coder's perspective.

Invitation to the Participants/Respondents:

You are invited to take part in a research study. However, before you decide whether or not to take part, it is important that you fully understand what the research is about and what you will be asked to do. It is important that you read the following information in order to make an informed decision and if you have any question about any aspect of the study that are not clear to you, do not hesitate to ask me. Please make sure that you are satisfied before you decide to take part or not. Thank you for your time and consideration of this invitation.

Purpose of the Research Study

The aim of the study is to find out what are the barriers to quality coding of clinical data within Irish hospitals as well as to highlight the importance of data quality in healthcare system. The study also seeks to find out the relationship between barriers to coding and quality of coded data.

Why choose clinical coders?

Clinical coders have been chosen because they are in the best position to respond to the questions raised by the research. All the clinical coders in your hospital are invited to participate in the study.

The voluntary nature of participation:

Participation in this research study is entirely voluntary and taking part in this research study is entirely up to you. Once the questionnaire is returned to the researcher, this indicates an implied consent from you.

During the Study

The questionnaire will be handed over to the HIPE manager who acts as the gate keeper for onward distribution to clinical coders in the HIPE department. The questionnaire contains 31 questions which will take about 15 to 20 minutes to complete. It involves filling out your responses and ticking appropriate boxes. The questionnaire will be returned by post in a stamped and addressed envelope provided to the researcher.

Potential harms/risks

There is no risk or harm associated with the study. All responses to the study will be classified as anonymous. Your name or the name of the hospital will not be mentioned in the study.

The researcher can be contacted on this mobile number **0863183515** or email atoyebit@tcd.ie at any time during the study.

Potential Benefits/Lack of Benefit

No benefit is associated to participating in the study.

Confidentiality

Information/data gathered from the study will be classified as anonymous and confidential. All questionnaires will be locked away in a secure place by the lead/principal investigator. All data analysis

will be stored in a USB key that will be password protected. All information or data that will identify anyone taking part in the study will be removed prior to publication or presentation. The study is carried out at part of fulfilment of the award of M.Sc. Health Informatics at Trinity College Dublin. The study is funded by the researcher.

At the End of the Study

The study ends in August 2012. All completed copies of the questionnaire will be shredded after data analysis by the researcher. The questionnaire will only be retained for the duration of the study. The information gathered from the questionnaire will only be used for the purpose for which it is sort for and will not be passed onto any third party.

Contact Details

For further information in regard to the study,

Lead/ Principal Investigator: Toyosi Atoyebi
Contact Telephone Number: 0863183515
Contact email: atoyebit@tcd.ie

Appendix C: Information sheet FOR HIPE/CASE-MIX MANAGERs

INFORMATION SHEET FOR HIPE/CASE-MIX MANAGERS

I am Toyosi Atoyebi an MSc student of Health Informatics in the department of Computer Science and Statistics, Trinity College Dublin.

I am conducting a research in identifying the barriers to quality coding of clinical data. This survey is directed towards clinical coder's in order to identify these barriers and their views on how these barriers can be minimised in order to achieve quality.

Participation in the study is voluntary depending on availability and consent from clinical coders in your department. Questionnaire will be forwarded to HIPE/ case-mix managers for onward delivery to clinical coders. Filled questionnaire will be returned to the researcher (Toyosi Atoyebi) in a stamped envelope that is provided by the researcher.

The Information obtained will be used purely for academic purposes and will be treated with respect and strict confidence.

Thank you for your anticipated co-operation.

Lead Researcher: **Toyosi Atoyebi**

Contact Details: **atoyebit@tcd.ie/0863183515**

Appendix D: SCSS RESARCH APPLICATION FORM

Research Ethical Application Form

Part A

Project Title: What are the Barriers to Quality Coding of Clinical Data in Irish Hospitals from a Coder's Perspective?

