The Impact of an Electronic Clinical Decision Support for Hospital Admission and Continued Stay Appropriateness Determination on Healthcare Quality

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in partial fulfilment of the requirements for the degree of
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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. I further declare that this research has been carried out in full compliance with the ethical research requirements of the School of Computer Science and Statistics.

Signed:_____

Paula Vernon

September 4th 2013

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List of Acronyms

AEP-Appropriateness Evaluation Protocol

AHRQ-Agency for Healthcare Research and Quality

AJMC-American Journal of Managed Care

AJMQ-American Journal of Medical Quality

BMJ-British Medical Journal

CMAJ-Canadian Medical Association Journal

CDS – Clinical Decision Support

CSO-Central Statistics Office

DOH-Department of Health

DOHC-Department of Health and Children

ECDS-Electronic Clinical Decision Support

ED-Emergency Department

EHR-Electronic Health Record

ERSI-Economic and Social Research Institute

GDP-Gross Domestic Product

GP-General Practitioner

HAI-Hospital Acquired Infection

HIPE-Hospital In-Patient Enquiry

HIT-Health Information Technology

HIQA- Health Information and Quality Authority

HSE- Health Service Executive

IMO-Irish Medical Organisation

IOM- Institute of Medicine

IPC-Infection Prevention Control

IRR-Inter-rater Reliability

IT-Information Technology

JOC-Joint Oversight Committee

LOS-Length of Stay

MCG-Milliman Care Guidelines

MDT-Multi-Disciplinary Team

MRSA-Methicillin-resistant Staphylococcus aureus

NAP-National Academies Press

NEJM-New England Journal of Medicine

NHS-National Health Service

OECD Organization for Economic Co-operation and Development

PCES-Patient Care Evaluation System

PSQI-Patient Safety Quality and Innovation

SCIP-Surgical care Improvement Project

UK –United Kingdom

UPMC-University of Pittsburgh Medical Center

UM-Utilization Management

UR-Utilization Review

US-United States

VA-Veterans Administration

VHI-Voluntary Health Insurance

VTE-Venous Thromboembolism

WHO-World Health Organization

Abstract

Background: Provision of acute health care requires quality improvement interventions. Healthcare can take advantage of electronic clinical decision support to provide evidence based guidelines and impact quality.

Objective: To test the hypothesis that the use of and electronic decision support for determining acute care admission appropriateness and length of stay will impact on health care quality in a private acute care setting.

Methods: A retrospective quantitative study of the emergency admission data pre and post implementation of the Interqual electronic clinical decision support using a paired t test with the same sample. The variables of length of stay (LOS) and admission appropriateness were the quality indicators considered.

Results: From the population of *N* 897 emergency patients admitted in 2010 *N* 92 were readmitted in 2012. The identification of the individual patients that were admitted with the same category of medical complaint on both occasions yielded *n*= 31 patients for the sample. The mean LOS and appropriateness of admission were determined to be statistically significant, respectively ($p < .001$) and ($p < .03$) and therefore applicable to the population.

Conclusion: The Electronic Clinical Decision Support intervention Interqual was found to have a positive impact on the quality culture of the research setting; as demonstrated by the augmentation and introduction of concomitant quality interventions. Patient length of stay and admission appropriateness data post Interquals implementation demonstrated a positive impact on the utilization of acute care beds within the research setting.

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1. Introduction

Healthcare was designed and envisioned to provide individuals with assistance in recovering and maintaining their health. A quality health system includes interventions that provide effective care at the most efficient time, that is patient centered in the correct setting (The Health Foundation 2012). The World Health Organization (WHO) (2012) defines a health system as "*all the activities whose primary purpose is to promote, restore or maintain health*" (Arah et al. 2006). Large volumes of data are collected during the process of providing care and treatment for a patient at a cost of up to 30% of a health care systems budget (Health Information and Quality Authority (HIQA) 2011). The requirements for safe quality health care include data that is defined by Ireland's HIQA (2011) as "*accurate, valid, reliable, timely, relevant, legible and complete*". The use of the analyzed data can assist in the adoption of interventions for providing quality, evidenced based, patient-centred healthcare. The use of Information Technology (IT) to analyze and organize healthcare data and create Electronic Clinical Decision Support (ECDS) provides quality interventions which have proven effective in supporting the provision of the right care, at the right time in the right setting (Sittig et al. 2007). The research undertaken within this dissertation will document the impact of such an ECDS intervention on health care quality in a private Irish acute care hospital setting.

1.1 Background

Acute care is defined as healthcare needs that require provision by licensed health professionals for twenty-four hours at a time within a hospital setting which is the most resource intensive, complex and expensive health care setting (Sahota et al. 2011). Whereas hospitalization places patients at risk for unintended harm and causes potential overutilization of scarce health resources, acute healthcare requires quality management interventions to ensure the provision of safe, reliable, cost effective care as defined by ethical, professional and legislative healthcare standards (DeCoster et al. 1999). Goodacre (2006) goes as far as to recommend acute inpatient admission only if the benefits outweigh the potential risks. Deciding if there is benefit to acute inpatient admission begins with the determination of admission appropriateness (M J Goran, 1979).

1.2 Healthcare Quality

As suggested previously the provision of quality healthcare has always been replete with challenges. The findings of the Institute of Medicine (IOM) report on the United States (US) hospital system found multiple errors, delays, inappropriate care and treatment and failures which were common and frequent; this resulted in their recommendation for the improvement in patient safety by developing a comprehensive "culture of safety" (IOM, 1999). The IOM went on to highlight the need for quality improvement interventions to resolve the void between clinical practice and research in 2001 (IOM 2000;The Health Foundation 2012). The additional challenge of ever increasing costs has also been noted to be a significant segment of some government budgets by DeCoster et al. (1997) and Kossovsky et al. (2002). Quality health care is universally recognized by the provision of safe, equitable, cost effective care and practice standardization (Goran, M J 1979; Kalant et al. 2000; Field & B. H. Gray 1989; Soria-Aledo et al. 2012). The determination of appropriateness of health care services has been touted as a tool to enhance the ability to provide quality and cost effective care (Wakefield et al. 1987; Inglis et al. 1995; Black CD, Roos NP 1995; Ballard 2003; Soria-Aledo et al. 2012; Mckesson 2012).

1.3 Electronic Clinical Decision Support

In 2005 Kawamoto et al. also noticed the deficiencies that existed in healthcare and the trend towards clinical decision support (CDS) systems being employed to realize improvements in quality. They defined clinical decision support as "*as any electronic or non-electronic system designed to aid directly in clinical decision making, in which characteristics of individual patients are used to generate patient-specific assessments or recommendations that are then presented to clinicians for consideration.*" The delay in making new evidence based guidelines available to clinicians and the increasing complexity of healthcare delivery are the primary reasons for using the electronic versions of clinical decision support according to Horasani et al. (2003). The quality of health care is improved by the use of CDS to standardize healthcare and improve patient safety (East et al. 1999).

1.4 Research Question

This study has been performed to determine the impact on healthcare quality when an electronic clinical decision support (ECDS) intervention is applied to patient clinical data to

ascertain the appropriateness of inpatient admission and continued inpatient stay in a private healthcare setting in Ireland.

This study seeks to answer the following questions

1. What impact does utilizing an ECDS Utilization Review (UR) intervention have on acute care admission appropriateness and length of stay?
2. Is there a relationship between acute care appropriateness; length of stay and healthcare quality as indicated by readmission and Methicillin-resistant Staphylococcus aureus rates?
3. What additional quality interventions were employed and impacts realized as a result of implementing the ECDS for UR?

The objective of this dissertation is a preliminary exploration of the potential of electronic clinical decision support utilization review interventions within Irish acute healthcare.

1.5 Research Design

A postpositive philosophy was adopted to accomplish this study. Employing quantitative research methods stated in the postpositive philosophy as recommended by Hazard Munro (2001) and Creswell (2003) enabled the theories of the impact of ECDS on healthcare quality of the subject population to be scientifically explored. The data studied was retrospective and therefore did not require any patient or healthcare provider interaction. The methods were applied pre and post intervention to determine if a difference in the quality indicators could be discerned (Creswell 2003). The decision to pursue this research methodology approach was assisted by the review of relevant research methodology literature a suggested by Blaxter et al. 2001.

1.6 Dissertation Guide

Chapter 1: **Introduction** provides the background of the research subject, the research question, the research design, and this dissertation guide

Chapter 2: **Literature Review** outlines the approach taken for the literature search, a general overview of the results, criteria for choosing the included literature and the gap in the literature identified.

Chapter 3: **Solutions Provided in Literature** provides an overview of the concepts, and quality indicators and interventions noted within the literature to be most appropriate to answer the subject of this research.

Chapter 4: **State of Art** introduces the currently most effective and successful quality interventions and declares the intervention that is the subject of this study.

Chapter 5: **Context** outlines the global, Irish and local healthcare situation surrounding the research setting. It also provides information on the quality components of the research setting, researcher's motivations and confounding factors.

Chapter 6: **Research Design and Methods** explains other methods used in research for this type of study and informs how and why this researcher chose the methods used in this study. It also explains the management of ethical requirements, decisions regarding data collection, inclusion and exclusion criteria and analysis and limitations.

Chapter 7: **Overall Impact** reveals the results of the statistical analysis of the sample data and other general data related to quality indicators in the research setting.

Chapter 8: **Discussion/Conclusion** considers the recent developments in Irish healthcare, and future directions of quality interventions and indicators that have been identified in literature as significant to improving healthcare quality and their relationship to the subject of this research.

2. Literature Review

2.1 Search Strategy

The review was accomplished using a search of multiple electronic databases including the Trinity College Dublin and University of Pittsburgh libraries, individual databases such as SciVerse, PubMed, The National Academies Press (NAP), and Google Scholar to name a few. Multiple electronic journals such as The British Medical Journal (BMJ), International Journal of Health Care Quality Assurance, International Journal for Quality in Health Care, Infection Control and Hospital Epidemiology, Health Informatics Journal, American Journal of Medical Quality (AJMQ), Canadian Medical Association Journal (CMAJ), Quality Safety in Health Care, Medical Care, The New England Journal of Medicine (NEJM), BioMed Central Health Services Research, and American Journal of Managed Care (AJMC) were searched. Additional web sites including Department of Health Ireland (DOH), Health Information and Quality Authority (HIQA), Health Service Executive (HSE), Institute of Medicine (IOM), Agency for Healthcare Research and Quality (AHRQ), McKesson United Kingdom (UK), and books such as Crossing the Quality Chasm; Research Design Qualitative, Quantitative and Mixed Methods Approaches; Statistical Methods for Health Care Research were also used. Searches carried out used, but were not limited to, a combination of the following keywords including: appropriateness admission; health care quality; quality indicators; utilization review (UR); Ireland acute care utilization; length of stay (LOS); Interqual; Milliman; Appropriateness Evaluation Protocol (AEP); overutilization; health care continuum; hospital acquired and nosocomial infection; to identify English language documents with relevant information.

2.2 Review Results

The results included research performed and published by, government, standards and healthcare, educational and commercial organizations as well as individuals. Results also included “grey literature” white papers, industry, academic and governmental agency reports, reviews, policies, opinions, commentary, and editorials. These searches resulted in the excess of 800 documents which then had their references examined to ensure the most frequently cited documents were included. To ensure the most current data was utilized serial re-reviews

were completed yielding primarily periodical articles. Documents published between 1975 and 2013 were considered in order to obtain a broad overview of the research topic. The English language documents determined to be valid and most relevant to the research question have been selected for inclusion in this research study.

2.3 Gap in Literature Identified

In conducting the literature review it was noted that, within Ireland no studies documented attempts to implement an electronic clinical decision support for appropriateness of admission and continued stay decisions in an acute care setting.

2.4 Conclusion

Considering the gap in literature that has been identified this dissertation will describe the implementation of; study and report the impact of implementing an electronic clinical decision support for appropriateness of admission and continued stay decisions in a private Dublin acute care hospital setting.

3. Solutions Provided in the Literature

3.1 Introduction

Surprisingly Moya-Ruiz et al. (2002) found while many researchers had explored the issues due to inappropriate hospitalizations because of its prevalence and impact only a few publications exist which address solutions to the problem. A decade later Soria-Aledo et al. (2012**)** reiterate the paucity of studies that have investigated utilization review tools applied in routine health care or after implementation of quality interventions.

In considering the current state of health care regarding hospital utilization Soria-Aledo et al. (2012) recognize that acute hospial resources continue to decrease as health care costs increase**.** This finding accentuates the requirement for solutions that prevent inappropriate use of this ever decreasing health care resource. As previously noted Moya-Ruiz, et al. (2002) and Soria-Aledo et al. (2012**)** found while many researchers had explored the issues due to inappropriate hospitalizations only a few publications looked at solutions to the problem. Studies that have investigated utilization review tools applied in routine health care or after implementation of quality improvement interventions are rare (Soria-Aledo et al. 2012**).** In Europe it was noted that up until 2002 utilization review tools were only used for research and not as part of routine health care provision by Moya-Ruiz, et al. (2002).

As observed previously, the application of appropriateness of inpatient admission and continued stay criteria has been forecasted as a requirement for improved healthcare quality globally and in Ireland (HSE & PA Consulting Group 2007,Collins & Joyce 2008;, Hogan et al. 2011). The necessity of establishing quality indicators to provide benchmarking for measurement of healthcare quality has been recognized by many including (Mainz 2003; Arah et al. 2006; Paillé-Ricolleau et al. 2012). In an effort to further improve healthcare quality; these types of data driven systematic changes in processes that increase efficiency have been adopted from manufacturing industries by the healthcare industry to realize quality improvement (Lynn et al. 2007).

3.2 Quality Improvement

The Health Foundation (2012) has expanded the IOMs definition of healthcare quality to include the use of specific techniques and a systematic approach to measure the degree to which healthcare is founded on current clinical knowledge and promotes positive patient outcomes. The Health Foundation (2012) further defines quality improvement as changed clinician and organizational behaviour that uses systematic methods to improve patient experiences and outcomes.

The relationship between health care overutilization and adverse events caused by poor quality healthcare has been widely acknowledged by government policy makers (HSE Health Steering Group 2008;, HIQA 2009) and researchers (French 2006, Al-Rawajfah et al. 2012). The Health Service Executive, (2012) cite adverse events as causes of increased costs, care delays and inefficiencies in inpatient healthcare. Decreasing and avoiding these adverse events requires criteria, guidelines, standards, and interventions that focus on monitoring, guiding and ensuring quality,(Rotter et al. 2010; Hogan et al. 2011; HIQA 2012). The systematic application of evidence based practice as a quality intervention is aimed at improving quality (Balas et al. 1997; Warren & Kollef 2005; Scott 2009; Navarro et al. 2012). Efficiency in applying quality interventions requires standardization beginning with the determination of the indicators that we use to measure the state of healthcare quality (Institute of Medicine: Committee on Quality of Health Care in America 2000; Poulos & Eagar 2007; Scott 2009; US Department of Health and Human Services 2011).

Healthcare quality encompasses a multitude of processes, factors and potential outcomes. The ability to monitor and measure quality in the health care setting has been formalized and standardized by the use of quality indicators sometimes called quality measures (Arah et al. 2006; HIQA 2012; Hauck et al. 2012). The formalization and standardization usually takes place within the oversight of health care regulatory, standards and accreditation bodies within governments, standards organizations and private accrediting bodies (Department of Health and Children 2008; US Department of Health and Human Services 2011). These indicators provide evidence based guidelines on the components of care that have been proven to provide the best patient care outcomes (Mainz 2003; S. C. Williams et al. 2006; Health Service Executive 2010; Joint Commission International (JCI) 2011; JCI 2012). The results

of the indicators are often used as criterion to measure the quality of a healthcare setting, benchmark quality and determine the compliance and satisfaction of requirements for certifications, accreditations and licensing activities (Ballard 2003; Williams et al. 2006; To et al. 2010).

According to (Kossovsky et al. 2002, 1998; McMullan R, et al., 2004) there are organizational and patient factors that influence care quality and hospital length of stay including diagnosis, social issues and the lack of standardized practice surrounding the ordering of investigations that form the health care context. The quality improvement process employed to manage these patient factors is approached differently by organizations depending on their context and goals (The Health Foundation 2012). The Scott 2009 research clarified the fact that upon review of quality improvement processes the most successful initiate from a patient focus that are clinician lead versus processes that initiate from administrative initiatives.

Arah et al. (2006) note;

"*The key criteria for selecting indicators are importance (including disease burden) of what is being measured, scientific soundness (i.e. validity, reliability, and explicit evidence) of measures, and their feasibility (i.e. mainly data needs and cost of measurement) and that burden of disease, health care utilization rates, and cost of associated health care are useful criteria for prioritization of health areas to be included in a performance framework*".

The success of defining and monitoring quality interventions that have been noted to be significant in improving the quality of healthcare has also led to the practice of some healthcare systems, individual healthcare providers and facilities public and private implementing their own quality benchmarking programs. This has process has been recommended by Ireland's Department of Health and Children in their 2008 Report on Building a Culture of Patient Safety. Appropriateness of healthcare as a quality indicator has been documented in an Australian study that recommends utilization review to standardize definitions of appropriate care for government policy (Poulos & Eagar 2007).

