DETERMING THE IMPACT OF THE EMERGENCY DEPARTMENT PHYSICIAN STAFFING MODEL ON CORE MEASURE PERFORMANCE WHEN TREATING ACUTE MYOCARDIAL INFARCTION/CHEST PAIN IN A CRITICAL ACCESS HOSPITAL

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This study is dedicated to my mother Audrey Alice Barnett. She always encouraged me to seek higher education and would have enjoyed seeing me complete this degree.

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ABSTRACT

DETERMING THE IMPACT OF THE EMERGENCY DEPARTMENT PHYSICIAN STAFFING MODEL ON CORE MEASURE PERFORMANCE WHEN TREATING ACUTE MYOCARDIAL INFARCTION/CHEST PAIN IN A CRITICAL ACCESS HOSPITAL

by Steve Barnett

Since the introduction and passage of the Affordable Care Act (ACA), it has been clear that value based service, without compromising quality or patient safety, will be necessary. Providing a value based service in the emergency department of a critical access hospital is in part dependent upon the physician staffing model. Although the literature is rich with information about many of the study key areas, very little was discovered that describes healthcare delivery service innovation, particularly as it relates to emergency department physician staffing models in a critical access hospital.

This study utilized quantitative research methods, descriptive and an inferential statistical approach to investigate the performance of emergency department physician staffing models on acute myocardial infarction/chest pain outpatient core measures. The emergency department patient visit volume was less than 10,000 per year and three (3) different physician staffing models were evaluated over a five (5) year period; 2008 – 2012. The outpatient core measures for acute myocardial infarction/chest pain, that was analyzed was aspirin administration within 24 hours of admission and was an electrocardiogram done within 10 minutes of admission.

The research study discovered that there is a significant association between the emergency department physician staffing model and core measure performance for patients presenting with symptoms of an acute myocardial infarction/chest pain. Specifically, the board certified emergency medicine physician staffing model (B) and board certified primary care physician staffing model (C) outperformed the mixed specialty physician staffing model (A).

This study highlighted the similarity in performance between different emergency department staffing models in a critical access hospital, as viewed by board certification and treating acute myocardial infarction/chest pain. Being able to determine that patients presenting with an acute myocardial infarction/chest pain are not compromised by changes within emergency department physician staffing composition is important when a decision to use an alternative staffing model is made by administrators.

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ABBREVIATIONS

ACLS	Advanced Cardiac Life Support
ACO	Accountable Care Organization
AMI/CP	Acute Myocardial Infarction (AMI) and Chest Pain (CP)
AMA	American Medical Association
ATLS	Advanced Trauma Life Support
AHRQ	Agency for Healthcare Research and Quality
BBA	Balanced Budget Act
BLS	Basic Life Support
CAH	Critical Access Hospital
CCP	Cooperative Cardiovascular Project
CDC	Centers for Disease Control and Prevention
CMS	Center for Medicare and Medicaid Services
CQM	Clinical Quality Measures
CP	Chest Pain
ECG	Electrocardiogram
ED	Emergency Department
HCFA	the Health Care Financing Administration
HCQII	Health Care Quality Improvement Initiative
EHR	Electronic Health Records
EMR	Electronic Medical Records
EKG	Electrocardiogram
FLEX	Medicare Rural Hospital Flexibility Program
HBC	Home-Based Care
HHS	The U.S. Department of Health and Human Services
HSRC	Human Science Research Council
ICD-9-CM	International Statistical Classification of Diseases
IT	Information Technology
MRC	Medical Research Council
NCQM	National Clinical Quality Measures
NQF	National Quality Forum
NQMC	the National Quality Measures Clearinghouse
NQS	National Quality Standards
NRMI	the National Registry of Myocardial Infarction
PALS	Pediatric Advanced Life Support
PMA	Pharmaceutical Manufacturers Association
PPACA	the Patient Protection and Affordable Care Act
RAC	Rural Assistance Care
SPSS	Statistical Package for Social Science

CHAPTER I

INTRODUCTION

Most healthcare providers and patients acknowledge hospital quality of care as a fundamental component of an exceptionally performing healthcare system. As a consequence, quantifying and continuously enhancing healthcare quality is an increasingly crucial mission of most healthcare providers. For that reason, an uncompromising improvement in every segment of healthcare is very important to researchers, healthcare providers and patients in the U.S and around the globe. This study, along with other studies, target improvements in healthcare by providing evidence that can be used to influence policy makers who can alter regulations that positively impact cost, quality and access.

In the hospital setting, there have been numerous deliberations about how high quality can be defined best. According to Lohr, quality of care is defined as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge" (Lohr, 1990). Desirable health outcomes are further described by measuring clinical indicators, which provide insight about performance (Mainz, 2003). Clinical indicators represent agreed upon standards of care that are often grounded in research and referred to as evidenced based practices (Mainz, 2003). Among clinical indicators of quality are those related to structure, process and outcome; these are the types of indicators used in this study.