Name of Lead Researcher (student in case of project work): Toyosi Atoyebi

Name of Supervisor: Gaye Stephens

TCD E-mail: atoyebit@tcd.ie Contact Tel No.: 0863183515

Course Name and Code (if applicable): Health Informatics Dissertation CS8003

Estimated start date of survey/research. 2nd of April 2012

I confirm that I will (where relevant):

- Familiarize myself with the Data Protection Act and the College Good Research Practice guidelines http://www.tcd.ie/info_compliance/dp/legislation.php;
- Tell participants that any recordings, e.g. audio/video/photographs, will not be identifiable unless prior written permission has been given. I will obtain permission for specific reuse (in papers, talks, etc.)
- Provide participants with an information sheet (or web-page for web-based experiments) that describes the main procedures (a copy of the information sheet must be included with this application)
- Obtain informed consent for participation (a copy of the informed consent form must be included with this application)
- Should the research be observational, ask participants for their consent to be observed
- Tell participants that their participation is voluntary
- Tell participants that they may withdraw at any time and for any reason without penalty
- Give participants the option of omitting questions they do not wish to answer if a questionnaire is used
- Tell participants that their data will be treated with full confidentiality and that, if published, it will not be identified as theirs
- On request, debrief participants at the end of their participation (i.e. give them a brief explanation of the study)
- Verify that participants are 18 years or older and competent to supply consent.
- If the study involves participants viewing video displays then I will verify that they understand that if they or anyone in their family has a history of epilepsy then the participant is proceeding at their own risk
- Declare any potential conflict of interest to participants.
- Inform participants that in the extremely unlikely event that illicit activity is reported to me during the study I will be obliged to report it to appropriate authorities.
- Act in accordance with the information provided (i.e. if I tell participants I will not do something, then I will not do it).

Signed: Toyosi Atoyebi TAyo2 Date: 20th March 2012.
Lead Researcher/student in case of project work

Part B

Please answer the following questions.		*Yes/No*
Has this research application or any application of a similar nature connected to this research project been refused ethical approval by another review committee of the College (or at the institutions of any collaborators)?		**NO**
Will your project involve photographing participants or electronic audio or video recordings?		**NO**
Will your project deliberately involve misleading participants in any way?		**NO**
Is there a risk of participants experiencing either physical or psychological distress or discomfort? If yes, give details on a separate sheet and state what you will tell them to do if they should experience any such problems (e.g. who they can contact for help).		**NO**
Does your study involve any of the following?	Children (under 18 years of age)	**NO**
	People with intellectual or communication difficulties	**NO**
	Patients	**NO**

School of Computer Science and Statistics

SCSS Research Ethics Application Form September 2011

Research Ethical Application Form

Details of the Research Project Proposal must be submitted as a separate document to include the following information:

1. Title of project
2. Purpose of project including academic rationale
3. Brief description of methods and measurements to be used
4. Participants - recruitment methods, number, age, gender, exclusion/inclusion criteria, including statistical justification for numbers of participants
5. Debriefing arrangements
6. A clear concise statement of the ethical considerations raised by the project and how you intend to deal with them
7. Cite any relevant legislation relevant to the project with the method of compliance e.g. Data Protection Act etc.

Part C

I confirm that the materials I have submitted provided a complete and accurate account of the research I propose to conduct in this context, including my assessment of the ethical ramifications.

Signed: Toyosi Atoyebi Date: 20th March 2012
Lead Researcher/student in case of project work

There is an obligation on the lead researcher to bring to the attention of the SCSS Research Ethics Committee any issues with ethical implications not clearly covered above.

Part D

If external ethical approval has been received, please complete below.

External ethical approval has been received and no further ethical approval is required from the School's Research Ethical Committee. I have attached a copy of the external ethical approval for the School's Research Unit.

Signed: ..... Date: .....
Lead Researcher/student in case of project work

Part E

If the research is proposed by an undergraduate or postgraduate student, please have the below section completed.