Interventions for hospital quality improvement have demonstrated significant reductions in inappropriate hospital care (Kossovsky et al. 2002)**.** Other researchers have reported an additional benefit of standardization of the definitions of quality healthcare allowing for the assessment of potential new care models (Poulos & Eagar 2007). The Health Foundation (2012**)** are not as optimistic, stating that quality improvements are rarely quick or universal fixes for poor quality health care. The litmus test for quality improvement is measured in patient outcomes (The Health Foundation 2012). Some of the complimentary and supporting interventions employed to manage healthcare utilization and quality improvement outcomes are examined in the subsequent sections of this chapter.

3.3 Utilization Management

The relationship between health care overutilization and adverse events has been widely acknowledged by government agencies (Health Service Executive Health Steering Group 2008; Health Information and Quality Authority 2009) and researchers (French 2006; Al-Rawajfah et al. 2012). The Health Service Executive,(2012) cite adverse events as causes of increased costs, care delays and inefficiencies in inpatient healthcare. According to McMullan R, et al. (2004) the solution for the resource crisis within the NHS has to include improvements in organizational strategy which should include improved resource utilization by implementing standardized investigation guidelines and enhanced social care. Utilization Management (UM) which includes UR, criteria development, cost containment, physician and administrative feedback and cost containment measures can have the additional benefit of identifying institutional systems problems leading to solutions (Nelson & Gardner 1993). The following sections provide an overview of some of the UM interventions that were employed in the study setting.

3.4 Utilization Review

A major step towards providing guidelines for standardizing and managing utilization of healthcare resources was the development of utilization review processes and tools. UR is based on clinical information from a patient's medical record to evaluate the efficiency of medical care by detecting care that is unnecessary, overly expensive or resource intensive, in the effort to increase efficiency and quality (Nelson & Gardner 1993). The utilization review processes is applied at selected points in a patient's health care journey to assist in

determining the appropriateness of a patient's hospital admission or stay. Utilization review tools are developed to provide guidelines that aid clinical decision making (Kalant. et al 2000). Although Field & Gray (1989) note that the process of performing reviews of appropriateness of health care began in the 1960s. Goran et al., (1975) state there was still a need for formalization of the process in the 1970s. This opinion was reiterated as late as 2008 by Mitus, J. (2008). The genesis of this solution came in 1974 when the US government passed legislation mandating the review of care being provided to patients that receive government healthcare benefits with the goal of improving the quality of care and resource utilization (Goran et al., 1975; Blanc et al., 1997). The US government agency charged with this assignment set out to examine the field of health care quality review and construct a program. This initial exploration of the challenges facing the US Government health care administrators identified several integral concepts and components required to implement the utilization review processes which have remained central to assessing health care quality (Goran et al., 1975; Goran, M J, 1979).

The quality improvement goals of healthcare utilization review are decreasing inappropriate care to increase access to scarce resources, hasten efficiency, and promote patient safety (Goran 1979). By 1989 UR was a routine part of providing health care and would continue to be according to Field & Gray (1989) because the cost of health care continued to increase along with the evidence that much of the care being provided is unnecessary and inappropriate. Field & Gray (1989) goes on to point out that UR was still lacking necessary standardization. We note the global spread of the practice of UR. For example, German healthcare providers also began an ad hoc system of reviewing hospital care in 1995 in an attempt to maintain the quality, accessibility and comprehensive coverage in a changing healthcare environment (Sangha, O et al. 2002). Additionally Australian and New Zealand's Health Policy recognized utilization review as a compliment to other initiatives used to improve patient safety and efficiency that had been proven internationally (Poulos & Eagar 2007). The New Zealand Health Technology Clearing House's 1998 review of studies related to UR revealed mixed results regarding the use for appropriateness of admission and in conclusion recommended their use as a screening tool with other interventions.

The Appropriateness Evaluation Protocol (AEP) has been the most widely used example of a UR intervention and continues to be valid for determining appropriateness of hospitalizations and causes of inappropriateness, (Nelson & Gardner 1993, Sangha, O et al. 2002, Soria-Aledo et al. 2012) . Sangha, O et al. (2002) continues on to explain the value of the AEP is that it has already been evaluated in the US and the strengths and weaknesses are well documented. A UK study by Smith, H E et al., (1997) cited any inefficiency in AEP assessments to be related to organizational issues. Blanc et al (1997) explains that the Appropriateness Evaluation Protocol has been adapted by many countries and applied more than any other tool worldwide.

Kossovsky et al. (2002) noted that the AEP does not look at medical procedure appropitateness which makes it a satisfactory tool for appropriateness assessment. The AEP considers a patient having a condition that can only be treated in an acute care setting as appropriate to stay in the acute setting (Poulos & Eagar 2007). There were also multiple German health care review systems developed independently and were never tested for validity and reliability causing Sangha, O et al. (2002) to use a modified AEP instead of these tools for their research into appropriateness of hospital admissions due to its reliability and validity being moderate (Nelson & Gardner 1993).

Conversely, Mariotto A, 2000 disagrees with the use of the AEP for appropriateness assessment and states it can be used to assess the efficiency of a hospital in caring for acutely ill patients instead. DeCoster et al. (1997) agreed that Interqual another widely applied UR tool should not be applied to determine admission appropriateness but employed only for reviewing for continued stay appropriateness after a LOS of ten days. However, Blanc et al (1997) explains that the AEP answered the need for explicit criteria and has been applied more than any other tool worldwide, and reminded us there is wide variation in the resulting levels of appropriateness and they ascribe this difference to the varied methods of application of the criteria.

Other purposes of applying UR have been identified. For example, the researchers in the Ludke et al., (1990) and Blanc et al., (1997) studies have found an additional benefit of

utilization review and recommend a provider examine the quality its medical records by applying both retrospective and concurrent review processes to a sample of its admissions. The importance of the quality of documentation by clinicians was reiterated by Ludke et al., (1990) and Mariotto A, et al., (2000) as this affects the validity of the review outcomes. The outcomes of the reviews that are undertaken are based on the clinical data from the medical record, clinical team or both being matched to appropriate review criteria (Poulos & Eagar 2007). In answer to these issues the purposes of inter-rater reliability (IRR), criteria sets and opportunities for the application of UR will be outlined below.

3.5 Inter-rater Reliability

The occasions which the same set of medical data is reviewed by different reviewers and the findings are classified identically by both reviewers defines inter-rater reliability (The Quality Indicator Study Group 1995). This is accomplished by interventions that standardize UR criteria (Poulos et al. 2007) and those that standardize the evaluation of inter-rater reliability itself (Cassidy et al. 2002). This helps to ensure the outcomes of UR results are consistently valid (McKesson 2013).

3.6 Criteria

By 1989 the criteria that was being employed was noted to still require standardization(Field & Gray 1989). Some of the difficulty with achieving standardization in criteria resulted from the participation of private utilization companies that class their review criteria as proprietary and refuse to share (Field & Gray 1989). Goran, M J et al.(1975) also observed that at that time criteria would need to be developed which would take time because not much was known about review using criteria. Additionally, they caution that the goal should be to quickly identify appropriate and inappropriate care so patterns of practice that require more intensive review can be selected. The initial criteria developed for review was specific to the patient's diagnosis, problem or planned procedure in conjunction with services which require hospital care (Goran et al., 1975).

To perform UR, criteria can be applied at different times, for different purposes during a patient's acute care stay. For example, Admission reviews are performed within twenty-four hours of admission to determine admission appropriateness (Ludke et al. 1990; Blanc et al.,

1997; Leung & Fan 2008; Woodhams et al. 2012). Concurrent reviews combine an initial admission review and periodic continued stay reviews and assists in determining when a patient is no longer appropriate for acute care (Blanc et al., 1997). Concurrent reviews are conducted during the inpatient stay and due to the requirement for an updated, available medical record, at times on daily basis, are resource intensive and therefore costly but worthy because it affects patient care immediately according to Blanc et al., 1997. Retrospective reviews are conducted post discharge and dependent on the quality of medical records therefore it will only affect future patient care Blanc et al., (1997). Retrospective reviews have been found to consider a larger set of available relevant data allowing for a more accurate determination; and resulting in a higher rate of appropriateness (Poulos & Eagar 2007). The importance of the quality of documentation by clinicians was reiterated by Ludke et al., 1990 and Mariotto A, et al., (2000) as this affects the validity of the review outcomes. Prior to the development of standardized criteria the process of utilization review was usually based on a physicians clinical judgement (Poulos & Eagar 2007).

3.7 Physician Feedback and Involvement

This research will focus on physicians due to their primary role in clinical assessment, diagnosis, ordering of diagnostic investigations, and ancillary care for patients. Supporting quality in healthcare requires clinician involvement (The Health Foundation 2012). The few studies available that examine quality improvement interventions which involve clinical staff have also been found to focus on physician involvement (Soria-Aledo et al. 2012). A study performed in Spain by Moya-Ruiz et al., (2002), found providing physicians with information regarding the amount and reasons for their inappropriate inpatient days resulted in a significant decrease in inappropriate days and a reduction in LOS. The short lived effect prompted the researchers to advocate additional changes to organizational processes derived from the results to realize long term benefits. Additional quality interventions were applied by Moya-Ruiz et al., (2002) to these organizational processes noted to cause the delays that resulted from non-physician actions such as diagnostic scheduling, and patient social issues, and waiting for sub-acute or community placements. The resulting overall effect on inappropriate days was slight and the researcher reported that it was possible that the Hawthorne effect could be partially responsible. In concluding the researchers in the Moya-Ruiz, et al., (2002) affirmed the benefit of even a small reduction in inappropriate days which

result in improved care quality and the prevention of secondary problems such as hospital acquired infections (HAIs).

This outcome was also realized by Soria-Aledo et al., (2012) who performed a study with the goal of reducing inappropriate hospital use by identifying the reasons and prompting physicians to take appropriate action with the information. The physician feedback resulted in a reduction in inappropriate admission and reduced length of stay that lasted only while this quality intervention was employed. The researchers also provided some education regarding the information to all clinical staff through working groups within the hospital. Additional quality interventions aimed at decreasing inappropriate care were implemented. Appropriateness was measured pre and post implementation of the physician feedback and the other quality interventions. In conclusion Soria-Aledo et al., (2012) recommend a programme of evidence based, facility specific quality interventions to achieve a reduction in inappropriate admissions and hospital days.

Another attempt to explore physician focused quality interventions by Kossovsky et al. (2002) implemented a dedicated phone line for primary care physicians to assist with the planning of elective admissions and realized a substantial decrease in inappropriate admissions .Encouraging physicians increased use of outpatient services along with more effective pre admission planning are thought to have achieved the gains realized by Kossovsky et al. (2002). Several other researcher agreed with Kossovsky et al. (2002) assertion that pre acute and inpatient physician assessment in conjunction with utilization review tools should be employed to identify patients appropriate for care in non-acute settings across the continuum (Nelson & Gardner 1993, Poulos & Eagar 2007).

3.8 Care Continuum Development

The lack of an adequate health care continuum is a global social issue that affects under-developed countries as well as developed countries. A 2012 Norway study by Lappegard & Hjortdahl (2012) state that the ability to co-ordinate patient care is still not sufficiently available. The research by Lappegard & Hjortdahl (2012) continues on the state that it is possible to improve health care quality by providing care instead of or after hospitalization.

Several studies including Irish, UK, Korean, Canadian and Swiss researchers have made the same conclusion. They found that hospital care has to be coordinated with social and community care to decrease the possibility of inappropriate hospital days (Kossovsky et al. 2002, 1998; McMullan R, et al., 2004; Aging Well Network 2011; Majeed et al. 2012; Costa et al. 2012). Hwang et al. (2011) claim that the availabilty of health care services outside of the hospital in long-term and home-care settings can assist with avoiding inappropriate hospitalizations if they are improved. However Majeed et al. (2012) point out that eldery patients often have additional complications not related to post hospital care that can still delay discharge.

Without appropriate after hospital placement and follow up healthcare patients are also more likely to be readmitted to the hospital(Aging Well Network, 2011; Majeed et al. 2012).
Ireland's HIQA (2012) in its Guidance for Safer Better Healthcare advises of the importance of, and provides guidance for, the information required to be shared across the continuum to ensure safe, quality health care.

Health care governing agencies in Ireland and the UK have found avoiding inpatient hospitalization and providing care in alternate healthcare facilities, community settings and home result in high quality patient outcomes (Heath Service Executive PA Consulting Group 2007). In addition it has been noted that decreasing length of stay appropriately does not put patients at risk for increased adverse outcomes (Health Service Executive 2012, National Health Service (NHS) United Kingdom (UK)2012). Lappegard & Hjortdahl (2012) agrees that if patient is clinically appropriate health care can be provided outside of the hospital setting.

Aging Well Network, (2011) encourages increased efficiency and earlier hospital discharge preparation coordinated with community health care to prevent inappropriate hospital stays due to discharge delays. This requires a multidisciplinary case management approach to quality interventions enabling improved hospital discharge efficiency (Kossovsky et al. 2002; Soria-Aledo et al., 2012). An optimized healthcare continuum is pivotal as the solution to

improving quality in part by preventing up to 50% of inappropriate acute admissions and assisting in cost containment according to Poulos & Eagar (2007).

3.9 Cost Containment

An additional desired outcome of healthcare review is cost containment. As early as 2002 German researchers Sangha, O et al. (2002) found future provision of health care in their high quality, comprehensive, open access system threatened by increasing costs. Sangha, O et al. (2002) and Nelson & Gardner (1993), demonstrated using the AEP to identify inappropriate hospitalizations a valid solution to realize savings. Research links increased health care quality with decreased cost. The is a relationship between HAIs and the resulting increase in health care costs (Soria-Aledo et al. 2012). The assertion that inefficiency equates with additional costs was made by Hwang et al. (2011).

Kossovsky et al. 2002, (1998) also state that along with quality improvement, costs can be improved by eliminating care that is uneccessary. The implementation of quality improvement interventions can maintain care quality while assisting with cost containment as demonstrated by Kossovsky et al. (2002) study by comparing pre and post intervention data. Conversly, examination of the review system initiated by the US Government on 1974 by Goran, M J (1979) found that improved quality and utilization does not always equate to decreased costs. However the popular opinion was supported by the Soria-Aledo et al. (2009) study which demonstrated quantitiative cost savings as an example of a solution to the continued inequity of resources and increasing demand within health care, by managing inappropriate admissions with the practice of utilization review.

3.10 Conclusion

The quality interventions outlined above constitute some of the solutions that have been applied and studied in the acute care health setting to improve quality. While accomplishing this study some of these interventions have been identified as developing is concert with the implementation of the ECDS for determining appropriateness of acute care admission and continued stay in the study setting. Therefore this researcher has provided the results of previous research investigating the potential effect the interventions might have on healthcare quality and will subsequently further outline their application in the current research setting.

For the purpose of this study the state of the art UR quality intervention was confirmed in the research and frequently used quality indicators chosen for investigation of its impact on healthcare quality.

Three of the most commonly occurring adverse events associated with inappropriate and prolonged hospital stays are nosocomial or hospital acquired infections (HAI), unplanned readmissions within thirty days and inappropriate procedures or interventions (Fellin, G. et al., 1995). For the purposes of this study appropriateness of admission, lengths of stay (LOS) were chosen as quality indicators to determine the impact of the Interqual ECDS. In addition this study will compare the pre and post implementation readmission rate, and the incidence of Methicillin-resistant Staphlococcus aureus (MRSA) in the study setting.

4. State of the Art

4.1 Introduction

As stated by Tamames et al. (2007), "*To ensure the highest efficiency, health services should be provided with the least possible complexity*"**.** Norris (2002); Steen (2006) and Walker & Carayon (2009**)** attest that the complexity of modern healthcare delivery and the potential of information technology (IT) interventions to assist clinicians in providing quality care. In order to simplify care decisions UR electronic clinical decision support interventions have combined electronic health record patient data and appropriateness criteria with evidence based research findings (Horasani et al. 2003; Charles et al. 2005; Brinner & Downing 2009; Handel et al. 2011).

The efficiencies that merging IT and evidence based medicine healthcare guidelines provide have been explored in research. Martich et al. (2004) cite the efficiencies that include increased productivity and revenues that have been realised by financial industries by the application of IT. As stated other industries have been an example to the healthcare industry regarding the benefits realised from IT. The airline industry provides healthcare with a demonstration of how IT allows the access to clear, seamless, timely communication ensuring safety (Aspden et al. 2004). In the same year Aspden et al. (2004) relates that the IOM began to establish data standards that would form the basis for the collection and coding of patient safety data at the request of the U.S. Department of Health and Human Services. The establishment of standards for healthcare data was the basis for the necessary expansion of the field of healthcare Information technology (HIT) (Committee On Quality Of Healthcare In America Institute of Medicine 2001; Niland et al. 2006; Baron 2007).