It is important to note that there is a significant difference between small rural and large urban hospitals in terms of resources, volume, staffing, finances, and so on. Therefore the outcome data generated from patient safety initiative studies conducted in larger urban hospitals should not be generalized to Critical Access Hospital's (CAH) (Casey, Wakefield, Coburn,

Moscovice & Loux, 2006), which are at higher risk due to limited resources and vulnerable population (Joynt, Orav & Jha, 2013). However, healthcare safety initiatives are often developed from the studies undertaken by large urban hospitals and thereafter, generalized to small rural hospitals, despite the organizational delivery differences (Klingner, Moscovice, Tupper, Coburn & Wakefield, 2009). The small rural hospitals characteristics differ substantially from urban hospitals and therefore must be taken into consideration when generating strategies to improve quality of care.

Background

According to the U.S. Census Bureau, the 2010 rural population was 59,492, 267 and represented 19.3% of the U.S. total population. The U.S. Census Bureau describes urban by two census characteristics; Urban Areas have 50,000 or more people living in them and Urban Clusters have 2,500 or more people living in them but less than 50,000 people. Rural is then described as everything else in the U.S. In that expansive area called rural, healthcare is typically delivered by one of 1,328 certified CAH's, according to the Rural Assistance Center (RAC, 2013) which is a division of the U.S. Department of Health and Human Services (HHS).

Hospitals are often called the health care safety net; when care is needed people know they can always find a provider at a hospital. Many hospitals in the U.S are experiencing financial pressure because of investment losses, higher borrowing, tight or limited credit, and uninsured and underinsured patients who are often unable to pay their bills (Bailey, 2009). This places many hospitals in a very difficult situation and it is often more pronounced in small and rural hospitals. In addition, most rural hospitals are in areas that are economically challenged (Bailey, 2009).

Rural hospitals are faced with many challenges such as their constrained financial resources, small sizes, low patient volume, remote geographic locations, and limited workforce (Casey & Moscovice, 2004). Nonetheless, they continue striving to provide patients with the best quality of care. These challenges however, present many difficulties in regards to handling the high fixed cost related to operating a healthcare facility. Furthermore, this makes rural hospitals especially defenseless to Medicare and Medicaid payment cuts, market fluctuations as well as healthcare policy changes.

In 1997 the Balanced Budget Act (BBA) created a Medicare Rural Hospital Flexibility Program (FLEX) that allowed for a new hospital classification, the CAH (Dalton, Slifkin, Poley & Fruhbeis, 2003). The purpose of creating a CAH designation was to allow for reasonable cost based reimbursement to the CAH for Medicare beneficiaries seeking care, this would be better than the reimbursement received under the prospective payment system they were working under. The now certified CAH began to experience better financial viability than they had been seeing, which in turn re-enforced the healthcare safety net for rural communities (Reif & Ricketts, 1999).

Small rural hospitals, which often are CAH's, already operate on very narrow margins and need to operate very efficiently. Innovative methods to deliver care are frequently created in CAH's because of their size, and developing an efficient emergency department (ED) physician staffing model that can also serve the inpatient population is an example of innovation. The integrated ED/Hospitalist staffing model is an innovation that can favorably impact cost, quality

and access (Casey & Moscovice, 2012). Regardless of the service, CAH's need to meet the same quality standards described for any other facility operating as a hospital, although sometimes it can be difficult in a CAH to meet the standards because denominators can be very low in a CAH and may skew the outcome measure.

With the sense of urgency caused by healthcare reform, healthcare executives must explore new ways of providing services that add value to the organization. Rural healthcare organizations often struggle with recruiting physicians, and yet must live by the same standards for quality and patient safety as any other healthcare facility. Consumer expectations in rural communities are not any different than their urban counterparts when accessing care through the ED of a hospital. Developing solutions that meet the demands of both healthcare providers, and consumers seeking services must be measured using the same standards of care.

Healthcare literature provides sufficient evidence of staffing models affecting quality of care. In many cases the studies have focused on board certification in emergency medicine having a direct positive impact on the overall quality of care (McNamara & Kelly, 1992). A reduction in morbidity related to airway management has been observed by researchers when using staffing models that utilize emergency medicine trained physicians (Jones, Weaver, Rusyniak, Brizendine & McGrath, 2002). In another study the researchers evaluated the use of electronic medical record systems, the use of treatment protocols and quality performance of the various ED staffing models in rural areas (Moscovice & Wakefield, 2007). ED physician staffing models vary dramatically by time of the day, day of the week, bed size of the facility, facility ownership and region of the country (Moscovice & Wakefield, 2007). For this study the staffing models are described by the researcher by training, relationship to the hospital and appropriate additional certifications.