I confirm, as an academic supervisor of this proposed research that the documents at hand are complete (i.e. each item on the submission checklist is accounted for) and are in a form that is adequate for review by the SCSS Research Ethics Committee

Signed: G. Stephes Date: 21/3/2012
Supervisor

Completed application forms together with supporting documentation should be submitted electronically to research-ethics@scss.tcd.ie Please use TCD e-mail addresses only. When your application has been reviewed and approved by the Ethics committee hardcopies with original signatures should be submitted to the School of Computer Science & Statistics, Room F37, O'Reilly Institute, Trinity College, Dublin 2.

Appendix E: STANDARD ETHICS APPLICATION FORM

STANDARD APPLICATION FORM

For the Ethical Review of Health-Related Research Studies, which are not Clinical Trials of Medicinal Products For Human Use as defined in S.I. 190/2004

DO NOT COMPLETE THIS APPLICATION FORM
IF YOUR STUDY IS A CLINICAL TRIAL OF A MEDICINAL PRODUCT

Title of Study: **WHAT ARE THE BARRIERS TO QUALITY CODING OF CLINICAL DATA IN IRISH HOSPITALS FROM A CODER'S PERSPECTIVE?**

Principal Investigator: **Toyosi Atoyebi**

Applicant's Signature: **Tatoyebi**

For Official Use Only – Date Stamp of Receipt by REC:

SECTION E DATA PROTECTION	MANDATORY
SECTION F HUMAN BIOLOGICAL MATERIAL	OPTIONAL
SECTION G RADIOCATIVE MATERIAL / DIAGNOSTIC OR THERAPEUTIC IONISING RADIATION	OPTIONAL
SECTION H MEDICAL DEVICES	OPTIONAL
SECTION I MEDICINAL PRODUCTS / COSMETICS / FOOD AND FOODSTUFFS	OPTIONAL
SECTION J INDEMNITY	MANDATORY
SECTION K COST AND RESOURCE IMPLICATIONS AND FUNDING	MANDATORY
SECTION I ETHICAL ISSUES	MANDATORY

This Application Form is divided into Sections.

Sections A, B, C, D, E, J, K, L are **Mandatory.**

Sections F, G, H, and I are optional. Please delete Sections F, G, H, and I if these sections do not apply to the application being submitted for review.

IMPORTANT NOTE: Please refer to **Section I** within the form before any attempt to complete the Standard Application Form. **Section I** is designed to assist applicants in ascertaining if their research study is in fact a clinical trial of a medicinal product.

IMPORTANT NOTE: This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

SECTION A GENERAL INFORMATION

SECTION A IS MANDATORY

IMPORTANT NOTE: This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

A1 Title of the Research Study:

What are the Barriers to Quality Coding of Clinical Data in Irish Hospitals from a Coder's Perspective?

A2 Principal Investigator(s):

Title: Dr. / **Ms.** / Mr. / Prof. **Name:** **Toyosi Atoyebi**
Qualifications: **Bachelor of Arts, Masters of Arts Communication and Language Arts**
Position: **Clinical Coder**
Dept: **HIPE/Case-mix**
Organisation: **St Vincent's University Hospital**
Address: **Elm Park Dublin 15**
Tel: **0863183515** **E-mail:** **atoyebit@tcd.ie**

A3 (a) Is this a multi-site study? **Yes** / No

A3 (b) Please name each site where this study is proposed to take place and state the lead investigator for each site:

Site:	Lead Investigator:
ST VINCENTS UNIVERSITY HOSPITAL **JAMES CONNOLLY HOSPITAL** **ST JAMES HOSPITAL** **THE ROTUNDA HOSPITAL** **AMNCH TALLAGHT** **NATIONAL MATERNITY HOSPITAL** **CAPPAGH HOSPITAL** **BEAUMONT HOSPITAL** **ST LUKE'S HOSPITAL** **OUR LADY'S CHILDREN HOSPITAL** **MATER MISERICORDIAE UNIVERSITY HOSPITAL**	**TOYOSI ATOYEBI**

A3 (c) For any of the sites listed above, have you got an outcome from the research ethics committee (where applicable)?