Since the early days of establishing data standards health systems within developed countries have achieved a decrease in hospital admissions by up to 10% and length of stay has reduced decreasing inpatient bed days by up to 30% with the use of health information technology's electronic clinical decision support applications for UR (Buckle et al 2010). This supports the opinion that evidence based ECDS provides clinicians with tools to realize the goal of providing quality health care that is safe and cost effective according to Mitus, J. (2008). However a review of thirty-six studies by Sahota et al. 2011 researching the impact of ECDS

in acute care demonstrated more positive results in health care process outcomes instead of patient outcomes. The importance of improving healthcare with technology continues to result in initiatives to evaluate and implement the HIT interventions discovered to be adventageous (Department of Health and Children 2010; Singh et al. 2011; Peterson et al. 2011; Valerio & Ricciardi 2011; Hollin et al. 2012)

4.2 McKesson's Interqual and Milliman's Indicia Care Guidelines

Goran, M J (1979) noted that electronic health care audit systems like the Patient Care Evaluation System (PCES) were developed in the late 70s for quality improvement and revision of criteria and standards for hospital care review. These systems were the forerunners to the current ECDS systems that are currently state of the art. State of the art systems such as Milliman's Indicia Care Guidelines and McKesson's Interqual provide case guidelines that allow efficiency, increased collaboration and flexibility of IT integration, scalability and portability due to their availability as software and web-based applications (McKesson 2011; Milliman Care Guidelines (MCG) 2013).

The state of the art ECDS applications Milliman's Indicia Care Guidelines and McKesson's Interqual were developed to allow payers and providers to determine medical necessity using evidence based criteria. These applications are used by providers to determine the medical necessity for planned procedures or retrospectively to determine the medical necessity for admission claims prior to paying the provider. The provider also uses the same application to ensure the medical necessity of its admission and their need for continued stay in an acute care setting to prevent retrospective claim denials (Buckle et al 2010). These applications provide healthcare guidelines and are used to screen individual patients for appropriateness of the care provided and assist with clinical decision making (McKesson 2010).

There is limited amount of information available on the contents of Milliman's InterQual and Milliman's Indicia Care Guidelines in reviewed literature is due to their proprietary nature (Poulos & Eagar 2007). The tool that Mitus, J. (2008) is advocating in her article and has been evaluated in this study is Interqual which has been applied since its creation in 1978 to assist in determining hospital admission appropriateness. Poulos & Eagar (2007) note that Interqual has been most reported within research.

4.3 Interqual

Researchers have described the criteria that Interqual uses as standardized and non-diagnostic which is to be used for acute care appropriateness of admission and continued stay reviews, as well as preventing errors related to diagnosis (DeCoster et al. 1999; Poulos & Eagar 2007). Interqual criteria is evidenced based with the ability to be integrated into a facilities current IT applications, incorporate facility protocols, identify quality indicator compliance, and includes US and UK versions (Mitus J 2008; McKesson 2012). In addition to the aforementioned capabilities the criteria is accompanied by discharge reviews, transition plans, and a bibliography of clinical evidence (Poulos et al. 2011, Mckesson 2012). These benefits offered by the Interqual ECDS application are underpinned by continuous clinical development based on the evaluation and validation of current evidence based research (McKesson 2010-2013).

4.4 Conclusion

Interqual is the ECDS that is subject of this study. A review of the literature was performed on the Interqual ECDS intervention and the majority of the literature confirmed its positive validity (Nitin V P et al., 1990 and Inglis et al. 1995 and Kossovsky et al. 2002, 1998). Respecting the proprietary nature of the McKesson Interqual quality intervention this disseration only includes information that is readily available within published research, marketing materials and websites.

5. Context

5.1 Introduction

This chapter outlines the context within which this study was undertaken. The research performed highlighted that many countries continue to experience a need for acute care hospital beds that is greater than their supply (Shepperd et al. 2011; Health Service Executive (HSE) 2012). The shortage of inpatient hospital beds reduces the ability to provide safe, efficient, quality healthcare globally (Soria-Aledo et al. 2009). The current healthcare paradigm that is prevalent in Ireland supports that prevention of inappropriate admissions and extended stays; this will increase hospital capacity; throughput and the ability to provide higher quality care for additional patients while decreasing patient exposure to adverse events (Health Service Executive 2010; Paillé-Ricolleau et al. 2012).

5.2 Global Healthcare

The challenge of providing healthcare is a global issue. The economic changes within the past five years have affected all paradigms of healthcare delivery. Researchers Kossovsky et al. 2002 (1998) and Field & B. H. Gray (1989) claimed that there is not only a perception of, but evidence that much of the health care being provided is inappropriate and unnecessary. This is still a prevalent perception of the state of healthcare provision currently (Poulos et al. 2011; Hwang et al. 2011; Paillé-Ricolleau et al. 2012). This is due to the fact that the healthcare environment continues to have ever increasing costs and demand for inpatient beds as well as increasing complexity (Bennett, K et al., 2004). This is a global issue that has been appreciated and deliberated by the Irish healthcare system in their strategy for future service provision (HSE 2013).

5.3 Irish Healthcare

Ireland's healthcare is based on the Beveridge styled system in which the government funds and provides public care; and an additional private health system of private payers and private providers (Colombo, F. and N. Tapay, 2004). Complications are added to these coexisting systems due to the Irish government's role in monitoring and regulating as well as owning the largest private insurer in Ireland, making true health care provider competition virtually impossible (Colombo, F. and N. Tapay, 2004). These researchers continue on to

state that initially private health insurance was bought by those wishing to avoid waiting times for public care. In 2001 almost half of the Irish population had private health insurance (Colombo, F. and N. Tapay, 2004). With the economic downturn the ability of many in Ireland to pay for private insurance has diminished (Central Statistics Office (CSO) 2011).

Ireland is a member of the Organization for Economic Co-operation and Development (OECD) with 34 other countries worldwide which focus on colaboratively implementing programs and analyzing data geared towards global development (OECD, 2013). The OECD's healthcare quality indicators project was started in 2002 with a goal of allowing healthcare to be measured and compared globally (Arah et al. 2006). The OECD (2013) has also noted that in most of its participating countries health spending is rising faster than the Gross Domestic Product (GDP). The monetary investment is considered an indicator of the importance of healthcare within the individual countries. The following graphics represent expenditure on healthcare as percentage of the Ireland's GDP over the years (Table 1) and Irelands global position regarding healthcare spending (Figure 1) (OECD 2013).

Irelands Healthcare Spending	**1980**		**1990**		**2000**		**2010** **(or latest available year)**
Public Expenditure	6.75%		4.3%		4.6%		6.4%
Private Expenditure	1.5%		1.7%		1.5%		2.8%
Total	8.2%		6.0%		6.1%		9.2%

Table 1. Public and Private Healthcare spending as a Precentage of GDP 2010 (or latest available year) (OECD 2013)

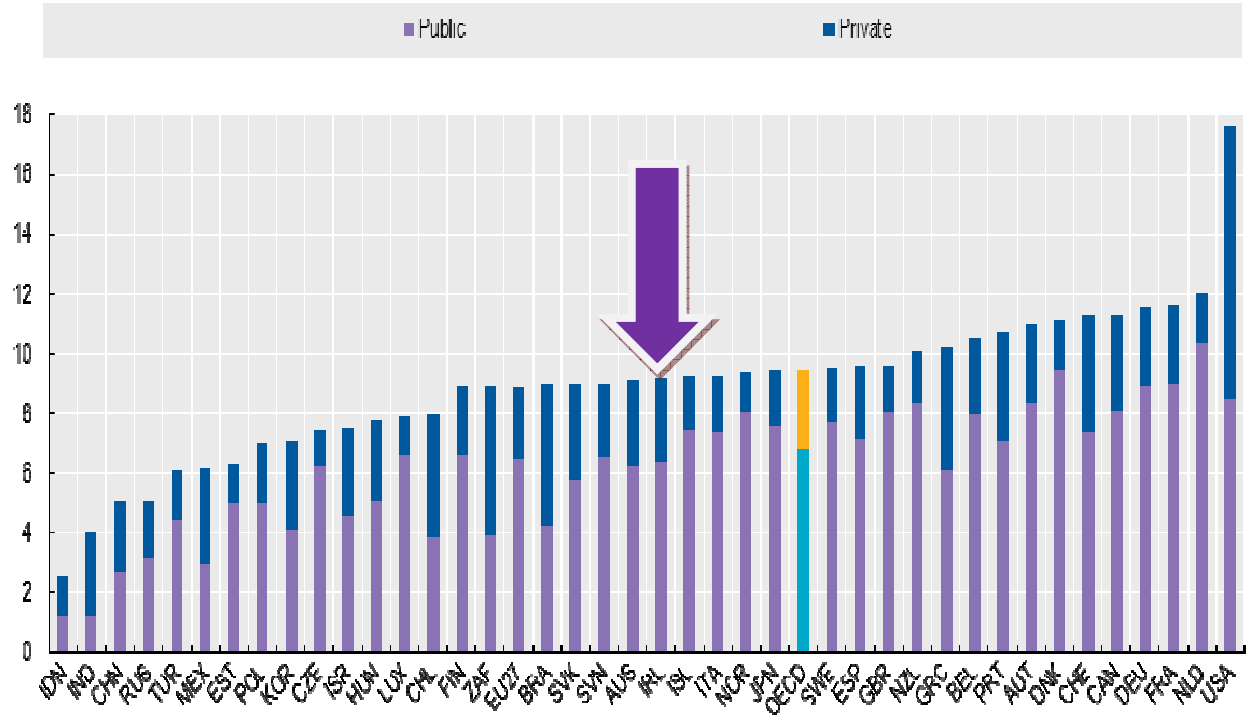

Figure 1. Comparison Irelands Global Position Regarding Healthcare Spending
(OECD Factbook 2013)

5.3.1 Ireland's Healthcare Facts

- Ireland is slightly above average as regards to healthcare spending.
- The global recession in 2007 caused a decline in GDP while health spending continued to increase until 2010 due to governmental budget deficits.
- Public funding of healthcare decreased in 2010 but it remains the main funding as in all OECD countries.
- Ireland meets the OECD average for the number of doctors while they are above average in nursing professionals.
- There are significantly less acute hospital beds in Ireland that in other OECD countries.
- Life expectancy in Ireland is higher than the OECD average.
- Ireland has had a decrease in smokers like all OECD countries but still has the highest alcohol consumption.
- Obesity is still an increasing problem in Ireland, potentially creating higher future healthcare costs.(OECD Health Data 2012).

Within Ireland the Central Statistics Office (CSO) conducted a Health Quality National Household Survey in 2010 which now includes a June 2012 update regarding health insurance coverage. The portion of the Irish population that have private health insurance cover has decreased from the 50% that was reported in 2009 by (Mcdaid et al. 2009). Figure 2.

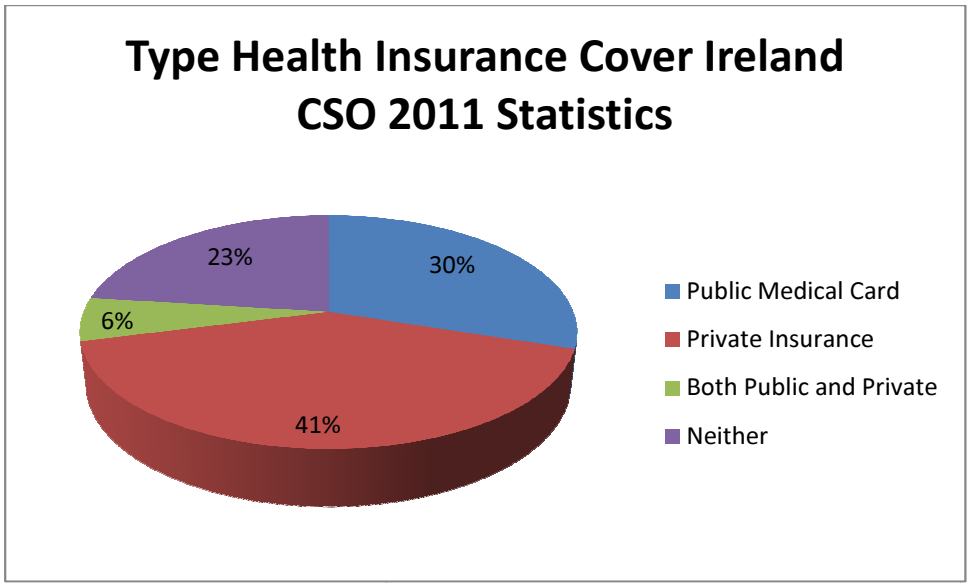

Figure 2. Type of Health Cover (CSO 2011)

5.3.2 Irish Healthcare Monitoring

A considerable amount of data is collected and reports compiled monitoring Ireland's healthcare activity. A review of the reports generated has revealed recurrent concerns, suggested solutions and promising proposals. In keeping with the research conducted and presented in this document the review of the reports will focus on acute inpatient admission appropriateness, length of stay (LOS), readmission and hospital acquired infection (HAI) data.

Since 1990 the electronic Hospital In-Patient Enquiry (HIPE) system maintained by the Economic and Social Research Institute (ERSI) has reported to the Health Service Executive (HSE) and the Department of Health and Children (DOHC) on a monthly basis. This data includes statistics covering the utilization of healthcare inpatient and outpatient services and is used to analyse current health service provision, plan for health care policies and service improvements (Economic and Social Research Institute 2010). The most recent HIPE data for

2011 showed an average acute care hospital inpatient length of stay of 5.8 which is an improvement of -2.5% from 2010. According to the CSO Inpatient beds available in public acute care have decreased from 11,369 in 2009 to 10,990 in 2010 (CSO 2012). The CSO also noted the average acute inpatient length of stay for 2010 to be 6.1 days. Irelands HSE in collaboration with other health and social care agencies continue to use the available data to plan quality improvements (HSE 2008- 2013).

5.3.3 Irish Healthcare Service Delivery Strategy

The HSE enlisted the PA Consulting Group to review Ireland's health services with a view up to the year 2020. A review was conducted which included Irish and international health experts along with as many stakeholders as possible. The review resulted in the Acute Hospital Bed Capacity Review of 2007 which focused on the current use of Irelands acute care beds and consequences thereof as well as forecasting future challenges and suggesting forward thinking solutions.

Observations regarding the health service in 2007 included:

- Many patients are inappropriately admitted
- Elective patients are admitted days before their procedures
- Irish acute care LOS is excessive
- Many acute beds are taken by patients waiting for diagnostics or results or a bed in a non-acute setting

Recommendations for service provision and improvement included:

- Developing an Integrated Health System balancing outpatient, acute, and community care provision
- Inpatient LOS reduction, provision of care in clinically appropriate alternate setting
- Increased outpatient and community care
- Increased discharge planning
- Elective admissions on the day of procedure (HSE 2008-2013).

To assist in advancing these quality improvement interventions in Irelands' public healthcare system the HSE will liaise with the DOH and HIQA to form a Patient Safety Authority (HSE

2012). Within the HSEs 2012 National Service Plan a structured programme of clinical audits was identified as a measurement tool that will be implemented to support their Quality and Patient Safety plan (HSE 2013).

Ireland's practice of allocating a certain number of beds in acute care public hospitals for the use of private patients also complicates the public/private balance (OECD 2012). The idiosyncrasies that exist within Ireland's health care system have been noted to be caused by competing stakeholders within the public and private systems. The largest private insurance provider is state owned creating role confusion because everyone who resides in the country is a stake holder in at least one way (Buckle et al 2010). The government has to cater for the interests of all residents regardless of them having private or public health insurance; the subscribers, all health care providers, users of the public health system, the private system users, the nation's government (Buckle et al 2010). Many consultants practice in both the public and private system. The reliance of all stakeholders on strained public primary care system also provides challenges according to Buckle et al 2010. The movement towards a fully integrated health care system that provides care in the correct setting has been recommended as the best solution for Ireland's healthcare system (HSE 2013).

The application of appropriateness of inpatient admission and continued stay criteria has been forecasted as a requirement for improved healthcare quality in Ireland. (Heath Service Executive PA Consulting Group 2007;Collins & Joyce 2008; Hogan et al. 2011). The importance of improving Ireland's healthcare quality and resource utilization will become increasingly important as current economic constraints make it increasingly difficult for people to afford private health insurance and make greater sacrifices to maintain their policies (Curtis & Macminn 2008). This development causes increased utilization of both the public and private Irish healthcare sectors. In 2012 Ireland's Economic and Social Research Institute (ERSI) reports that 83% of the patients in Irish public hospitals in 2011 were treated as public patients and 17.2% were treated as public patients.

Since the commencement of this study the HSE has amended its public hospital acute care bed allocation in order to allow 100% of these beds to be available to private patients in an

attempt to increase revenues (HSE 2013). The previous service plans allocated only 20% for private patient use. The HSE National Service Plan 2013 projects their largest revenue increase of 60 million Euros to come from the increased billing of private patients (HSE 2013). The Irish Medical Organisation concurs with this new policy regarding the management of private patients in the public healthcare system (Irish Medical Organisation 2013). This change is one of many that are being implemented by the HSE to ensure they are able to meet their obligations of increased healthcare quality and efficiency in an environment of changes in society and demographics which raise demands and expectations for new technologies while driving increased costs (HSE 2013).