Among quality indicators, current literature has focused on process of care measures; AMI/CP, congestive heart failure (CHF) and pneumonia (Joynt, Harris, Oray & Jha, 2011). This can be viewed as an assessment of ED physician staffing model performance because patients with these conditions typically present in the ED. Patient assessment of care delivered by a hospital is done through the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey; rural hospitals tend to score higher on this survey (Casey & Davidson, 2010). In this study the researcher focused on AMI/CP as a process of care measure, which given the incidence of occurrence in the U.S., served as an appropriate measure of the ED physician staffing model performance (Baldwin, MacLehose, Hart, Beaver, Every & Chan, 2004).

At the same time, studies based on small rural hospitals and specifically CAHs are rare (Rangachari & Hutchinson, 2006; Baronner & Wolf, 2006). Since the passing of healthcare reform there has been an increased effort to understand cost and quality of surgical care, particularly in CAH's (Gadzinski, Dimick, Ye & Miller, 2013). This recent interest in potentially lower cost care environments does not adequately address the care delivered in CAH ED's, this study directly addresses this issue.

Statement of Problem

The problem is that we need to ensure that quality care is delivered to patients presenting to an ED in a CAH. CAH's often have fewer resources, both human and financial, and therefore must be efficient while not compromising care. Therefore we must know if the CAH ED physician staffing model affects clinical quality indicators, in this study that indicator were AMI/CP.

Research Question

The purpose of this study is to determine if there is any significant difference in clinical outcomes under three different ED physician staffing models. Therefore the research question is: Does the ED physician staffing model effect core measure performance when treating AMI/CP?

Research Methodology

This non experimental case study used data from a CAH to compare quality indicators under three staffing models. The data was extracted from approximately 30,000 medical records during 2008-2012. CMU IRB approval was determined to not be needed due to a lack of human subject involvement.

This study followed Donabedian's Structure-Process-Outcome model (Donabedian, 1980) as a useful tool for healthcare providers seeking to improve the overall quality of care for patients through structure and improved processes. The Donabedian Model is commonly used by healthcare researchers in hospitals (Kobayashi, Takemura & Kanda, 2010; Lilford, Mohammed, Spiegelhalter & Thomson, 2004), long-term care (Spector & Takada 1991), primary care (Kringos, et al, 2010) and other areas (Callaghan, Eales, Coates & Bowers, 2003). There does not appear to be any evidence of Donabedian's model being used to study quality in the CAH environment. Figure 1 represents overall Donabedian model and application of the model to this study.

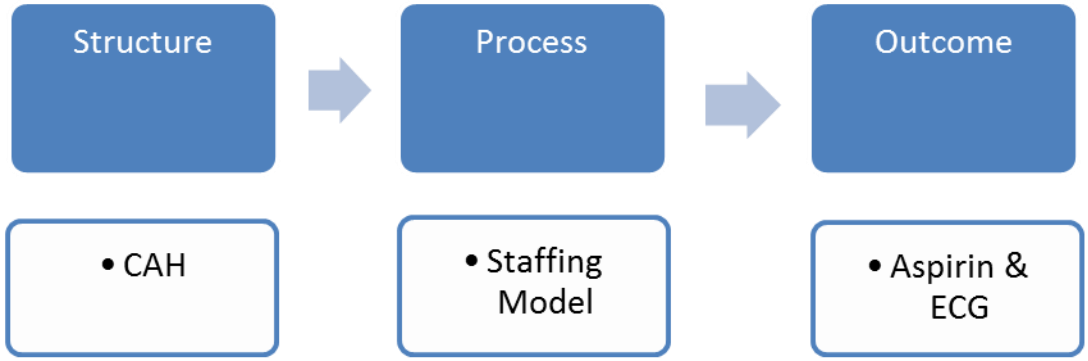

Figure 1. Conceptual Framework of the study, Based on Donabedian SPO Framework (Donabedian, 1980)

Significance of the Study

If a consumer is going to benefit from a positive health outcome, the consumer must be able to utilize the healthcare services in a timely manner, have a way to get to a healthcare location where needed services are provided, and have access to a trusted healthcare provider. Consumer disparities related to healthcare service access and cost significantly impacts some populations, which directly affects quality of life and that population's ability to realize its full potential.

Healthcare quality and safety improvements are absolutely critical to the viability of hospitals serving rural communities. Critical Access Hospitals (CAH) have unique characteristics that are not always taken into consideration by national hospital patient safety initiatives. Consequently, most of the patient safety standards are generally stemming from studies that are conducted in large urban hospitals. This study focused only on the CAH environment, specifically the ED physician staffing model, and how the models impact improvements in efficiency and quality of care for rural populations, which further indicates why this is an important study for patients.

If the quality of care delivered in the ED to those patients presenting with AMI/CP is not compromised by the physician staffing model, then hospital executives may have alternatives to consider when staffing their ED. In this case, the researcher was interested in whether or not the primary care ED physician staffing model compromises the quality of core measures, because these physicians are easier to recruit and can fulfill an additional task, that being a hospitalist role. Therefore, this study may present significant results for health care administrators of small rural facilities.