5 responses received. (Response attached)

A4. Co-Investigators: NONE

Name of site

N/A

Title: Dr. / Ms. / Mr. / Prof. **Name:**
Qualifications:
Position:
Organisation:
Address:
Role in Research:

A5. Lead contact person who is to receive correspondence in relation to this application or be contacted with queries about this application.

Title: Dr. / **Ms**. / Mr. / Prof. **Name:** **Toyosi Atoyebi**
Address: **Dept of Computer Science & Statistics Trinity College Dublin**
Tel (work): **Tel (mob.):** **0863183515**
E-mail: **atoyebit@tcd.ie**

A6. Please provide a lay description of the study.

The research aims at identifying the barriers to clinical coding of patient record with the view to finding out how these barriers can be minimised in order to improve the quality of coded data and to understand the relationship between barriers to coding and quality of coded data. The study aims to gather information by distributing questionnaires amongst clinical coders in the hospital.

A7 (a) Is this study being undertaken as part of an academic qualification? **Yes** / No

A7 (b) If yes, please complete the following:
Student Name: **Toyosi Atoyebi**
Course: **MSc Health Informatics**
Institution: **Trinity College Dublin**
Academic Supervisor: **Gaye Stephens**
gaye.stephens@scss.tcd.ie

SECTION B STUDY DESCRIPTORS

SECTION B IS MANDATORY

B1. Provide information on the study background.

In recent times, emphasis has been placed on data quality in the health care industry because of the use of these data. Coded data is one of the types of data that is generated in the health care industry. Coded data is used for clinical audit, teaching, performance planning and resource allocation. It is also use for research, epidemiology, morbidity data and case-mix (Robinson and Shepheard 2004, Walker and Nicholson 2009). Since the purpose of coded data is important to the healthcare industry, it has become imperative that the barriers to this activity of coding be identified in order to achieve quality. Studies have also shown that there are different barriers to coding of clinical data, and these barriers can lead to miscoding and that the quality of coded data has not been queried. (Robinson and Shepheard 2004, and Cheng P et.al, 2009). Studies have also shown that data of high quality is the life-line of all business irrespective of the product or services they are engaged in (Lindsey E, 2011 and Scott et al., 2007).

B2. List the study aims and objectives.

The study aims at identifying the barriers to quality coding of clinical data, describing the coding process, and highlighting the importance of data quality in Healthcare. This study also aims to look at data quality models as it applies to coded data and to identify if there is a relationship between barriers to coding and quality of coded data.

B3. List the study endpoints (if applicable).

The study will identify the barriers to coding clinical data, how these barriers can be minimised and how the quality of the coded data is measured. The study will identify if there is a relationship between barriers to coding and the quality of coded data.

B4. Provide information on the study design.

Study design – Survey through questionnaire.
Justification – Study design best suited to gather coder's opinion about barriers to coding clinical data, how these barriers can be minimised and how the quality of coded data is measured.

B5. Provide information on the study methodology.

The methodology for this study is literature review and questionnaire. Information gathered from the questionnaire will be analysed on excel spread sheet and presented in tables and graphs. The number of responses to questions that relates to barriers and quality in the questionnaire will form variables to measure the relationship between barriers to coding and quality of coded data. These variables will determine the correlation coefficient graph.

B6. What is the anticipated start date of this study?

10th April 2012

B7. What is the anticipated duration of this study?

4 months. Ends in August 2012

B8 (a) How many research participants are to be recruited in total?

The Researcher will distribute questionnaires across hospitals in Dublin region who are engaged in clinical coding. In total, the participants will be the total number of clinical coders in Dublin hospital who consent to participate.

B8 (b) Provide information on the statistical approach to be used (if appropriate) / source of any statistical advice.