5.4 UPMC Beacon Hospital

University of Pittsburgh Medical Center (UPMC) Beacon Hospital is an independent acute care hospital with Joint Commission International accreditation in South Dublin which opened in 2006. The hospital comprises of 142 inpatient beds 16 of which are in the intensive care unit. The hospital provides consultant led diagnostics, care and treatment in specialties ranging from cardiology, emergency, gastroenterology, general medicine and specialist surgery. Care is provided in inpatient and outpatient settings (UPMC Beacon Hospital 2012). The mission of UPMC Beacon Hospital is a healthcare environment based on the pillars of quality, respect, caring and compassion (UPMC Beacon Hospital 2012).

5.4.1 Information Technology

Clinical and ancillary processes are supported by UPMC Beacon Hospital's Information Services Department. To support clinical services all patients who attend the hospital for diagnostics care and or treatments have an electronic health record (EHR) created upon registration. For Emergency Department (ED) patients the Interqual ECDS receives patient identification data from the EHR and on admission there is shell of an admission review auto created for completion within twenty-four hours. The use of ECDS provides additional efficiencies to be realised in the hospitals UM quality interventions by providing automatic referrals to the Care Coordinator from nursing triage and admission assessments. This ability to provide proactive identification of patients that require additional resources in tandem with the determination of appropriateness of healthcare setting allows patients to safely progress

along the care continuum. Safe appropriate patient flow supported by the UM processes outlined in the State of the Art chapter prevent overutilization of acute care resources and supports improvement of indicators of a hospitals healthcare quality (C. Poulos et al. 2011; Talib et al. 2011).

5.5 Patient Safety, Quality and Innovation

The provision of health services according to UPMC Beacon Hospital's mission requires implementation, monitoring, and measurement of the quality of services provided. The implementation of any quality improvement intervention is an iterative process requiring continuous reassessment, readjustment, ethical and validity testing (The Health Foundation 2012).

UPMC Beacon's Patient Safety Quality and Innovation (PSQI) department's brief definition of quality is "*care and services which are safe, effective, efficient, patient-centered, timely and equitable*" (Taguinod, F., 2011). The PSQI Department leads and participates in quality indicator initiation and monitoring activities related to but not limited to;

- Quality Improvement Committee Leadership
- Patient Safety Committee Leadership
- Healthcare Quality Data Collection and Dissemination
    - Length of Stay
    - Readmission Rate
    - Mortality Rate
    - HAI Rate
- Joint Commission International Accreditation
- Incident Investigation utilizing with Case Reviews, Root Cause Analysis etc.
- Culture of Patient Safety Surveys and the resulting Quality Improvements
- Clinical Auditing
    - Surgical Care Improvement Project (SCIP)
    - Venous Thromboembolism Prevention Project (VTE)
- Patient Satisfaction Monitoring
- Risk Management
- Complaint and Compliment Management

- Physician Credentialing
- Policy and Procedure Development

5.5.1 Additional Quality Indicators

Additional quality indicators are derived from the activities of the Infection Prevention and Control Department (IPC) in concert with the PSQI Department by providing guidance, policies and procedures, surveillance and audits aimed and the prevention of HAIs. The Utilization Management Department which encompasses the UR/Interqual Project and the Care Co-ordination Department are also within the the PSQI Department as of 2012.

5.5.2 Utilization Management Pre-Interqual Pilot

Prior to 2012 the UM processes at UPMC Beacon Hospital were managed without ECDS. A Patient Pathway/Discharge Planning Nurse provided retrospective reviews for acute care inpatient criteria upon receipt of queries for the private health insurance payers. This was a paper based process that included retrospective reviews of the patients' clinical information contained in paper and electronic health records. This nurse was also responsible for leading the development and coordination of discharge planning processes; providing guidance for routine needs and executing plans for more complex patient discharge needs. Meetings were held to ensure a multi-disciplinary approach to discharge planning was practiced. The most common method of dissemination of information regarding a patient's status was the bi-weekly multi-disciplinary team (MDT) meetings. There was also a Patient Pathway meeting held at the beginning of each week with MDT members and inpatient managers to ensure that inpatients had a valid discharge plan in place.

5.5.3 Current Utilization Management Process

The UM process at UPMC Beacon Hospital has evolved to encompass the Interqual project and enhance quality by ensuring care is provided in the correct setting promoting efficiency and the avoidance of adverse events as advocated by DeCoster et al. (1997), (1999). In 2011 the change in the economic and healthcare climates in Ireland prompted the largest private health insurance provider Voluntary Health Insurance (VHI) to implement a utilization review pilot project with UPMC Beacon Hospital (Buckle et al 2010). This pilot project provided a platform to evaluate the application of an ECDS for utilization review within the

private sector of Ireland's healthcare system. The purpose of the ECDS is determining the appropriateness of admission and acute care continued stay in the acute care hospital setting (Buckle 2010, McKesson 201-2013). This process is represented in Figure 3. The VHI chose McKesson's Interqual UK version to accomplish this goal. The details of the UR process are provided in the subsequent sections of this dissertation and Figure 4.

The main role of UM is utilizing the acute care appropriateness status derived from UR to proactively coordinate patients care leading to a safe transition through the acute care setting and across the healthcare continuum from acute to non-acute settings. According to Kossovsky et al. (2002) and Soria-Aledo et al., (2012), this requires a multidisciplinary case management approach to quality interventions enabling hospital discharge efficiency. The Aging Well Network (2011) also encourages increased efficiency and earlier hospital discharge preparation coordinated with community health care to prevent inappropriate hospital stays due to discharge delays. Implementing proactive multidisciplinary coordination begins with sharing the patient's acute care status information with the clinicians and allied health professionals involved in the patients care as well as the patient and their family. The main forums for sharing this information at UPMC Beacon Hospital are the Family Meetings, Patient Pathway and Multi-Disciplinary Meetings.

The evolving UM process included the development of the patient centred collaborative Family Meeting process which allows patients and family members to make their needs known and have expectations set according to a patient's holistic needs. This allows patients and their families in conjunction with the admitting consultant; Care Coordinator, nurses and allied health professionals inclusion within a collaborative Family Meeting process as required. This evolution also included the expansion of the Patient Pathway/Discharge Planning Nurses role to encompass earlier engagement with patients and their family to assess on-going needs; set expectations; proactively plan for a safe discharge; and provide closer collaboration with community non-acute care resources. This revised role is appropriately called Care Coordinator in contrast to Patient Pathway/Discharge Planning Nurse as it fits the emerging paradigm of integrated healthcare across the continuum that has been touted by Buckle et al. (2011); Silow-Carroll et al. (2012); Cornett (2012); and The World Health Orgainzation (2012).

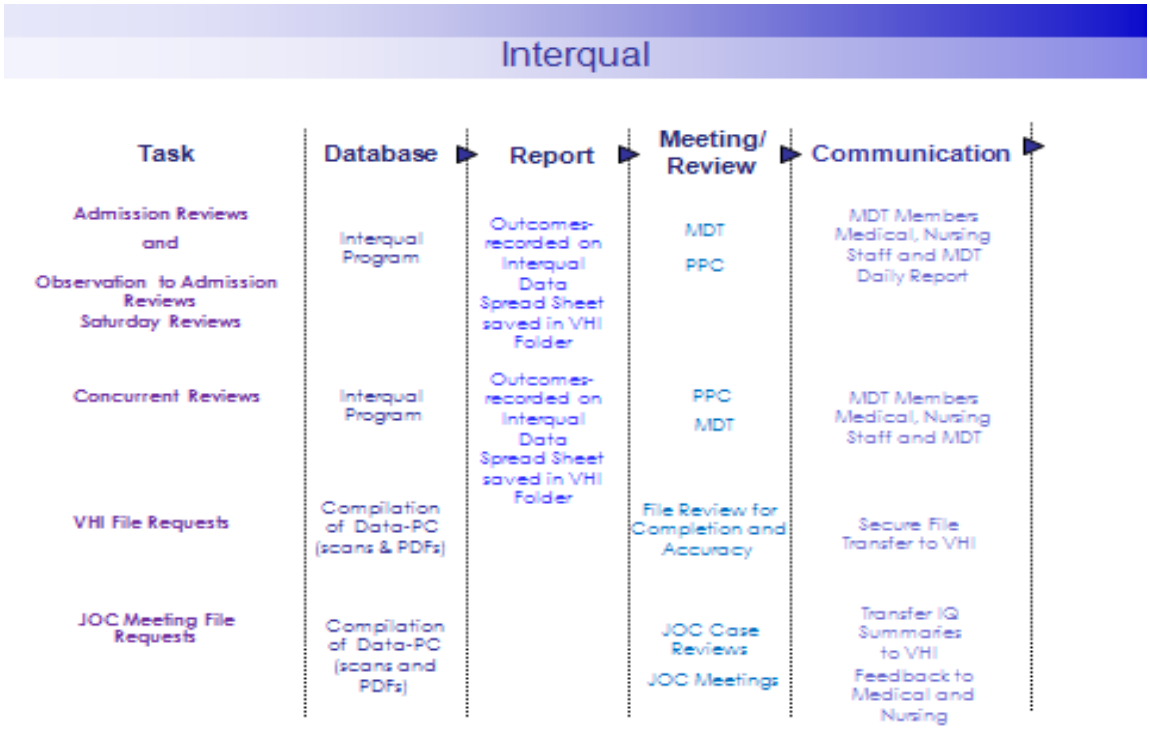

Figure 3. UPMC Beacon Hospital Utilization Management Process

5.5.4 Utilization Review /Interqual Pilot

Upon completing an actuarial review of the leading Irish private health insurer VHI; Buckle et al (2010) noted that UR would be of benefit to determine medical necessity of acute care admissions. They demonstrated that UR would initially increase costs due to administrative requirements but ultimately improve quality and reduce costs (Buckle et al 2010). VHI and UPMC Beacon Hospital agreed to collaborate in implementing the first UR program in Ireland to utilize an ECDS quality intervention.

The use of the Interqual ECDS required process and workflow innovations due to the fact that patient medical records are stored within an EHR and a paper chart, which is the case with many modern healthcare providers (Nelson & Gardner 1993). A utilization review program was developed for the UPMC Beacon Hospital and Voluntary Health Insurance (VHI) Interqual Pilot. The process outlined within Interqual's Guide to Completing a Review is used by an appropriately trained registered nurse to complete reviews of the patients' clinical information contained in paper and electronic health records. All patients admitted through the Beacon Emergency Department (ED) were included in the UR process. This was

not a requirement of the programme with VHI; but was determined at the time to be the fair and equitable approach to implementing an overall UM program to support the Interqual Pilot. Patients admitted regardless of diagnosis and admitting consultant's service have their clinical information reviewed to ascertain the presence of Interqual criteria for acute inpatient care. Clinical information considered included; General Practitioner (GP) letters; emergency department triage and nursing assessments and notes; emergency consultant assessment and orders and notes; diagnostic results; and admission orders. Patients were categorized according to the outcome of their Interqual review into one of four categories and managed according to the workflow noted in Figure 4 below.

1. Observation- Patient with the onset of symptoms within twenty-four hours prior to presenting in the ED. The symptoms meet the Interqual Observation criteria and require observation for exacerbations or resolution and or additional diagnostics within the following twenty-four hours. The patient is again reviewed following the observation period to determine if they require an admission to inpatient status or discharge home.

2. Inpatient- Patient with the onset or exacerbation of symptoms within the twenty-four hours or week prior to presentation that require an acute inpatient admission and meets the body system specific Interqual criteria. The level of care bed required is also determined by the severity of symptoms. The patient is assigned an acute, intermediate or critical care status. The patient is reviewed within the next three days to one week and if/when they are transferred to a lower level of care by a clinician.

3. Medical Necessity- Patients with symptoms and or diagnostic results documented that do not meet Interqual criteria but they have significant symptoms or significantly abnormal results. These patients require clear documentation of the medical necessity for acute inpatient admission and plan of care by the Emergency Department consultant on admission and admitting consultants throughout their stay. The patient is again reviewed following the first twenty-four to forty-eight hours to determine if they require an admission to acute inpatient status or discharge home.

4. Criteria Not Met for Inpatient Admission- Patients without significant diagnostic results or symptoms or those with symptoms resolved during their ED care; or the onset of complaint without significant exacerbation is greater than one week prior to presentation in the ED.
   (McKesson 2010).

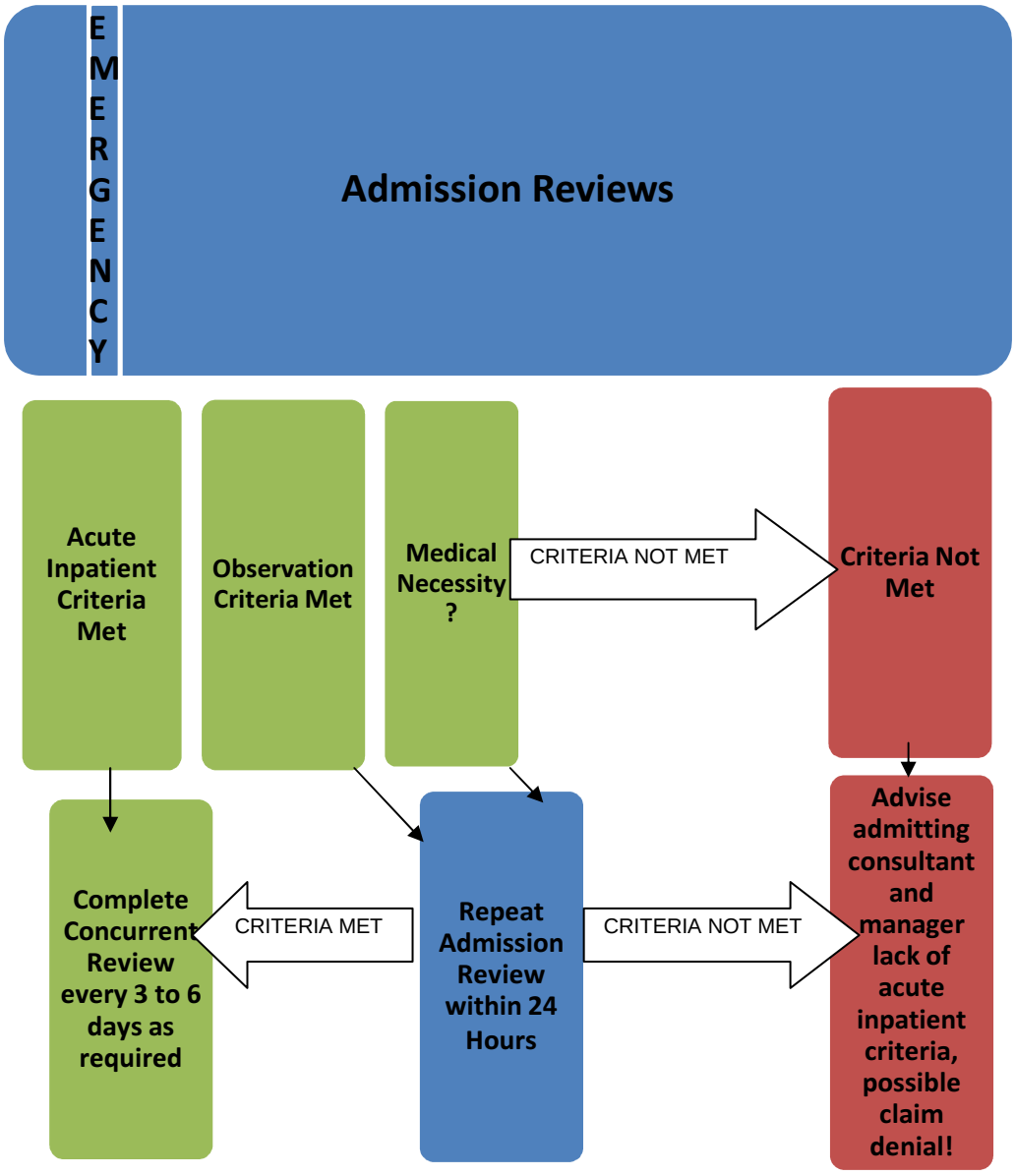

Figure 4. UPMC Beacon Hospital Interqual UR Workflow

5.5.5 Interqual Oversight/Inter-rater Reliability

To ensure the Interqual Project would result in data geared towards an improved utilization of acute care services and a collaborative understanding of its application and outcomes a Joint Oversight Committee of VHI and UPMC Beacon participants was formed to evaluate and discuss a sample of reviews outcomes on a regular basis. This provides the IRR necessary to secure validity for the decisions of appropriateness of acute care admission and continued stay. The components of the UM process are presented in Table 3 and the following section illustrates the dissemination of the agreed upon acute care criteria among healthcare providers within the research setting.

5.5.6 Physician Involvement

As documented in the workflow above (Figure 4.) patients which are identified that have not met criteria for acute admission or continued stay within the acute hospital setting the consultants and nurse managers involved in their care are advised. Consultants rarely attend the routine meetings and therefore the Utilization Manager discusses the cases personally with each consultant or if necessary will schedule a patient specific MDT meeting including the attending consultant. The information provided to the consultant regarding the lack of Interqual acute criteria signals that the patients can probably be provided care in a non-acute hospital setting. The information also signifies that there is a possibility the claim for services provided to the patient can be denied by their health insurance provider. Consultants are always reminded that the decision is theirs and that it is best for them to ensure they document medical necessity and a plan of care requiring inpatient acute care daily for the patient.