Studies exploring the quality of care delivered in rural hospitals are limited, by extension this would include CAH's (Baernholdt, Jennings & Lewis, 2013). There are however some studies that evaluate mortality rates in CAH facilities as compared to non-CAH facilities, the conclusion indicates that outcomes were worse in the CAH facilities during the period of 2002 – 2010 (Joynt, Orav & Jha, 2013). Given the conclusions drawn by Joynt, et al it is important to conduct health services research as a study on small rural CAH facilities.

CHAPTER II

LITERATURE REVIEW

Introduction

Countless studies have been conducted on healthcare changes emphasizing the impact of quality of care, accessibility, affordability and measurement of healthcare outcomes. Many of these quantitative and qualitative studies addressed a wide range of healthcare topics and they have contributed significantly to our knowledge and understanding of the ways in which healthcare providers, the government, and groups that can influence change can positively impact the quality of care for individuals, society and ultimately around the globe. Subsequently, there have been positive healthcare quality improvements however; there is still a lot of work to be done.

A comprehensive literature review was conducted on several key areas. Challenges related to providing healthcare in rural designated areas, CAH certification, physician recruitment, specialty board certification requirements, quality assessment, outpatient core measures and ED physician staffing models. Although the literature is rich with information about many of these key areas, very little was discovered that describes healthcare delivery service innovation, specifically as it relates to ED staffing models in CAH's. Attention to healthcare reform and a general presumption that healthcare providers will need to do more with less, frames the significance of measuring quality of care delivered in an ED where different staffing models have been employed.

Hospital Quality

The Institute of Medicine's 2001 report, Crossing the Quality Chasm, the definition of quality was reiterated as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge" (Lohr, 1990; IOM, 2001). A subsequent IOM report published in 2005, Quality through Collaboration: The Future of Rural Health, builds upon previous IOM work by addressing quality of care issues in rural America. The IOM rural report recommended adoption of a comprehensive approach to quality improvement in rural areas. This approach would include using clinical knowledge, providing tools to put the knowledge into practice, utilize standardized performance measures, provide data feedback, and the development of quality improvement processes (IOM, 2005). Public and private sector health care organizations have implemented several national initiatives focused on performance measurement and quality improvement in recent years. These initiatives have multiple purposes within a health care organization, one being the assessment of organizational performance, which can help inform and motivate staff to improve the quality of care. Sharing data on standardized quality measures allows health care organizations to benchmark with their peers, and public reporting of comparative information can be used to improve purchaser decision making. While quality is viewed as a multidimensional construct (WHOQOL, 1998), health related quality of life domains minimally include "physical functioning, psychological well-being, social and role functioning and health perceptions" (Hennessy, Moriarty, Zack, Scherr & Brackbill, 1994).

In 2008 the Agency for Healthcare Research and Quality (AHRQ) described limited access to comprehensive, quality healthcare as impacting quality of life, Detection and treatment of health conditions, Life expectancy, Prevention of disease and disability, Preventable death, as well as Overall physical, social, and mental health status. Among barriers to Healthcare services AHRQ listed High healthcare cost, Lack or limited healthcare providers' availability and or services, Lack of healthcare insurance coverage, Delays in receiving healthcare, Unmet health needs, Lack of preventive healthcare services, Avoidable Hospitalizations.

While access to healthcare is of utmost importance, quality is recognized as equally important. AHRQ acknowledges the importance of making healthcare affordable, equitable, safer, more accessible and of the highest quality. AHRQ often collaborates with the U.S. Department of Health and Human Services (HHS), and other healthcare organizations, to ascertain that the evidence is thoroughly comprehended and utilized accordingly. Some of the AHRQ's priority areas of focus include:

- Improving healthcare quality. Can we convert this into text, too?

  AHRQ will expedite the implementation of patient-centered outcomes research (PCOR)

- Make health care safer.

  AHRQ conducts patient safety research which investigates how patients are harmed, the reasons why the harm took place, and the ways to prevent such harm. Thereafter, AHRQ translates the investigation or the research's outcome into "practical tools for providers to use in making health care safer" (AHRQ, 2008).

- Evaluate the Affordable Care Act (ACA) coverage language in order to enhance healthcare accessibility.
- Improve healthcare cost transparency, efficiency and affordability.

However, as noted in Figure 2, devised by the researcher below, healthcare quality, access, cost and outcome are interconnected, interrelated and therefore equally important to healthcare providers and organizations.

Figure 2. Healthcare Access, Quality, Cost and Outcomes

Some hospitals have seen improvements in the quality of healthcare provided as a result of new legislation, changes in Medicaid/Medicare and primary insurers' payment practices. For example, Blue Cross Blue Shield of Massachusetts (BCBS) implemented a global payment model that shares cost savings and deficits with its providers. This strategy uses risk as a motivator to control costs. Additionally, bonuses and financial incentives create an environment where serving the patient thoroughly, with consistent diligence is in the best financial interest of a healthcare provider (Song, Gelb, Landon, et al, 2011)

As payers reward providers for greater efficiency and lower costs, caution must be taken to avert encouraging a lesser quality of care. Factors such as leadership, whether it is a non-profit or for profit organization, and the number of Medicaid patients seen must also be considered when comparing cost verses quality. According to authors such as Ashish, Orav, Dobson, & Epstein, (2009) in their article - Measuring Efficiency: The Association of Hospital Costs and Quality of Care - low cost hospitals generally have somewhat worse quality of care for common medical conditions, but a significant amount of research is still required to clearly understand the relationship between costs and quality of care.