Tables and graph will be used to present the data collected from the questionnaire on frequency basis reflecting the number of respondents that answered a particular question in favour of a particular option. Responses will be in simple percentage. The variables for measuring the relationship between barriers and quality will be determine by the number of responses to the questions that relates to both barriers to coding and quality of coded data through the use of correlation coefficient statistical analysis. This has been checked with the statistics lecturer in the department of Statistics at Trinity College Dublin.

B8 (c) Please justify the proposed sample size and provide details of its calculation (including minimum clinically important difference).

The study sample size is 50 clinical coders in Dublin hospitals that consent to participate.

B8 (d) Where sample size calculation is impossible (e.g. It is a pilot study and previous studies cannot be used to provide the required estimates) then please explain why the sample size to be used has been chosen.

According to ESRI, there is an estimate of 100 clinical coders in Ireland. For the purpose of this study and time constraint, the research is limited to sampling clinical coders in Dublin hospital who consent to participate.

SECTION C STUDY PARTICIPANTS

SECTION C IS MANDATORY

IMPORTANT NOTE: This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

SECTION C1 PARTICIPANTS – SELECTION AND RECRUITMENT

C1. 1 How many research participants are to be recruited? At each site (if applicable)? And in each treatment group of the study (if applicable)?

Name of site:	**No of Participant**	**Names of Treatment Group (if applicable)**		
		Insert name of group:	**Insert name of group:**	**Insert name of group:**
St Vincent's University Hospital	**9**			
James Connolly Hospital	**3**			
St James Hospital	**8**			

Rotunda Maternity Hospital	**5**			
AMNCH Tallaght	**6**			
National Maternity Hospital	**1**			
Cappagh Hospital	**5**			
Beaumont Hospital	**8**			
St Luke's Hospital	**2**			
Our Lady's Children Hospital	**5**			
Mater Misericordiae University Hospital	**8**			

C1.2 How will the participants in the study be selected?

Participation is voluntary and based on availability and consent of clinical coders in the HIPE department.

C1.3 How will the participants in the study be recruited?

The HIPE manager will act as the gatekeeper and will be the person to distribute the questionnaire amongst the coders in the hospital.

C1.4 What are the main inclusion criteria for research participants? (please justify)

Participants are clinical coders and professional colleagues. They are based in Hospital within the Dublin region. Participants who complete and returns questionnaire irrespective of coding experience or length of employment. The HIPE managers are going to be the gate keepers in each respective hospital that the study will be carried out.

C1.5 What are the main exclusion criteria for research participants? (please justify)

Participant who do not return questionnaire.

C1.6 Will any participants recruited to this research study be simultaneously involved in any other research project?
Yes / **No** / Not to my knowledge

SECTION C2 PARTICIPANTS – INFORMED CONSENT

C2.1 (a) Will informed consent be obtained? Yes / **No**

C2.1 (b) If no, please justify.

Completing and returning the questionnaire, indicates implied consent by participants.

C2.1 (c) If yes, how will informed consent be obtained and by whom?

C2.1 (d) Will participants be informed of their right to refuse to participate and their right to withdraw from this research study?

Yes/No

C2.1 (e) If no, please justify.

N/A

C2.1 (f) Will there be a time interval between giving information and seeking consent? Yes / **No**

C2.1 (g) If yes, please elaborate.

N/A

C2.1 (h) If no, please justify.

Completing and returning the questionnaire, indicates implied consent by participants.

SECTION C3 ADULT PARTICIPANTS - CAPACITY

C3.1 (a) Will all adult research participants have the capacity to give informed consent? **Yes** / No / Non-Applicable

C3.1 (b) If no, please elaborate.

N/A

C3.1 (c) If no, is this research of such a nature that it can only be carried out on adults without capacity? Yes / No

C3.1 (d) What arrangements are in place for research participants who may regain their capacity?

N/A

SECTION C4 PARTICIPANTS UNDER THE AGE OF 18

C4.1 (a) Will any research participants be under the age of 18 i.e. Children?