5.6 Researchers Motivations

As the Clinical Lead who assisted with designing and implementing the UM and Interqual UR Pilot, it will be beneficial going forward to ascertain the genuine impact of the Interqual ECDS quality intervention. The ability to study the impact of the intervention provides opportunities for reflection. Planning for future applications of the data generated while using the electronic decision support intervention is also possible. The resulting data could provide clues as to amendments in current practice that could improve the quality of the healthcare

provided in the future. The possibility of these findings allowing for the improvement of ECDS for the determination of admission appropriateness and continued stay is also possible.

5.6.1 Background of Researcher

The researcher's professional experience includes both clinical and administrative responsibilities within healthcare settings across the continuum in the US and Ireland. Health IT and CDS especially for the determination of appropriateness of care to improve quality and efficiency and reduce costs is a very familiar quality intervention for this researcher.

5.7 Confounding Factors

In preparing for this research additional factors that changed within the research setting between the years 2010 and 2012 were considered. Kossovsky et al. (2002) identified and documented pre study trends that could possibly affect their results. Following this example an analysis of the UPMC Beacon Hospital ED admission data for 2010 and 2012 exhibited changes in the research setting. These were changes in patient age, and the increase in patient presentations. Considering these confounding factors prompted the use of a single sample measured pre and post quality intervention implementation as recommended by Hazard Munro 2001.

5.7.1 Patient Age

Advanced patient age has been linked to increased length of stay and is often linked to multiple co-morbidities and additional social issues according to McMullan R, et al., (2004); Tamames et al. (2007). Canadian researchers also cite the increasing elderly population and cuts in health care budgets as challenges (DeCoster et al. 1997). Poulos & Eagar (2007) research of international UR studies found approximately 55% of the patients that were determined to be inappropriately treated in acute care were age 75 years or older. Another Canadian study on behalf of the government by Curtis & Macminn (2008) found that the middle-aged were the lease likely to utilize acute care. Figure 5 demonstrates a decrease in mean age of the patients attending UPMC Beacon Hospitals ED in 2012. The percentage of patients over the age of 75 also decreased by 7% in 2012 compared to 2010.

5.7.2 Increased Patient Presentations

The number of ED admissions was also noted to have increased. As the patronage of UPMC Beacon Hospital increased there has been a anticpated increase in ED admissions. Comparison of the ED admission data from the subject years showed an increase of 3786 days which represents a 10.428% increase from 2010 to 2012 as illustrated in Figures 5 and 6.

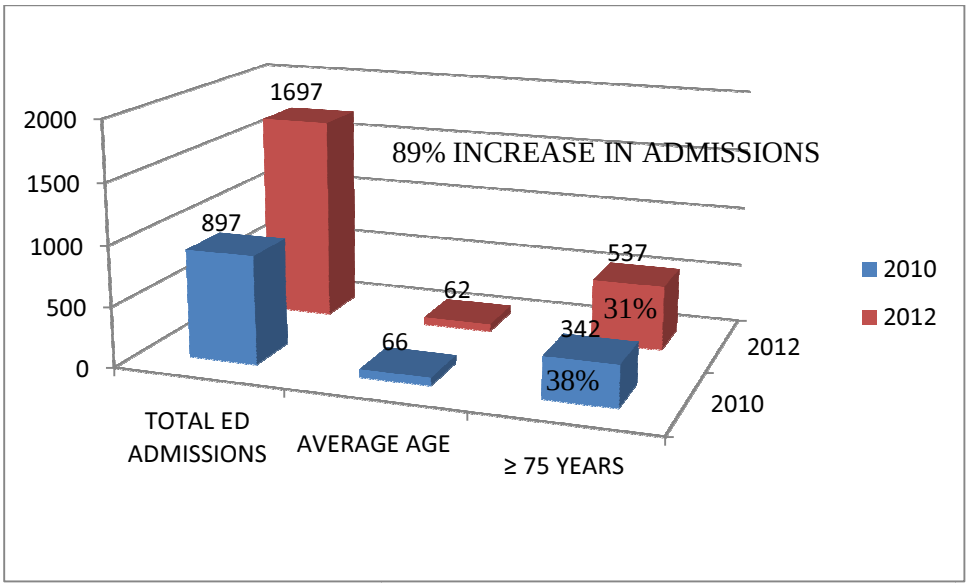

Figure 5. UPMC Beacon Hospital ED Admissions differences in number of presentations; average age and percentage of patients over the age of 75 years 2010 vs. 2012

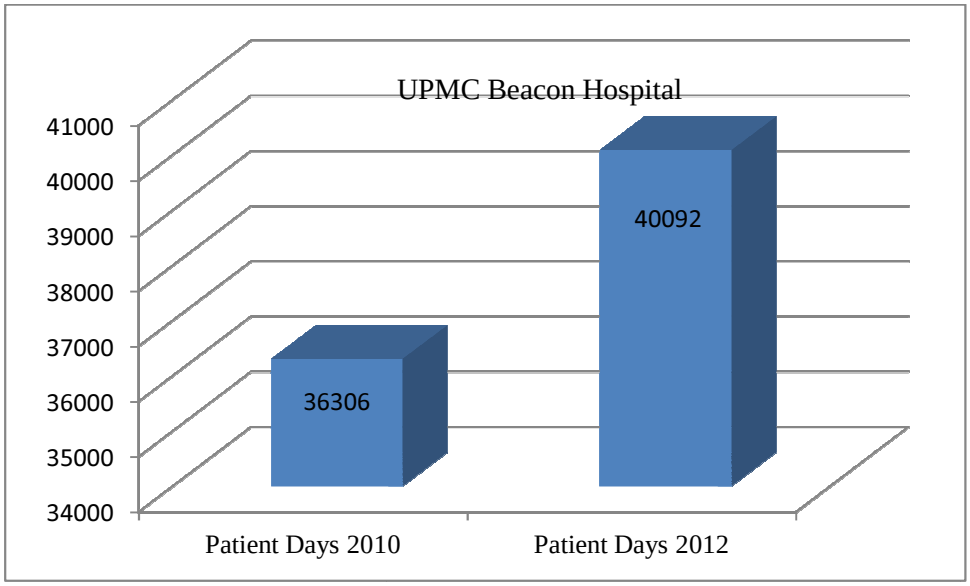

Figure 6. Comparison of Inpatient Days 2010 vs. 2012

5.8 Inter-rater Reliability

In order to address the importance of inter-rater reliability that Wellens et al.(2012) identified; variation due to reviewer subjectivity is mitigated in the setting of this research because the UPMC Beacon Hospital UR reviewers consist of two nurses; and the lead nurse provides training and updates for the review nurse. The initial training for the lead nurse prior to the commencement of the Interqual Pilot and ongoing support are provided by McKesson. Interqual has also addressed the need to understand and decrease variations among reviewers by providing the ability to measure the consistency and accuracy of each reviewer by using its IRR suite in conjunction with training and education including a train the trainer program (McKesson 2013). The Interqual IRR capability is not being availed of in this study setting due to the small set of reviewers required to satisfy the hospitals UR requirements. The training and support provided by McKesson has also been availed of by the health insurer VHI's reviewers. In order to ensure that both the hospital and health insurer reviewers maintain the same interpretation of patient review data and the application of Interqual criteria over time; a Joint Oversight Committee (JOC) was formed. The JOC consists of administrators and lead reviewers from both organizations. The JOC meets routinely to discuss a sample of recent reviews and agree upon the applicability of the Interqual's UK criteria version to Irish patients.

5.9 Conclusion

The setting of this research is unique in the sense that this is the first time that a quality intervention involving ECDS for this purpose will be used within a private Irish acute care facility. The global and national contexts with regards to the challenges of providing safe quality healthcare are longstanding (IOM 1999; Health Foundation 2012). The context outlined above affords an understanding of some of the pros and cons of the research setting.

6. Research Design and Methods

6.1 Introduction

This chapter will provide the rationale for the research methodology and approach utilized to answer the research question. Justification of the quantitative method selected will be provided. The data selection inclusion and exclusion criteria will also be outlined. Data categorization and analysis methods will be outlined and explained as well. Finally the information on the limitations that were identified and taken into consideration when interpreting the research findings will be stated. This section begins with a review of the methods used by other researchers evaluating the impact of a quality intervention.

An example of a study evaluating the impact of a quality improvement interventions by Kossovsky, M.P. et al., (2002) presented a cross sectional measure of inappropriate hospitalizations.using the AEP UR tool. The researchers then held interviews with clinicians and performed qualitative and quantitative analysis of 14 key proccesses were identified. as well as inefficiencies. Interventions were then identified and appled by the group. The AEP was used again to determine the level of appropriateness, A sample size of 500 cases was used for pre and post analysis. To try to maintain study valididty Kossovsky, M.P. et al., (2002) used inter-observer reliability as a check on a sub sample used logistic regression models to account for differences in patient demographics and hospital stay.. The Kossovsky group noted the limits of their study design and identified trends prior to the study taking place that could have affected their outcomes.

Moya-Ruiz et al., (2002) also performed a study to evaluate the impact of implemeting a UR tool and used non equivalent groups, a control and and intervention group. Moya-Ruiz et al., (2002) declared their design to be "*a quasi-experimental pre-test/post-test with non-equivqlent control group*" and noted their limitations due to the non-comparability of their groups. They went on to state that the contact between the groups could cause contamination of their results as well as the Hawthorne effect. This method was also employed by Anton, P et al., (2007).while studying physician feedback. The statistical analysis of the hospital days was performed using and x-test or the Fisher's exact test as applicable (Anton, P et al., 2007). Unlike the Moya-Ruiz group the Anton et al researchers felt that the possibility of

contamination was remote. The Anton group felt their limitations were caused by their choice of the AEP utilization review tool.

6.2 Ethics

Ethics approval was requested on December 13th 2012 and approval was received from UPMC Beacon Hospital Ethics Committee on March 7th 2013 after the submission of a research proposal which outlined the purpose of the study; provided a literature review and stated the gap identified in the literature. Only retrospective quantitative data was used by this researcher to prevent the necessity of performing interviews and surveys involving patients and care givers. The possibility that this researcher's position as Clinical Lead for the Interqual Pilot; Quality Coordinator; Care Coordination and Utilization Manager could influence qualitative data results was clearly recognized by this researcher. The data that has been used for this dissertation is routinely accessible by this researcher within her professional role.

This researcher ensured conducting research ethically included being mindful of maintaining non-disclosure of the intellectual property and proprietary information of the UPMC Beacon Hospital, McKesson Interqual's software licence holder, and VHI. This research was conducted by utilizing published data. All information included in the dissertation has been referenced appropriately. In particular any data and literature regarding VHI, McKesson, and Milliman products or services were obtained from sources such as the database publications, marketing websites and the internet.

6.3 Research Method

Quantitative research methods were chosen for this research question ascertaining the impact of the Interqual electronic decision support for acute care admission appropriateness and continued stay on healthcare quality in a private healthcare facility. This method was chosen to eliminate bias within this research study due to the subject matter, the researcher's relationship to the subject and the research setting. Creswell (2003) defines quantitative research as a study design that "*provides us with numeric descriptions of trends, attitudes or opinions of a population by studying a sample of that population*". He goes on to state that

from quantitative data we can ascertain results from a sample and then generalise these results to the population the sample was obtained from (Creswell 2003). This ability to make inferences about a larger population assisted in enabling this research to be completed in the time allotted and situations that could present ethical issues to be avoided by this researcher. Creswell 2003 also described quantitative research as a postpositivist approach; meaning numeric data is used to represent observations of behaviour that have taken place which enables researchers to study problems.

6.3.1 Postpositivism

The postpositive approach looks at possible causes and their effects. This method looks at possibilities as the only way to verify the theory that is not absolute truth. Because considering possibilities does allow us to prove a hypothesis; we can only say that we are able to reject the null hypothesis if our hypothesis is proven (Creswell 2003). The researchers' reliance on possibilities is considered a claim to have knowledge of the possible outcome (Creswell 2003). The approach makes allowance for the unpredictability of human behaviour. The postpositive approach is used in this study to present numerical data that represents observations of behaviour.

6.4 Quality Indicators

The quality improvement interventions analysed in the study were limited to those noted to be most frequently measured globally. For the purposes of this study; appropriateness of admission; length of stay (LOS); readmission rate, as well of the incidence of a common Hospital Acquired Infection (HAI) were chosen as quality indicators. This focus provides the ability to define, analyze, and describe the implementation and impact of the Interqual ECDS intervention in clear and concise manner within the scale and scope of the dissertation undertaken. Evaluation of quality improvement interventions begins with practical data collection methods; a clearly determined population; and defined quality indicators (The Health Foundation 2012).

6.5 Data Collection

Data collection requires that the data is prepared and analyzed appropriately to validate that it will provide statistically significantly results (Hazard Munro 2001). The decision on how data

is to be collected organised and analysed depends on the type of variable we are studying and the scale that we used to measure the variable (Hazard Munro 2001) For the purpose of this study we used ordinal scales for our variables of appropriateness of the admission and category of complaint (Hazard Munro 2001). A ratio scale is used for the variable representing length of stay due to the fact that it is a precise level of measurement as they are measured in days (Munro 2001).

6.5.1 Population

The population studied consisted of all inpatients admitted through the emergency department of UPMC Beacon Hospital during the years 2010 and 2012 for the analysis of appropriateness of admission and LOS. All inpatients admitted during the years of 2010 and 2012 were included in compiling the routinely reported PSQI Department data that has been included in this dissertation.

In order to prepare our population for selection of a representative sample the data collection process began with generating reports from the electronic health record with all ED admissions for the year 2010 and 2012. The data in these reports included the patient's name, admission and discharge dates, visit number, and name and specialty of the admitting consultant. The total 2010 ED admissions were 897; and 1697 in 2012. To identify the patients that were admitted in both years these reports were merged into one spread sheet using Microsoft Excel's V Lookup function. The 92 patients who were admitted in both years were filtered out of the population data. The electronic health records of these 92 remaining patients were reviewed to ensure they were the identical patient admitted in both years and that they were admitted into the same medical category. Patient that were identified as not matching identity or admission category were eliminated leaving 31 patients for the sample. Admission reviews were then completed for the 2010 admissions of the sample patients.

Inclusion criteria for the population;

1. ED admissions from January 1st 2010 to December 31st 2010
2. ED admissions from January 1st 2012 to December 31st 2012
3. Patients with all payer sources from self-pay to private insurance
4. Observation Admissions of 24 to 48 hours or less
5. Inpatient Admissions

6.5.2 Sample

To ascertain the level of admission appropriateness a sample of the population from the year 2010 prior to and 2012 post the implementation of the Interqual ECDS was chosen and compared. The sample consisted of one each of 2010 and 2012 admissions of the same patients paired by similar complaint. Limiting variations to a minimum was accomplished by this paired research design that selected the same patient for review pre and post application of the ECDS within the setting.

Inclusion criteria for the sample;

1. Patients with admissions in 2010 who were readmitted in 2012 with a complaint in the same category medical category.

Exclusion criteria for the sample;

1. Patients with chronic end stage disease history and multiple co-morbidities.

A paired sample of the same patients with admissions in both years was used to avoid the variation that would be introduced by using different patients with similar age sex and history as well as complaint category. Only one patient was excluded due to chronic disease and multiple co morbidity history. Pallant (2007) confirms this method of using data from the same sample on two different occasions which can be analysed to determine the existence of a significant difference between the occasions.

To further ascertain the organizational impact the data that is routinely collected by UPMC Beacon's PSQI department will also be used to analyse the overall impact of the implementation of the Interqual ECDS and the supporting quality improvement interventions.

6.6 Data Validity

In general researching the overall validity of CDS for UR a Canadian study assessed the validity of three popular utilization review tools; Intensity of Service, Severity of Illness, Discharge Screens (ISD), Appropriateness Evaluation Protocol (AEP), and Managed Care Appropriateness Protocol (MCAP) and found them all to be of low validity (Kalant et al. 2000). In response to the Kalant et al., study; five letters with the opposite opinion were published in the Canadian Medical Association Journal (CMAJ).The letters upheld the

importance of utilization review tools for improving health care as they pointed out the limited sample size, use of outdated criteria and other inappropriate study methodology used by Kalant et al.(2000); Dodek P et al. (2000); Mariotto A, (2000); Robens-Paradise Y et al.; (2000); Kalant. et al(2000); Zitner D et al. (2000). Previous research by Nitin V P et al.; (1990) and Inglis et al. (1995) and Kossovsky et al. 2002, (1998) also demonstrated positive validity of these tools.

Conversly the researchers found a US study conducted in 1990 that asserted that a review that resulted in a determination of inappropriate utilization requires a physicians opinion because Interqual is only moderately relliable and valid depending on appropriate updates according to current clinical practice (Poulos & Eagar 2007). In their comprehensive review of multiple international studies Poulos & Eagar (2007) and The New Zealand Health Technology Clearing House's (1998) reported that the validity of Interqual criteria diminishes outside of the US due to a lack of healthcare contiuum and differences in clinical care and terminology.

Australian researchers Poulos & Eagar (2007) note that Interqual has been researched and utilized frequently and globally as well as being externally validated. They have also cited the frequent criteria updates that reflect evidenced based practice used by Interqual to maintain validity. Poulos & Eagar (2007) also note that Interqual is broadly accepted by clinicians. The NHS found this broad acceptance to be true only if the appropriate supports including a full range of non acute care was available across the continuum (Poulos & Eagar 2007). They then remind us that validity will vary according to facility processes and the availablity of a alternate care settings along the continuum.