With the passing of the Patient Protection and Affordable Care Act (PPACA) in March of 2010, the future of healthcare delivery and financing will most likely look much different than it ever has before. A basic challenge facing healthcare executives and providers will be a premise that they must deliver more care, not compromise quality or safety, and probably be paid less for the delivery of care. Many healthcare executives are facing these challenges by evaluating the very care they deliver and the number of services they can continue to support within their healthcare delivery system. Most consumers expect that a facility holding itself out to be a hospital will provide emergency care and have inpatient facilities.

The Affordable Care Act (ACA) also often referred to as Obama care, caused the development of new programs focused on changing the way healthcare is delivered and how providers are paid. Accountable Care Organizations (ACO) are committed to caring for and supporting a group of patients, by doing so the patient can benefit from improved care and coordination of services. One barrier to meeting this commitment is that a patient's socioeconomic characteristics can have a direct impact on their ability to access quality care (Epstein, Ashish, Orav, et al, 2014).

Studies show that Medicaid patients have worse access as well as healthcare outcomes than patients privately insured. This is certainly a result of the gross difference in Medicaid's payments for service, which amounts to 56 percent of what a private insurer would pay. With such a low reimbursement rate, many low income patients find it extremely difficult to locate a primary care physician or specialist that accepts Medicaid in their area. This can lead to exacerbated health conditions, longer hospital stays, and ultimately higher health care costs (Durham J, Owen P, Bender B, et al., 1998).

Studies exploring the quality of care delivered in rural hospitals are limited, by extension this would include CAH's (Baernholdt, Jennings & Lewis, 2013). In one study that evaluated mortality rates for AMI, congestive heart failure and pneumonia in CAH facilities, as compared to non-CAH facilities, the conclusion indicates that outcomes were worse in the CAH facilities during the period of 2002 – 2010 (Joynt, Orav & Jha, 2013). In another study eight common surgical procedures were evaluated for mortality variation between CAH and non-CAH facilities, no differences were discovered (Gadzinski, Dimick, Ye & Miller, 2013).

At the same time, the relevance of hospital outpatient quality measures for rural hospitals was questioned in a 2012 study and concluded that there may be value in extending evaluation periods so sample size can be increased (Casey, Prasad, Klingner & Moscovice, 2012). In addition to sample size being small another study made recommendations about relevant quality measures; they include specific medical conditions, care across multiple conditions and the ED (Casey, Moscovice, Klingner & Prasad, 2013). In 2009 a grant funded collaborative activity between rural hospitals demonstrated that the culture is different than urban environments, financial characteristics and organizational structures vary from urban, and technology structure is different (Tietze, Williams & Galimbertti, 2009). In 2006, Winterstein et al, described

medication safety infrastructure, and emphasized the need for CAH's to focus on medication reconciliation, use of standard procedures when able, encourage a culture of safety, promote a continuum of care and prioritize information technology investments (Winterstein, Hartzema, Johns, DeLeon, McDonald, Henshaw & Pannell, 2006). Recently, medication error reporting in CAH's was studied by Scott et al, they found that using a telepharmacy model was helpful in identifying and resolving quality related events (Scott, Friesner, Rathke & Doherty-Johnsen, 2014). In 2004 a study by Pink et al assessed what exists to date that allows CAH's to be comparatively evaluated and found that little is in place to allow for that comparative analysis (Pink, Slifkin, Coburn & Gale, 2004). Similarly, a comparative study of financial data sources by Ozmeral et al in 2012, found that audited financial statements across a sample of non-profit CAH's showed significance variance and opportunities to improve the quality of these statements should be considered (Ozmeral, Reiter, Holmes, & Pink, 2012).

For a small rural hospital, it would be beneficial to implement processes that create a lean and efficient healthcare system. Challenges of healthcare reform have certainly brought about a strong decree for change as well as a sense of urgency. Lean methods and techniques can assist small and rural hospitals to streamline processes, increase efficiencies while positively impacting patient outcomes and satisfaction, which are critical to the success of organizations if they are to overcome most of the health care reform challenges. For instance, length of patient stay in a hospital is considered one of the critical measures of efficiency and performance. Gautam et al studied the technical efficiency of CAH's and found that in Missouri there is relative inefficiency as compared to hospitals paid under a prospective payment model, these findings indirectly

confirm the challenges that CAH's face (Gautam, Hicks, Johnson & Mishra, 2013). However, Nedelea & Fannin reached a different conclusion and stated that cost based reimbursement may not have had a negative impact on the technical efficiency previously described (Nedelea & Fannin, 2013).