Yes/ **No**

C4.1 (b) If yes, please specify:
Persons < 16 Yes / No
Persons aged 16 – 18 Yes / No
Children in care Yes / No

C4.2 Is this research of such a nature that it can only be carried out on children? Yes / No

C4.3 Please comment on what will occur if the researcher discovers that a child is at risk during the course of this study?

N/A

C4.4 Will each child receive information according to his/her capacity of understanding regarding the risks and benefits of the study? Please elaborate and provide copies.

N/A

C4.5 Will the explicit wish of the child who is capable of forming an opinion and assessing information to refuse to participate or to be withdrawn from the study be considered by the lead investigators, co-investigators and principal investigator? Please elaborate.

N/A

C4.6 Please comment on the involvement (if any) of parents / legal guardians of the child in the consent process.

N/A

C4.7 Please explain your approach to reviewing assent where research subjects reaches the age of 18 during the course of the study.

N/A

SECTION C5 PARTICIPANTS - CHECKLIST

Please confirm if any of the following groups will participate in this study. This is a quick checklist for research ethics committee members and it is recognised that not all groups in this listing will automatically be vulnerable or lacking in capacity.

C5.1 Patients Yes / **No**
C5.2 Unconscious patients Yes / **No**
C5.3 Current psychiatric in-patients Yes / **No**
C5.4 Patients in an emergency medical setting Yes / **No**
C5.5 Relatives / Carers of patients Yes / **No**
C5.6 Healthy Volunteers Yes / **No**
C5.7 Students Yes / **No**
C5.8 Employees / staff members **Yes** / No
C5.9 Prisoners Yes / **No**
C5.10 Residents of nursing homes Yes / **No**
C5.11 Pregnant women Yes / **No**
C5.12 Women of child bearing potential Yes / **No**
C5.13 Breastfeeding mothers Yes / **No**
C5.14 Persons with an acquired brain injury Yes / **No**
C5.15 Intellectually impaired persons Yes / **No**
C5.16 Persons aged > 65 years Yes / **No**

C5.17 If yes to any of the above, what special arrangements have been made to deal with issues of consent and assent (if any)?

Completing and returning the questionnaire, indicates implied consent by participants.

SECTION D RESEARCH PROCEDURES

SECTION D IS MANDATORY

IMPORTANT NOTE: This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

D1. What research procedures or interventions (over and above those clinically indicated and/or over and above those which are part of routine care) will research participants undergo whilst participating in this study?

N/A

D2. If there are any potential harms resulting from any of the above listed procedures, provide details below:

N/A

D3. What is the potential benefit that may occur as a result of this study?

It will enable Irish hospitals to identify areas of concern in respect of Clinical Coding and also add to body of knowledge.

D4 (a) Will the study involve the withholding of treatment?
Yes / No / **Non-applicable**

D4 (b) Will there be any harms that could result from withholding treatment? Yes / **No**

D4 (c) If yes, please elaborate.

N/A

D5. How will the health of participants be monitored during and after the study?

N/A

D6 (a) Will the interventions provided during the study be available if needed after the termination of the study? Yes / No

D6 (b) If yes, please state the intervention you are referring to and state who will bear the cost of provision of this intervention?

N/A

D7. Please comment on how individual results will be managed.

This study is purely for academic purposes and it will be included in the Research Analysis chapter of the dissertation and the conclusion. No individual or hospital will be identified.

D8. Please comment on how aggregated study results will be made available.

All study result will be included in the dissertation and available to any participants who are interested in knowing the outcome of the study.

D9. Will the research participant's general practitioner be informed the research participant is taking part in the study (if appropriate)? Yes / No / **Non-applicable**

D10. Will the research participant's hospital consultant be informed the research participant is taking part in the study (if appropriate)?
Yes / No / **Non-applicable**

SECTION E DATA PROTECTION

SECTION E IS MANDATORY

IMPORTANT NOTE: This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

SECTION E1 DATA PROCESSING - CONSENT

E1.1 (a) Will consent be sought for the processing of data? **Yes** / No

E1.1 (b) If no, please elaborate.