These questions of sample data validity were addressed within this study by taking into account the provisions of UR iterrater reliabillity included in the Interqual Pilot. The validity of the data generated within UPMC Beacon Hospital is also governed and ensured by the organization wide Data Validation policy.

6.7 Variables

Hazard Munro (2001) describes variables as a characteristic that measured according to rules and assigned a numerical value; and are different for each event person or object. The

dependent variables considered in this study are length of stay and admission appropriateness.

6.8 Analysis

Quantitative methods were utilized to examine the length of stay and appropriateness of admission corresponding to the sample patients chosen (Creswell 2003). A paired sample t test has been employed to calculate the difference of the mean scores for the sample from the year before the implementation Interqual ECDS to the year after implementation. The t test was designed to test the difference between two groups (Hazard Munro 2001). The pairing of admissions of the same patient will assist in eliminating variations in the sample patients chosen (Creswell 2003; Sharp 2012); this enhances the chance of identifying the existence of a significant difference between the groups (Hazard Munro 2001).

In order to determine if the Interqual intervention had an impact the average difference should be greater than zero. The null hypothesis states there is no difference between the groups; if we can reject the null hypothesis there is a significant difference (Hazard Munro 2001).

6.8.1 Limitations

Some of the limitations of this study included;

- The inability to separate the influence of the other quality initiatives taking place in conjunction with the introduction of the Interqual ECDS.
- The use of the UK version of the ECDS for an Irish population of patients has also been considered and addressed with the inclusion of iter-rater reliability.
- The unquantifiable influence that the unique culture with Irish and American influences of the research setting has exerted on the variables considered.
- The role and requirement of supporting quality interventions with UR tools which has been noted by multiple researchers (Soria-Aledo et al. 2009; Hwang et al. 2011a; Paillé-Ricolleau et al. 2012) .
- Only two variables were studied admission appropriateness and LOS.
- This study was performed in only one hospital and the data resulted in a small sample size (*n* 31). The small sample size was approached by applying the paired t test to allow generalization of the results to the larger population within the study setting (Creswell 2003).

- Possible bias of this researcher due to familiarity and experience with the use of Interqual.
- Possible bias of the researcher due to professional role in the implementation of Interqual.

6.9 Conclusion

To assist in further ascertaining the organizational impact quality improvement data routinely collected by UPMC Beacon's PSQI department will also be used to analyse the overall impact of the implementation of the Interqual ECDS and the supporting quality improvement interventions.

7. Impact

7.1 Introduction

Identification of inappropriate admission, unnecessary length of stays and practice variation that compromise the quality of care by exposing patients to inappropriate and unnecessary interventions is important (McMullan R et al., 2004). The prevalence of the previously mentioned items are evidence that much of the care being provided is unnecessary and inappropriate (Field & Gray 1989; DeCoster et al. 1999). Investigations that could have been performed in the outpatient setting or caused delay due to poor planning at the admission stage have been identified by Kossovsky et al. 2002 (1998). The necessity for and application of supporting interventions discussed below were anticipated as a result of the literature review undertaken at the beginning of this process and the researchers experience. These have been taken into account when considering the impact reported within this dissertation.

The 1999 Institute of Medicine report on the United States (US) hospital system supported the earlier findings regarding the prevalence of inappropriate care, treatment and quality system failures (Institue of Medicine, 1999). A review of multiple international healthcare utilization studies found inappropriate health care being delivered at consistently high levels worldwide (New Zealand Health Technology Clearing House; 1998; Poulos & Eagar 2007). An example of the typical result was a demonstrated by Canadian researchers DeCoster et al. 1999 who found the following:

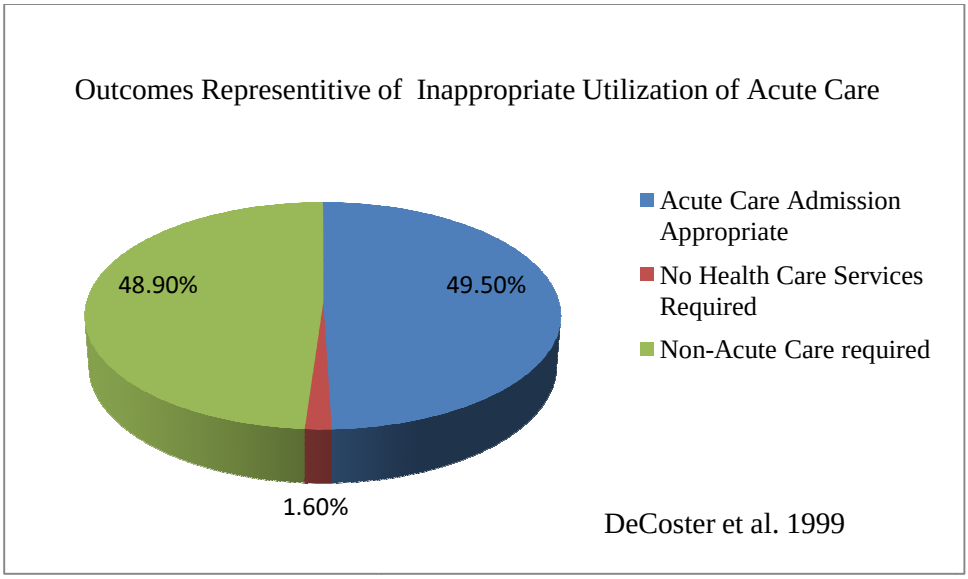

Figure 7. Typical Results of Reviews for Inappropriate Acute Care Utilization (DeCoster et al. 1999).

7.2 Admission Appropriateness

Arah et al (2006) defines appropriateness as clinical needs being provided for with healthcare that is evidence based and relevant. Inappropriate hospitalization has been defined by Soria-Aledo et al., (2009) as "*Hospital admissions for health care that could have been provided in a less complex health care setting at a lower cost*." The Health Service Executive, (2012) have additionally cited overutilization of hospital care and the resulting adverse events as causes of increased length of stay (LOS), increased costs, care delays and inefficiencies in inpatient healthcare. Review and management of admission appropriateness and LOS provide an opportunity to formulate solutions (Soria-Aledo et al. 2012). The Dublin Mid Leinster Regional Service Plan relates that one of their quality improvement indicators are geared towards decreasing the HSEs public acute hospital length of stay in 2012 by 5% by admitting patient on the day of their elective procedure (HSE 2012).

Soria-Aledo et al. (2012) continue by stating that hospial resources continue to decrease as health care costs increase.The hospital setting allows access to patient data that provides the ability to assess the appropriatesness and implement utilization management (Tamames et al. 2007) .Kossovsky et al. 2002 (1998); Hwang et al. (2011) found inappropriate hospitalization reduction is an important focus because it is the most costly healthcare setting. The application of appropriateness of inpatient admission and continued stay criteria has been forecasted as a requirement for improved healthcare quality in Ireland especially in the public healthcare system.(Health Service Executive PA Consulting Group 2007;Collins & Joyce 2008; Hogan et al. 2011). The resulting challenges require criteria, guidelines, standards, and interventions that focus on monitoring, guiding and ensuring quality,(Rotter et al. 2010; Hogan et al. 2011; Health Information and Quality Authority 2012).
Appropriateness of admission was determined by the application of Interqual criteria using the process noted in the paragraphs above. See Table 2 and Figure 8.

t-Test: Paired Two Sample for Means

	Appropriateness 2010	*Appropriateness 2012*
Mean	1.387096774	1.193548387
Variance	0.24516129	0.161290323
Observations	31	31
Pearson Correlation	0.448812598	
Hypothesized Mean Difference	0	
df	30	
t Stat	2.257064382	
P(T<=t) one-tail	0.015722146	
t Critical one-tail	1.697260887	
P(T<=t) two-tail	0.031444292	
t Critical two-tail	2.042272456	

Mean Difference	0.193548387
Stand Dev of Difference	0.477448415
Standard of Error of Difference	0.085752267
T alpha half 95% Conf Interval	2.042272456
Lower Confidence Level	0.018418895
Upper Confidence Level	0.36867788

Table 2. Sample t Test Admission Appropriateness

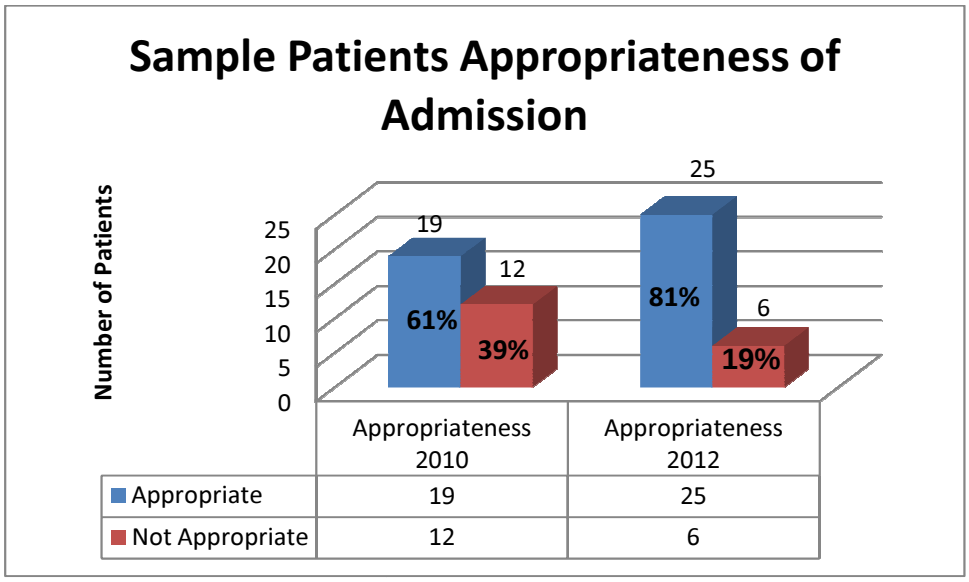

Figure 8. Analysis of Admission Appropriateness Sample 2010 vs. 2012

7.2.1 Analysis Admission Appropriateness Sample Data

Analysis of the resulting study data demonstrated the mean appropriateness for 2010 (μ=1.3870) as greater than the mean for the sample in 2012 (μ=1.1935) post implementation of the Interqual ECDS. The categories were coded 001 for appropriate; 002 for inappropriate. The higher mean in 2010 demonstrating a larger volume of admissions were found to be inappropriate.

The alpha level chosen for analysis = .005

If the probability that this result was caused by a sampling error is $p \leq .05$ we can reject the null hypothesis (East et al. 1999; Creswell 2003). Our resulting probability for appropriateness was $p = .03$.

Application of a paired t test to the sample inappropriateness in 2012 after the implementation of the Interqual ECDS showed it to be significantly lower than in 2010, $t(30) = 2.042$, $p \leq .05$. This allows us to find that the rate of appropriateness of admissions in our sample increased in 2012 as compared to 2010.

7.3 Length of Stay

As noted previously LOS is a variable that can provide information about the quality and appropriateness of inpatient hospital care. Bennett, K et al,. (2004); McMullan, R et al., (2004) declare there is value in identifying the variables that cause increases in length of stay. Advanced patient age and certain diagnoses have been identified as a variable linked to increased length of stay according to McMullan R, et al., (2004); Tamames et al. (2007); Majeed et al. (2012); Costa et al. (2012). Interestingly Tamames et al. (2007) also stated that researchers had not identified the age link with increased length of stay previous to their study. Another interesting point of view regarding LOS as a quality indicator was made by Rotter et al. (2010) decreases as mortality increases and therefore patient outcomes must always be considered. The particular day of the week the admission takes place, which varies according to facility, can also correlate with increased LOS (McMullan R, et al.; 2004; Tamames et al., 2007). Another view presented concluded that while quality interventions were found to increase quality and decrease costs they could also potentially increase LOS, due to variations in resource use. (Kossovsky et al. 2002).

The routine LOS data which collected and reported as a quality indicator by the UPMC Beacons PSQI department is reflected in Figure 10. The average LOS rate is calculated by the PSQI Department using the following formula; See Table 3 and Figure 10.

Length of Stay
Numerator
Sum of each patient length of stay
Denominator
Total discharges

(UPMC Beacon Hospital IPSG 2012).

t-Test: Paired Two Sample for Means

	LOS 2010	*LOS 2012*
Mean	9.451612903	5.548387097
Variance	49.78924731	15.05591398
Observations	31	31
Pearson Correlation	0.508076709	
Hypothesized Mean Difference	0	
df	30	
t Stat	3.571616929	
P(T<=t) one-tail	0.000610188	
t Critical one-tail	1.697260887	
P(T<=t) two-tail	0.001220377	
t Critical two-tail	2.042272456	

Mean Difference	3.903225806
Standard Deviation of Difference	6.084706724
Standard Error of Difference	0.70104005
T alpha half 95% Confidence Level	2.042272456
Lower Confidence Level	2.471511022
Upper Confidence Level	5.334940591

Table 3. Sample t Test Length of Stay

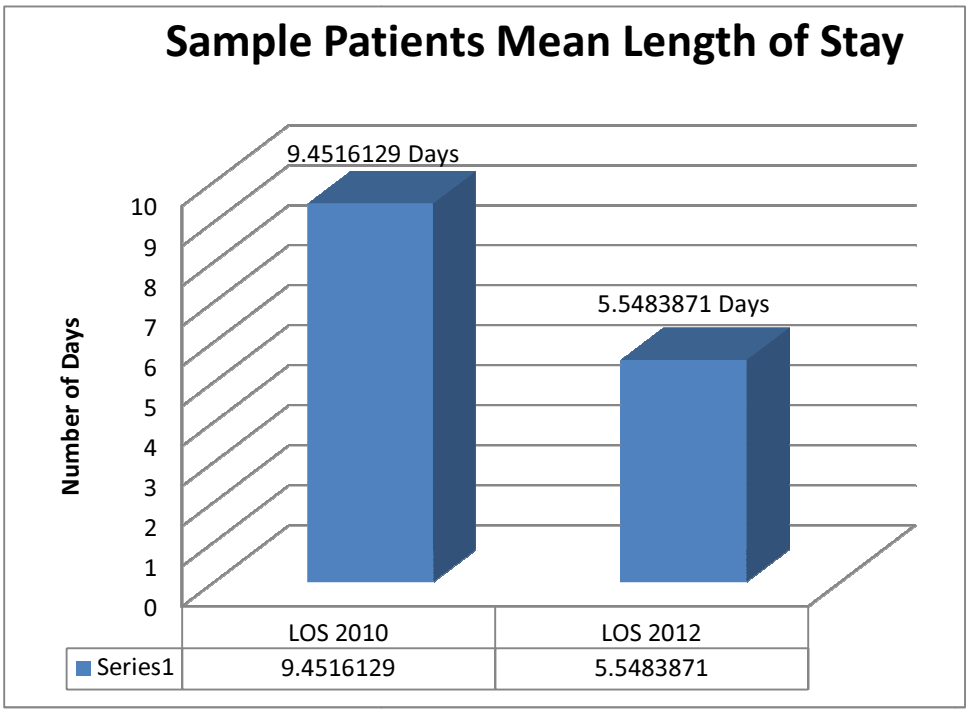

Figure 9. Analysis of Length of Stay Sample 2010 vs. 2012

7.3.1 Analysis Length of Stay Sample Data

Analysis of the resulting study data demonstrated the mean LOS for 2010 (μ=9.451613 days) and is greater than the mean LOS for the sample in 2012 (μ=5.548387 days) post implementation of the Interqual ECDS.

The alpha level chosen for analysis = .005

If the probability that this result was caused by a sampling error is $p \leq .05$ we can reject the null hypothesis (East et al. 1999; Creswell 2003). Our resulting probability for LOS was p = .001.

Application of a paired t test to the sample length of stay in 2012 after the implementation of the Interqual ECDS showed it to be significantly lower than in 2010, $t(30) = 2.042$, $p \leq .05$.

7.4 Readmission

Readmissions of recent hospitalized patients are indicators of inefficient quality of care and resource utilization according to Ludke et al. (1990) after conducting a study in a large US Veterans Administration (VA) hospital. Majeed et al. (2012) concludes that improving community care will assist in preventing hospital readmissons. According to Berlucchi et al. (1990) it has been recognized that working to improve healthcare quality will also reduce inappropriate inpatient admissions and readmissions which produces improved outcomes for all stakeholders. The HSE has identified a quality performance indicator goal rate for 28 day acute care readmissions for 2012 as 9.6% for the Dublin Mid Leinster Region (HSE 2012).See Figure 10.

The readmission rate is calculated by the PSQI Department using the following formula;

Readmissions
Numerator
 # patients readmitted within 30 days (each admission is reviewed for an admission that occurred in the previous 30 days)
Denominator
# of admissions

(UPMC Beacon Hopsital IPSG 2012).