The effect of staffing on quality of care was studied in many healthcare areas. Needleman et al found in 2002 that more hours of care being delivered by registered nurses was linked to better patient care (Needleman, Buerhaus, Mattke, Stewart & Zelevinsky, 2002). Given the financial strain placed on hospitals, it is not uncommon for a hospital or provider to be understaffed or improperly staffed at peak times or for unexpected emergencies. As Stanton stated in his article - Hospital Nurse Staffing and Quality of Care" – published in AHRQ, "Hospitals without adequate nursing staff tend to have higher rates of poor patient outcomes. Being under staffed can easily tip the quality of care scale in almost any organization" (Stanton, 2004). Ironically, Mark et al demonstrated that there may not be a link between higher registered nurse staffing and improved quality of care (Mark, Harless, McCue & Zu, 2004). For a CAH staffing patterns can be even more detrimental, because there may not be enough available skilled professionals or resources to support their community's healthcare needs. Therefore, many CAH's must transfer patients on to other acute care hospitals. To successfully transfer a patient in today's healthcare environment a hospital must have adequate and necessary technology in order to efficiently share crucial information with other providers, especially if they are seeking to become an ACO (Joynt, Harris, Oray & Jha, 2011).

For CAH's, human resource management was viewed, along with revenue/cost and capital strategies, as being used as a financial improvement strategy (Holmes & Pink, 2012). Similarly Marsh et al proposed the removal of federal and state restrictive advance nurse practice

barriers, that are often embedded in law or policy, to improve the utilization of this cost-effective provider (Marsh, Diers & Jenkins, 2012). Small staff was listed as one of the many challenges in implementing quality improvement initiatives in CAH's, along with limited resources, low patient volumes, and inadequate information technology systems (Casey & Moscovice, 2004).

One of the major disadvantages for CAHs is the high cost associated with having a robust Information Technology (IT) system to run the organization internally while providing seamless external communication and data transfer. Many rural hospitals lack the budgets to afford the process measuring tools needed to steer their organization on a path to success. As a result CAH's still face many challenges such as limited technologies and slightly worse patient outcomes. Studies have shown that implementing an electronic medical record system does improve the quality of patient care, but at a cost (Wang, et al 2003).

Nonetheless, healthcare outcome measures are also very crucial to healthcare providers and patients alike, particularly in terms of morbidity and mortality. Notably, healthcare outcomes entail the greatest entanglement because a large portion of variance in outcomes is attributable to environmental factors as well as the patient.

In furtherance of facilitating healthcare cost and transparency, AHRQ determines measures and public reporting strategies that results in data about healthcare cost and quality. Thus, it is imperative to AHRQ to construct and disseminate evidence and mechanisms that can be used to measure and advance the efficiency of healthcare systems. In order to pinpoint factors differentiating systems that perform better from those that perform poorly, AHRQ analyzes variations in the utilization of resources as well as in quality of care delivered. Thus, according to AHRQ, the ability to deliver quality care and sustainable results without the overutilization of resources will significantly contribute to the overall performance of a healthcare system (AHRQ, 2008).

There are several studies that compare the cost of health care to the quality of care received (Arah, Klazinga, Delnoij, Ten Asbroek & Clusters, 2003; Connolly & Cohen, 2009). One may assume that the more money he/she pays for care the better the outcome, however according to the American Medical Association, this is not necessarily the case. Many studies revealed that the cost of care did not ensure a consistent quality of care and that the underlying issue is more likely to be how these costs are derived and allocated, although over time these costs tend to stabilize for small, medium and large hospitals (Lena, Chen, Ashish, Jha, Guterman, Ridgway, Orav, & Epstein, 2010).

According to Lawton Robert Burns, director of the Wharton Center for Health Management and Economics, a shorter length of stay can result in hospital beds turning over rapidly and therefore more patients are taken care of without a hospital incurring an additional cost. However, in order to achieve this, sacrifices are typically made in other areas which could include the services provide and the level of expertise afforded. The unfortunate reality of improving organizational processes is that it can easily take 3 to 5 years to reap the benefits they may offer as indicated in Figure 3. Hence, many smaller CAHs have difficulty creating a financial bridge to reach the other side.