SECTION E2 DATA PROCESSING - GENERAL

E2.1 Who will have access to the data which is collected?

The Principal Investigator.

E2.2 What media of data will be collected?

Paper-data and electronic-data. All information will be written on the questionnaire. The analysis will be done by the lead/principal researcher using excel spread sheet. The data analysis will be saved on a USB key and password protected.

E2.3 (a) Would you class the data collected in this study as anonymous, irrevocably anonymised, pseudonymised, coded or identifiable data?

Anonymous

E2.3 (b) If 'coded', please confirm who will retain the 'key' to re-identify the data?

N/A

E2.4 Where will data which is collected be stored?

The data collected will be on the questionnaire which is paper-based and electronic. The questionnaire will be locked away in a secured place by the principal investigator. The data analysis will be saved on a USB key and password protected.

E2.5 Please comment on security measures which have been put in place to ensure the security of collected data.

The researcher will be the sole custodian of the questionnaire and names of participant will not be included in the questionnaire or passed on to third parties. All completed questionnaire will be locked in a secured palace and USB key password protected.

E2.6 (a) Will data collected be at any stage leaving the site of origin?
Yes / No

E2.6 (b) If yes, please elaborate.

The questionnaire will be posted to the researcher for further analysis.

E2.7 Where will data analysis take place and who will perform data analysis (if known)?

The Principal Investigator will be carrying out the analysis of the data at the Trinity College library.

E2.8 (a) After data analysis has taken place, will data be destroyed or retained?

Destroyed

E2.8 (b) Please elaborate.

Data collected from questionnaire is solely for academic purpose. The copies of completed questionnaire will be shredded and electronic data deleted by the Principal Investigator as part of data protection.

E2.8 (c) If destroyed, how, when and by whom will it be destroyed?

The questionnaire will be shredded by the Principal Investigator once the study ends in August 2012.

E2.8 (d) If retained, for how long, for what purpose, and where will it be retained?

N/A

E2.9 Please comment on the confidentiality of collected data.

Data gathered is solely for academic purpose and will not be retained or passed on to third parties.

E2.10 (a) Will any of the interview data collected consist of audio recordings / video recordings? Yes / **No**

E2.10 (b) If yes, will participants be given the opportunity to review and amend transcripts of the tapes?

N/A

E2.11 (a) Will any of the study data collected consist of photographs/ video recordings? Yes / **No**

E2.11 (b) If yes, please elaborate.

N/A

SECTION E3 ACCESS TO HEALTHCARE RECORDS

E3.1 (a) Does the study involve access to healthcare records (hard copy / electronic)? Yes / **No**

SECTION F HUMAN BIOLOGICAL MATERIAL

F1 BODILY TISSUE / BODILY FLUID SAMPLES - GENERAL

F1 1 (a) Does this study involve human biological material? Yes / **No**

If answer is No. Please delete following questions in Section F.

SECTION G RADIOACTIVE MATERIAL / DIAGNOSTIC OR THERAPEUTIC IONISING RADIATION

G1 RADIOACTIVE MATERIAL / DIAGNOSTIC OR THERAPEUTIC IONISING RADIATION - GENERAL

G1.1 (a) Does this study/trial involve exposure to radioactive materials or does this study/trial involve other diagnostic or therapeutic ionising radiation? Yes / **No**

If the answer to question G1.1(a) is No, please delete the following questions in this Section.

SECTION H MEDICAL DEVICES

H1 (a) Is the focus of this study/trial to investigate/evaluate a medical device? Yes / **No**

If the answer to question H1 (a) is No, please delete the following questions in this Section.