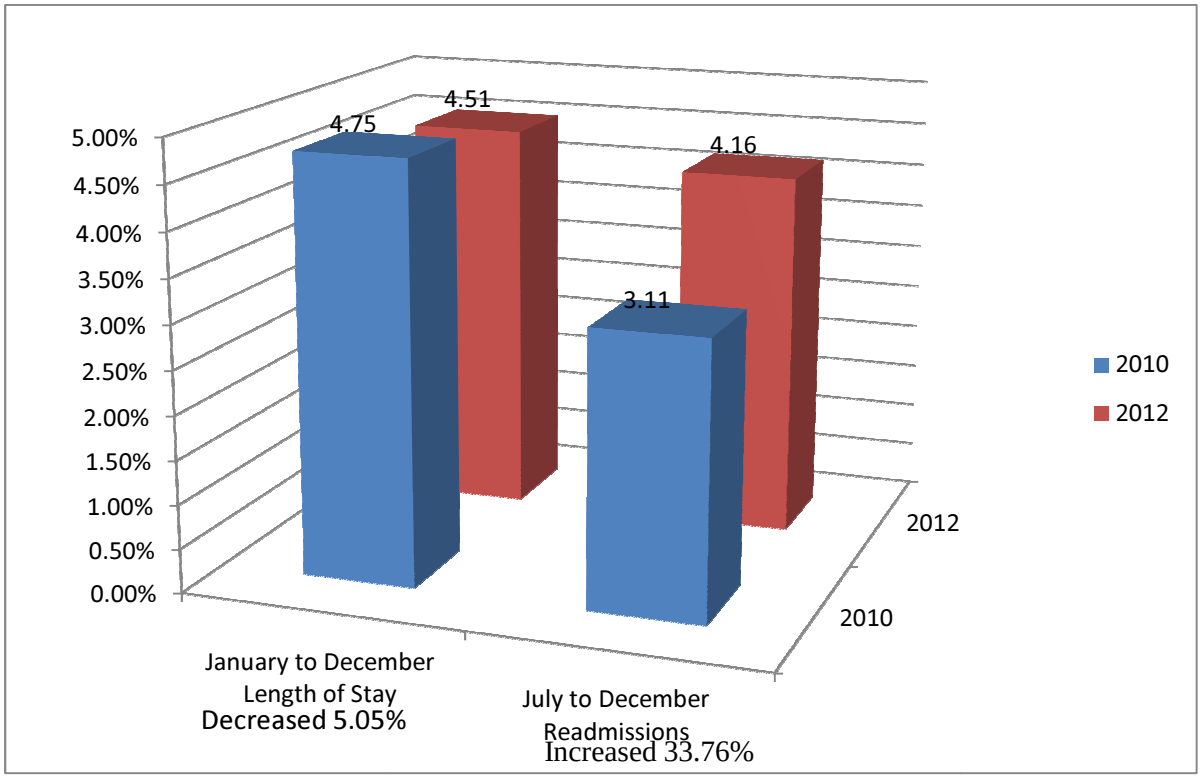

Figure 10. UPMC Beacon Length of Stay January to December 2010 vs. 2012 and Readmission Rate July to December 2010 to 2012

7.5 Hospital Acquired Infections

Healthcare Associated infections are defined as infections which are a result of treatment in a hospital or a healthcare service unit, but secondary to the patient's original condition (Center for Disease Control 2004). Infections are considered healthcare associated if they are not present or incubating at the time of admission and become evident 48 hours or more after admission (Center for Disease Control 2004). HAIs are so prevalent in the U.S. that Al-Rawajfah et al. (2012) ,points out that 2.5 million of the 35 million acute care inpatients acquire an HAI each year. The correlation with extended lengths of stay and HAIs was clearly demonstrated in the Irish Point Prevalence Survey of 2012 with a statistical significance demonstrated by a p value of < 0.001(Health Protection Surveillance Center 2012).

Moya-Ruiz, et al., 2002 affirmed the benefit of reducing inappropriate hospital days which result in improved care quality and the prevention of secondary problems such as nosocomial infections/hospital acquired infections (HAIs). According to Hassan, M et al. (2010) each additional day of hospital admission increases the chance of a HAI by 1.37%. The same study says that the HAI will increase the length of stay by an average on approximately 9 days. This is confirmed by a recent study reaffirming that hospital acquired infections are also known to result in increased health care costs due to the resulting increased LOS (Soria-Aledo et al. 2012, Al-Rawajfah et al. 2012. The control of HAIs was credited with the ability assist in reducing costs while improving care (Department of Health and Children 2008).

7.5.1 MRSA

A hospital acquired infection is additionally defined as "*an infection which may have occurred as a result of being admitted to the hospital*" by Health Protection Surveillance Center (2012). Ireland's Department of Health and Children's 2008 report on Building a Culture of Patient Safety stated that the control of HAIs were a important concern and pinpointed the recent spread of MRSA within the country. The DOHC also stated that MRSA was the infectious organism that caused up to 15.8% off all reported HAI s. Recognizing the danger of HAIs the HSE's set out in their Dublin Mid Leinster Regional Service Plan a goal of MRSA bloodstream infections of less than 0.067% per 1000 bed days for the year 2012 (HSE 2012). HAIs are a healthcare quality concern because they can result in a severe illness or death of patients (Health Protection Surveillance Center 2012).

At UPMC Beacon Hospital all MRSA infections are accounted for while the HSE focuses its data collection on MRSA bloodstream infections. See Figure 11. The MRSA infection rate is calculated by the UPMC Beacon Hospitals IPC Department using the following formula;

Hospital Acquired MRSA infection (Hospital-wide)
Numerator
# of hospital-wide MRSA infections identified >3 calendar days after admission (regardless of colonization status)
Denominator
# of patient days (rate per 1,000 patient days)

(UPMC Beacon Hospital IPC and IPSG 2010).

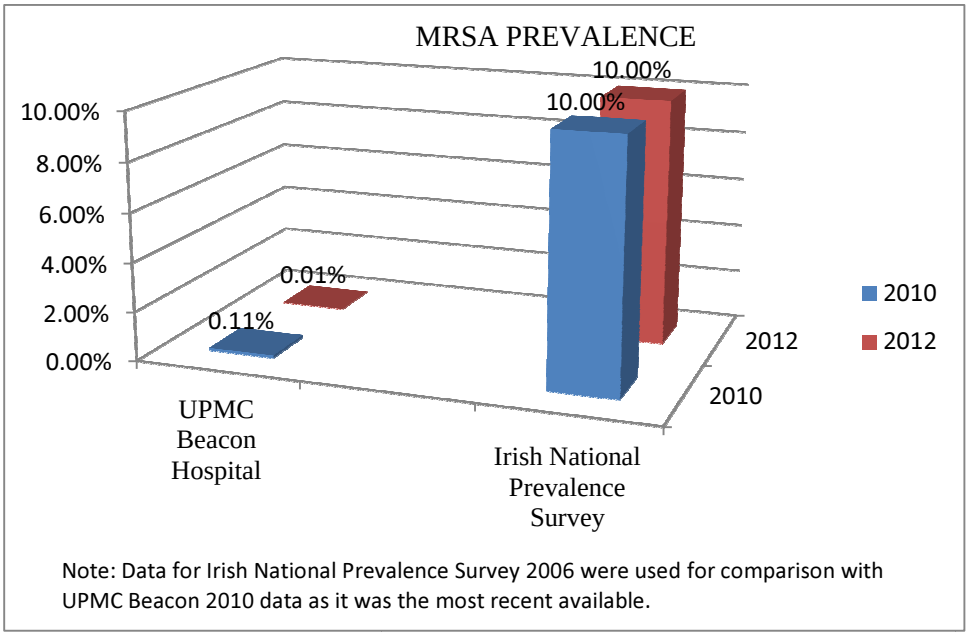

Figure 11. UPMC Beacon Hospital MRSA Prevalence 2010 and 2012 with Comparison to Irish National Prevalence Survey 2006 and 2012

7.6 Conclusion

The most obvious impact of the implementation of Interqual at UPMC Beacon hospital can be observed in the improvements in the quality indicators chosen for this study. Admission appropriateness measured within the sample increased post implementation of Interqual. Within the same period the sample length of stay also demonstrated a decrease. Additional hospital wide data that is routinely collected also demonstrated positive trends in quality indicator such as length of stay and MRSA rates. It was noted from the data available that only readmission rates increased within the period studied. While the majority of the quality indicators demonstrate a positive outcome it is not possible to attribute these wholly to the implementation of the ECDS within the research setting. The requirement for additional quality interventions to support the Interqual ECDS Pilot prompts this researcher to admit the positive results rely on a range of concurrent influences.

Ascertaining the true impact on the quality culture of the research setting and its clinicians was not possible within this study but would certainly be a worthwhile subject for further research. The inclusion of questionnaires and surveys for clinicians, ancillary staff and patients would provide a richer understanding of the results of implementing this quality intervention .The impact on private insurance claims reimbursement practices would also

provide valid information for further models of care and improvements in the provision of private acute healthcare. This study is just the beginning of the understanding of the pitfalls and potentials of the Interqual ECDS in the Irish healthcare system. The ability to have a greater understanding of the Interqual ECDS on healthcare quality will require further research.

8. Discussion/Conclusion

8.1 Introduction

After all the attempts to improve health care quality across the continuum it has still been noted by The Health Foundation (2012) that the care we actually receive is sometimes not what has been recommended by research. This study has shown that the introduction of ECDS quality intervention for utilization review with the goal of identifying inappropriate admissions and length of stay promoted the development of a positive culture of safe, quality healthcare within the research setting. The ever-changing and challenging nature of healthcare has also evolved to allow for increased innovations and opportunities to realize improvements with a renewed patient focus, new models of care and payment, and the expansion of HIT (Navarro et al. 2012; HIQA 2012). These emerging forces will have impact on the present quality indicators and require the creation of additional indicators and interventions (Soria-Aledo et al. 2012a; Paillé-Ricolleau et al. 2012).

8.2 Recent Developments Irish Healthcare

Minister Riley TD (2013) provided his vision for the future of Irish healthcare delivery by first acknowledging the need for major reforms to allow the continued delivery of health services within the nation. He outlined the challenges and opportunities involved in delivering efficient and effective healthcare as noted below;

Challenges;

- Increasing economic constraints
- Increasing population
- Aging population
- Decreased uptake of private insurance
- Increase in population eligible for state assistance
- Decreased mortality
- Increased life expectancy

Opportunities;

- Single tier Irish integrated healthcare system
- Increased hospital care quality and efficiency
- Money Follows the Patient Funding

- Universal Health Insurance
- Establishment of Network for Health and Wellbeing
- Health Insurance Reforms
- Health Insurance Risk Equalisation Schemes
- Increased equitability and transparency

These changes have already begun in 2013 with the Risk Equalisation Scheme and will be implemented incrementally up until 2015 and beyond; as The Health Foundation (2012) agreed with this in their research suggesting that quality impovement interventions are more readily successful if changes are made incrementally.

8.3 Future Directions

Emerging and existing quality interventions and indicators have been transformed, reapplied and invented to meet the challenge of future healthcare provision. Efforts continue to improve healthcare quality with the provision of the appropriate care; in the correct setting at the correct time (Sittig et al. 2007).

8.3.2 Meta-Analysis and Big-Data

The Health Foundation (2012) reminds us future planning and reflection has to be based on the evidence and data collected during research. Meta-analysis combines the results from several trials to improve precision and provide a broader evidence base (HSE 2011). The focus on measurement has increased and the use of IT to analyse large amounts of data are being touted by some as the answer to propelling healthcare quality forward and a more rapid pace (Handel et al. 2011; Downing 2013). The use of the same concept as meta-analysis will allow for earlier evaluation of quality indicators and an ability to provide increasing intuitive planning and care model formulation (Mcdaid et al. 2009). This would create ability for large health systems and governments or global organizations to stay ahead of the increasing challenges; by analysing all the data from several populations not just at sample; providing information that is more accurate and timely (Downing 2013). The NHS has recognized this potential for improving healthcare quality with more accurate , relevant information as reported by Downing (2013) and have plans to utilize it to improve their service delivery. The IOMs definition of “a learning health system” which describes the ability of providers to

aggregate large amounts and produce more timely and intuitive quality interventions will improve quality and decrease costs (Adler-Milstein et al 2013).

8.3.3 Utilization Review

UR has been touted as allowing healthcare policy makers to identify areas of the healthcare continuum that require future development (Poulos & Eagar 2007). Poulos & Eagar (2007) continue on to advise the use of propietary utilization review tools that utilize evidence based practice to improve patient safety and efficiency due to lack of open source tools.. The new direction finds clinicians and commercial enterprises producing UR tools that target the utilization of specfic medical specialties treatment and or diagnostics such as radiological studies (McKesson Health Solutions 2012 -2013; Cornett 2012).

8.3.4 Hospital Aquired Infections

The future survellance of the quality interventions suggested by the WHO to reduce HAIs have been subjected to mandatory reporting in the US since 2011 (Al-Rawajfah et al. 2012). This new U.S. National Healthcare Safety Network will monitor several quality indicators such as HAIs, LOS, mortality and healthcare costs in an attempt to drive healthcare quality improvement according to Al-Rawajfah et al. (2012). The data resulting from this new agency will form the basis for future U.S. initiatives and legislation. Within Ireland the HSE has set specific goals and quality interventions that provide efficiencies and appropriate utlization of acute care services targeting HAI reduction (HSE 2013). Preventing avoidable admissions will continue to provide the most effective protection against HAIs (Graves et al. 2007; Graves et al. 2010; Glance et al. 2011; Mitchell & Gardner 2012)

8.3.5 Disease Management

Disease Management programs have been identified by the WHO as the most important strategy recommended for future strategic implementation leading to global healthcare improvement Magnezi et al. 2013. The Villagra study noted this solution as early as 2004 and recommended further research to improve outcomes and value realization. In 2008 Dorr et al. observed improvement in disease specific chronic care that was partially attibutable to information technology. Disease management programs used by health plans rely on evidence based guidelines included in their IT solutions (Somers & Bella 2007; Gingrich &

Hasan 2010; Valerio & Ricciardi 2011; RAND 2012). The VHI has already begun to utilize Disease Management in addition to the Interqual ECDS quality intervention to improve the future provision of services, quality of care and ultimately the health of its members (Buckle 2011).

8.4 Conclusion

The ability to combine evidence based guidelines with HIT will allow Interqual to provide advances for future healthcare quality. Recognizing that providing quality care requires multiple quality interventions in conjunction with UR; McKesson's Interqual ECDS has evolved over the years and currently encompasses a suite of patient care focused products that assist stakeholders to answer the needs of individual patients across the healthcare continuum. (McKesson 2013). The solutions provided include:

- Evidence based level of care clinical criteria for the patient's journey from acute, rehabilitation, homecare to outpatient and community care including psychiatric and chemical dependence.
- Care Planning criteria to determine the appropriateness of healthcare resource utilization of diagnostics, procedures, and medical equipment and specialist referrals.

These solutions are supported by IT that allows integration, expendability, and portability within the chosen healthcare settings. Additional training, implementation assistance, support and audit services provided by McKesson enable providers to provide a foundation which supports appropriate healthcare utilization, increasing efficiency, access, and quality (McKesson 2013). Initially the provision of quality care requires a determination of the appropriateness of the care setting that can be provided by Interqual or a like UR quality intervention (C. J. Poulos et al. 2011b; Handel et al. 2011). This study has demonstrated that there are potential benefits that can be realised by employing Interqual ECDS as part of an the integrated healthcare system in Ireland.