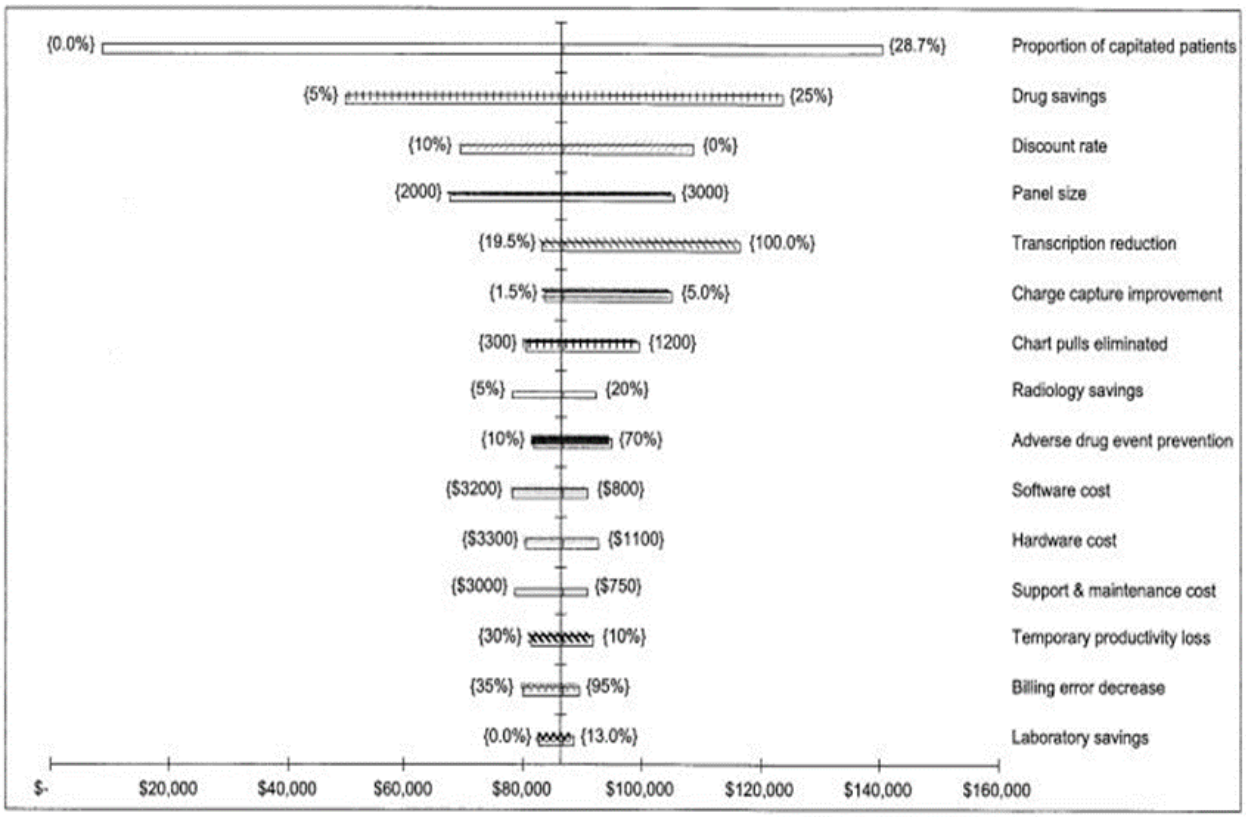

Figure 3. Cost-Benefit Analysis of Electronic Medical Records/Wang et al
Note: Tornado diagram showing the one-way sensitivity analysis of net 5-year benefits per provider. Each bar depicts the overall effect on net benefits as that input is varied across the indicated range of values, while other input variables are held constant. The vertical line indicates the base case.

Some studies describing the cost of un-insurance high rates to communities have indicated that hospitals which are unable to cope with rising costs of healthcare could cease to exist (Paganand & Pauly, 2006). As the researcher indicated earlier in this study, this could certainly devastate a rural community because CAHs provide the first point of access to emergency care for approximately 20% of Americans who are living in these rural areas. As a consequence, studies and work relative to enhancing quality of care and creating policies that ensure best care continues to be delivered, particularly in CAH's are pivotal. Among other benefits, this will also help CAH's avoid having to transfer patients to urban hospitals because they do not have the service or the right provider.

Many consumers also have expectations of the quality of care providers may be able to deliver and associate that care with those providers being board-certified. In a small rural hospital, attracting board-certified emergency medicine physicians to staff your ED may not be practical even when they can be recruited. Many physicians today are also interested in having a personal life and do so by limiting the hours they are available to care for patients. For primary care providers, limiting hours are typically referred to as an outpatient only model of care, which means the primary care providers will not be interested in rounding on any patients that they may have admitted to the hospital for an inpatient stay.

What primary care providers tend to for is a hospital that has organized itself such that the inpatient stay is covered by a hospitalist. To fulfill the staffing of the ED and covering the inpatient stay, some small rural communities with volumes in the ED of less than 10,000 per year are integrating the ED staffing and hospitalist service into one program. When integrating services healthcare executives must be sensitive to not compromising the quality of care or patient safety for patients seeking care in the ED or inpatient area

Critical Access Hospital Programs

In 1997 the Balanced Budget Act (BBA) created a Medicare Rural Hospital Flexibility Program (FLEX) that allowed for a new hospital classification, the CAH (Dalton, Slifkin, Poley & Fruhbeis, 2003). The purpose of creating a CAH designation was to allow for cost based reimbursement to the CAH for Medicare beneficiaries seeking care, this would be better than the reimbursement received under the prospective payment system they were working under. The now certified CAH began to experience better financial viability than they had been seeing, which in turn re-enforced the healthcare safety net for rural communities (Reif & Ricketts, 1999).