SECTION I MEDICINAL PRODUCTS / COSMETICS / FOOD AND FOODSTUFFS

Section I is designed to assist applicants in ascertaining if their research study is in fact a clinical trial of a medicinal product. Section I is optional. Please delete if this section does not apply.

SECTION I.1 NON-INTERVENTIONAL TRIALS OF MEDICINAL PRODUCTS

I1.1 (a) Does this study involve a medicinal product? Yes / **No**

If the answer to question I1.1 (a) is No, please delete the following questions in this Section.

SECTION I.2 COSMETICS

I2.1 (a) Does this study involve a cosmetic? Yes / **No**

If the answer to question I 2.1 (a) is No, please delete the following questions in Sub-Section I 2.

SECTION I.3 FOOD AND FOOD SUPPLEMENTS

I3.1 (a) Does this study involve <u>food or food supplements?</u>
Yes / **No**

If the answer to question I 3.1 (a) is No, please delete the following question in Sub-Section I 3.

SECTION J INDEMNITY

SECTION J IS MANDATORY

<u>IMPORTANT NOTE:</u> This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

J1 (a) Is each site in which this study is to take place covered by the Clinical Indemnity Scheme (CIS)? **Yes** / No

J1 (b) If the answer is 'no' for any site, what other arrangements are in place in terms of indemnity / insurance?

N/A

J2 (a) Is each member of the investigative team covered by the Clinical Indemnity Scheme (CIS)? Yes / **No**

J2 (b) If no, do members of the investigative team not covered by the Clinical Indemnity Scheme (CIS) have either current individual medical malpractice insurance (applies to medical practitioners) or current professional liability insurance either individually or as provided by their hosting/employing institution (generally applies to allied healthcare professionals, university employees, scientists engineers etc.)?

N/A

J3 (a) Who or what legal entity is the <u>sponsor</u> of this research study?

Principal Investigator (Toyosi Atoyebi)

J3 (b) What additional indemnity arrangements has the <u>sponsor</u> put in place for this research study in case of harm being caused to a research participant (if any)?

None

SECTION K COST AND RESOURCE IMPLICATIONS AND FUNDING

SECTION K IS MANDATORY

<u>IMPORTANT NOTE:</u> This application form permits the applicant to delete individual questions within each section depending on their response to the preceding questions. Please respond to each question carefully and refer to the accompanying *Guidance Manual* for more in-depth advice prior to deleting any question.

K1 (a) Are there any cost / resource implications related to this study? Yes / **No**

K2 (a) Is funding in place to conduct this study? **Yes** / No

K2 (c) Please state the source of funding (industry, grant or other) and the amount of funding.

Personal Funding/income (€500.00)

K2 (d) Is the study being funded by an external agency? Yes / **No**

K2 (f) Do any conflicts of interest exist in relation to funding? Please elaborate.

NO

K2 (g) Please provide additional details in relation to management of funds.

The research is in fulfilment of an award of M.Sc. in Health Informatics from Trinity College Dublin. This has being taken into consideration from the beginning of the course in September 2010. All funding is from personal income.

K3. Please provide details of any payments (monetary or otherwise) to investigators.

N/A

K4. Please provide details of any payments (monetary or otherwise) to participants.

N/A

SECTION L ETHICAL ISSUES

SECTION L IS MANDATORY

L1. Please identify any particular additional ethical issues that this project raises and discuss how you have addressed them.

NONE

PLEASE ENSURE THIS APPLICATION FORM IS FULLY COMPLETED AS

INCOMPLETE SUBMISSIONS WILL NOT BE REVIEWED.

Appendix F: T Score Distribution

Sampling Error (SE) = 0.55

Degree of Freedom (DF) = 1

T score = -3.63

Describe the random variable	t score
Degrees of freedom	1
t score	-3.63
Cumulative probability: P(T ≤ -3.63)	0.0856

P (t < -3.63) = 0.0856 and P (t > 3.63) = 0.0856.
Thus the probability error P-value = 0.0856 + 0.0856 = 0.1712