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List of Tables

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Appendices

Appendix A Coded Sample Data

Patient Code	Appropriateness 2010	Appropriateness 2012	LOS 2010	LOS 2012	Complaint 2010	Complaint 2012
1	2	2	5	4	3	3
2	1	1	5	2	1	1
3	2	1	16	11	5	5
4	1	1	6	3	1	1
5	1	1	3	3	1	1
6	1	1	15	15	5	5
7	2	1	12	12	3	3
8	1	1	14	2	5	5
9	1	1	1	1	1	1
10	1	1	3	4	1	1
11	1	1	10	6	3	3
12	2	2	11	2	3	3
13	2	2	14	8	4	4
14	1	1	11	12	3	3
15	2	1	11	5	5	5
16	2	1	2	4	4	4
17	2	2	3	3	3	3
18	2	1	3	1	1	1
19	1	1	14	7	1	1
20	2	1	7	2	2	2
21	1	1	3	9	5	5
22	1	1	12	2	3	3
23	1	2	5	5	2	2
24	1	1	15	2	2	2
25	2	2	16	8	5	5
26	1	1	6	5	1	1
27	2	1	15	3	5	5
28	1	1	7	8	3	3
29	1	1	3	2	1	1
30	1	1	37	12	5	5
31	1	1	8	9	3	3
MEANS			9.451613	5.548387		

Presenting Complaint Categories
01 Cardiology
02 Gastroenerology
03 Medical
04 Orthopaedic
05 Respiratory
06 Neurology

Appropriateness Codes
001 MET
002 NOT MET

Length of Stay (LOS) in Days

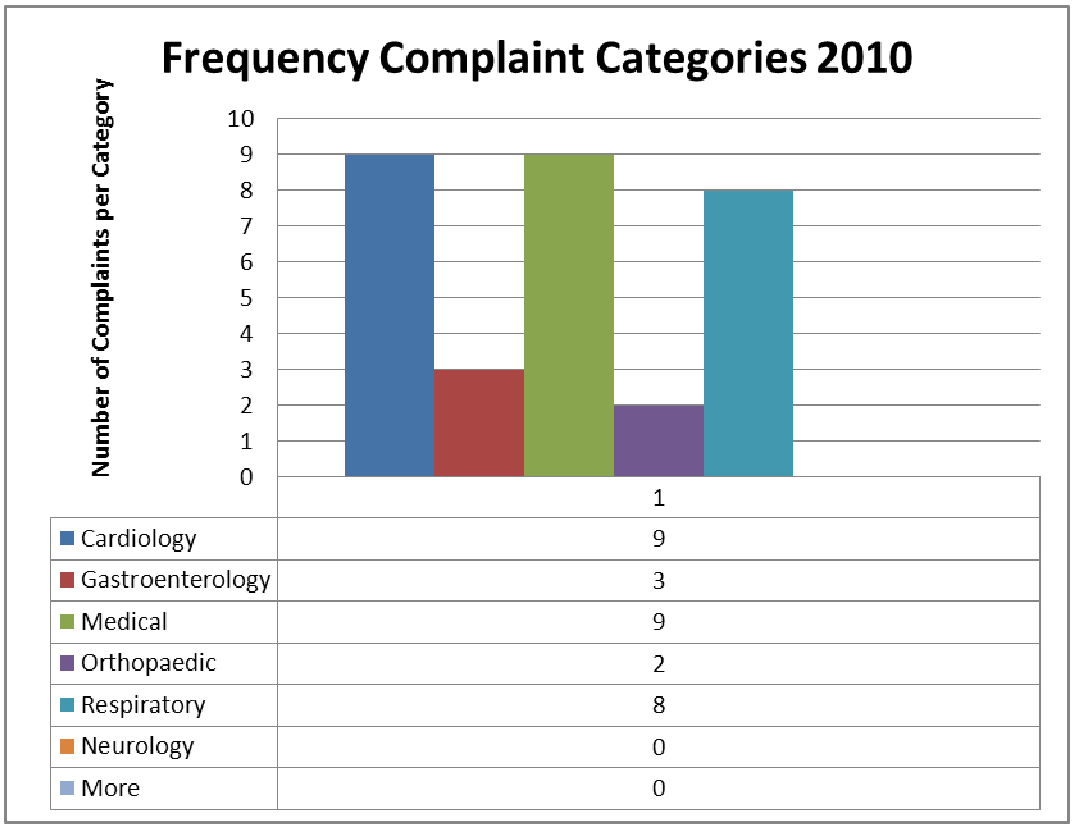
Appendix B Appropriateness Data

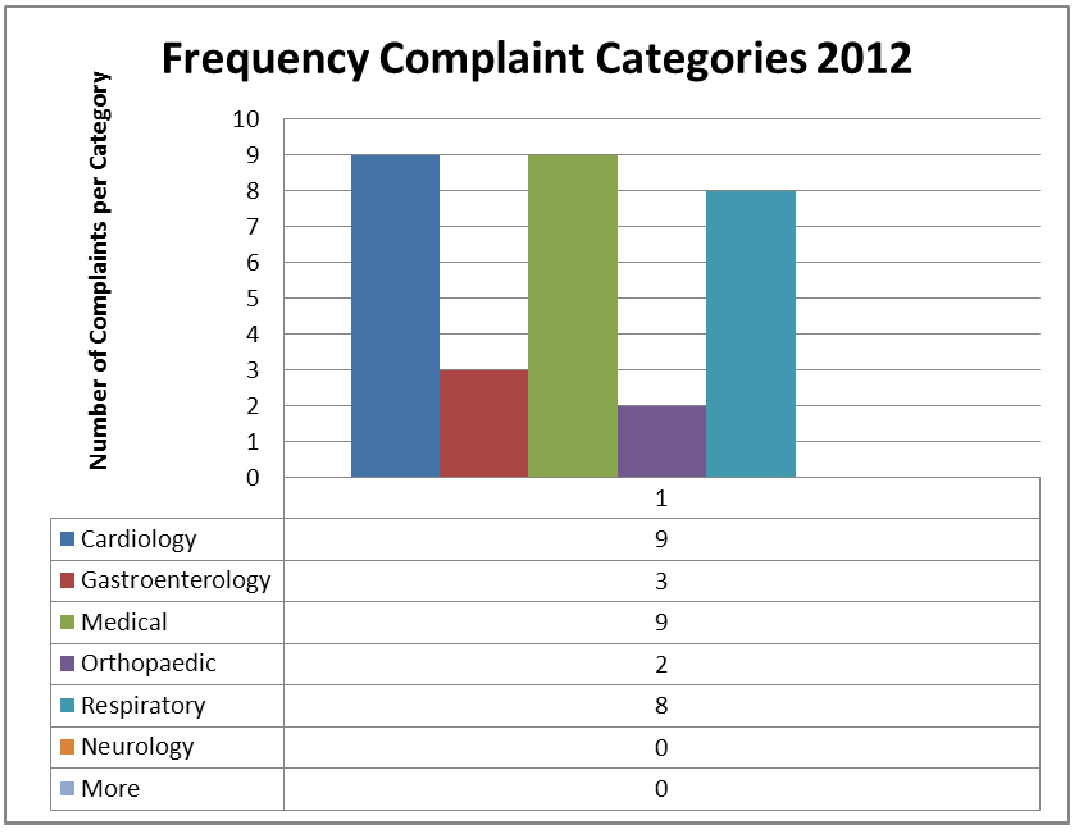
APPROPRIATENESS 2010	APPROPRIATENESS 2012	DIFFERENCE
2	2	0
1	1	0
2	1	1
1	1	0
1	1	0
1	1	0
2	1	1
1	1	0
1	1	0
1	1	0
1	1	0
2	2	0
2	2	0
1	1	0
2	1	1
2	1	1
2	2	0
2	1	1
1	1	0
2	1	1
1	1	0
1	1	0
1	2	-1
1	1	0
2	2	0
1	1	0
2	1	1
1	1	0
1	1	0
1	1	0
1	1	0
1.387096774	1.193548387	

Appendix C Length of Stay Data

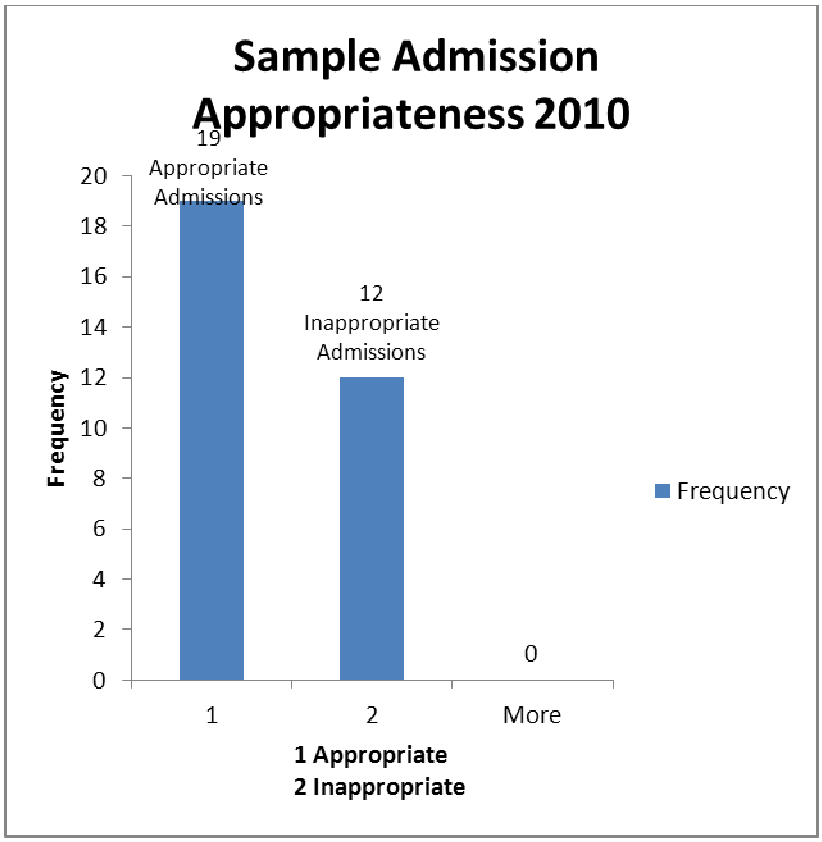
PATIENT CODE	LOS 2010	LOS 2012	DIFFERENCE
1	5	4	1
2	5	2	3
3	16	11	5
4	6	3	3
5	3	3	0
6	15	15	0
7	12	12	0
8	14	2	12
9	1	1	0
10	3	4	-1
11	10	6	4
12	11	2	9
13	14	8	6
14	11	12	-1
15	11	5	6
16	2	4	-2
17	3	3	0
18	3	1	2
19	14	7	7
20	7	2	5
21	3	9	-6
22	12	2	10
23	5	5	0
24	15	2	13
25	16	8	8
26	6	5	1
27	15	3	12
28	7	8	-1
29	3	2	1
30	37	12	25
31	8	9	-1
	9.451612903	5.548387097	

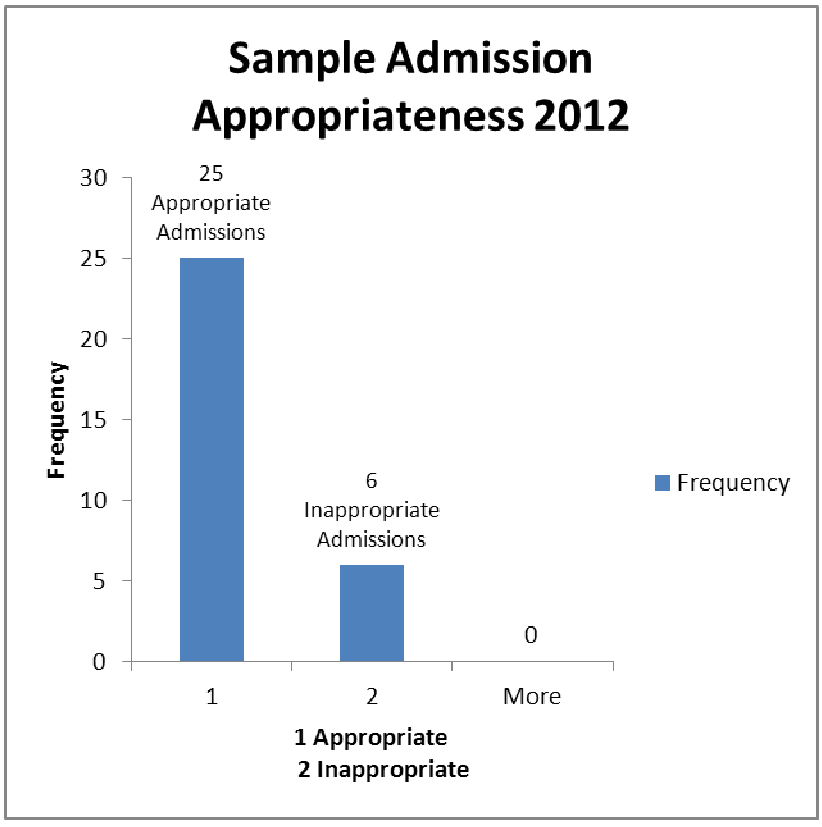
Appendix D Frequency of Complaint Categories



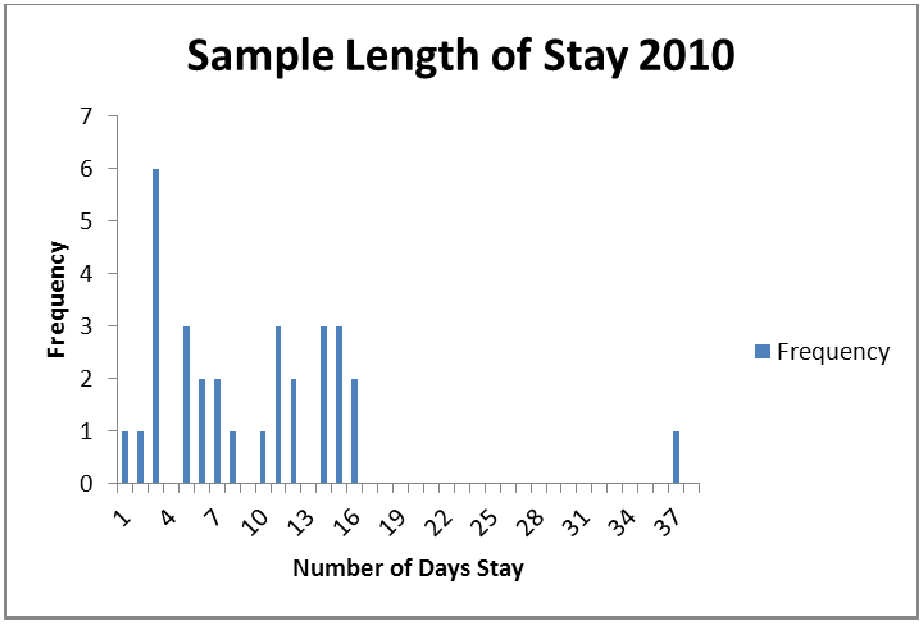


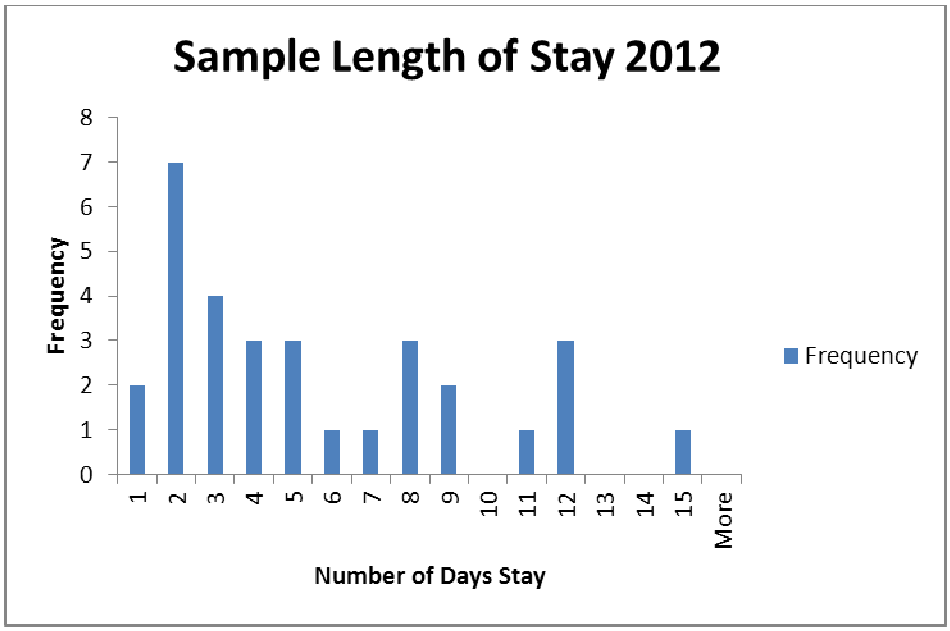
Appendix E Histogram Sample Appropriateness





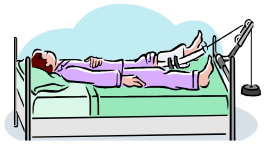
Appendix F Histogram Sample Length of Stay





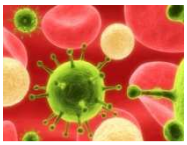
Appendix G Impact Inforgraphic

IMPACT of INTERQUAL INFOGRAPHIC



SAMPLE APPROPRIATENESS

HOSPITAL LENGTH OF STAY



HOSPITAL MRSA RATE

Quality Indicators

2010	61%	4.75 Days	0.11 %
2012	81%	4.51 Days	0.01 %

Percent of Change

33% ↑ 5.05% ↓ 91% ↓

Influences and Future Directions of Quality Indicators Investigated

	APPROPRIATENESS	LENGTH OF STAY	MRSA
 **Patient Centred Care**	↑ Continuum Development	↑ Patient Collaboration	↓ Increased Self-Care
 **New Payment Models**	↑ Increased Claims Denials	↓ Increased Partial Payment of Claims	↓ No reimbursement for HAI Care
 **Innovations in Healthcare IT**	↑ Increased Payer/Provider Collaboration	↓ Increased Ease of Continuum Access	↓ Evidence Based Medicine and ECDS at Point of Care

Appendix H Letter of Ethics Approval

UPMC Beacon Hospital

Research Ethics Committee

Ms. Paula Vernon,
UPMC Beacon Hospital
Beacon Court
Sandyford
Dublin 18

14th March 2013

Study Title: The Impact of an Electronic Decision Support for Acute Admission and Continued Stay Appropriateness Determination on Healthcare Quality

Dear Ms. Vernon

The UPMC Beacon Hospital Healthcare, Research & Ethics Advisory Committee received your ethics submission for the above study on the 13th December 2012, and reviewed and discussed it on the 7th March 2013.

I am pleased to inform you that this study has now been approved.

We wish you all the best in your research and would appreciate a copy of your thesis on completion.

If you have any queries please let me know.

p.p. Treasa

Mr. Maher Shuhaibar
Chairperson, UPMC Beacon Hospital REC