Although CAH's are often viewed as having fewer services than non-CAH facilities, this should not be confused with lesser quality. To be considered applicable for CAH certification a hospital must be in a rural area, providing both inpatient and outpatient services, maintain an open emergency department 24 hours per day, have less than 96 hours for overall length of stay and not be licensed for more than 25 beds (Nedelea & Fannin, 2012). How care is organized and delivered is under increased scrutiny, payment for services are not increasing and innovation is becoming a requirement for growth.

Providing emergency department (ED) services in rural hospitals has always been a challenge. Recruiting board-certified emergency medicine physicians is expensive and quite often they are difficult to recruit to rural ED's. Justifying the expense, particularly in today's healthcare reform environment, has resulted in exploring alternative ways to provide ED care without compromising quality and patient safety.

Many studies have indicated that length of hospital stay for patients with Myocardial Infarction has significantly declined since the 1980s. However, according to these studies there is no clear association of re-hospitalization and higher death rates after discharge from the hospital for Myocardial Infarction. Declines in length of hospital stay were correlated to increased readmissions within 30 days in a study of approximately 8600 Medicare patients with AMI between 1991 and 1997 (Husak & Cebul, 2004). The study's findings also indicated that the declining hospital length of stay was not related to the higher 30 day death rates in every patient, instead it was observed that AMI patients with a predetermined do-not-resuscitate (DNR) order had a higher post-discharge mortality. This study concluded that certain groups are likely to be at risk for undesirable outcomes after a shorter hospital length of stay (Husak & Cebul, 2004).

AMI has traditionally ranked high when evaluating leading causes of death in the U.S. and chest pain accounts for 5 – 8% of ED visits (French, 2000). In 1990 the National Registry of Myocardial Infarction (NRMI) was formed and continued to exist until 2006. The NRMI database has been analyzed and published many times and primarily contributed to the quality measure development used today to monitor and guide practitioners in the best practices for treating AMI/CP (French, Reddy & Barron, 2012).

Outpatient Core Measures

In 1992 the Health Care Financing Administration (HCFA), the agency responsible for monitoring and ensuring quality care is delivered to Medicare beneficiaries, introduced a Health Care Quality Improvement Initiative (HCQII) (Jencks & Wilensky, 1992). The first initiative focused on AMI and the investigation was overseen by the Cooperative Cardiovascular Project (CCP), a group reporting through the HCQII. A CCP Steering Committee decided to assess the use of care indicators determined to be representative of quality care for AMI patients (Vogel, 1994).

The CCP Steering Committee choose 13 care indicators described by the American College of Cardiology and American Heart Association practice guidelines, as seen in table 2 (Gunner, Passamani, Bourdillon, Pitt, Dixon, Rapaport, Fuster, Reeves, Karp, Russell, Kennedy, Sobel, Klocke, Winters, Fisch, Beller, DeSanctis, Dodge & Weinberg, 1990). Of the 13 care indicators, confirmation of an AMI and the timing of administering aspirin could become a core measure for assessing the delivery of care when a patient presents to the ED with symptoms or complaints consistent with an AMI/CP.

In 1969 a controlled trial of aspirin administration to patients who had survived a myocardial infarction was conducted by Peter Elwood, the results were published in 1974. More than one thousand male patients with post infarction diagnoses were randomly selected and put either on a dose of 330 mg aspirin or a daily matching placebo. The findings indicated that there was a 24% reduction in mortality in patients that were put on a daily dose of aspirin (Elwood, et al, 1974). This study sparked a wide interest and many other aspirin trials have been conducted and published as early as 1980. For instance, in 1994, the Antiplatelet Trialists Collaboration published another successful aspirin trial study.

These studies indicate that aspirin is by far the most comprehensively researched available drug used for vascular disease in clinical practice (Ridker, Cook, Lee, Gordon, Gaziano, Manson, Hennekens, & Buring, 2005). In fact, the American Heart Association (AHA) stated "In high-risk patients, aspirin reduced non-fatal MI's by 30% and vascular death by 17%." Many study findings have suggested that aspirin is straightforward and easy to administer, it is relatively safe and has served as one of the most effective treatments that makes a crucial difference in reducing mortality for patients with symptoms associated with an AMI/CP (.Redberg, Benjamin, Bittner, Braun, Goff, Havas, Labarthe, Limacher, Lloyd-Jones, Mora, Pearson, Radford, Smetana, Spertus, & Swegler, 2009).

An assessment of performance when treating AMI/CP in three New England states was done in 1998 and found five quality indicators had the most impact on outcomes: aspirin during hospitalization, thrombolytics, aspirin at discharge, beta-blockers at discharge and calcium channel blockers not being used (Ramunno, Dodds & Traven, 1998). In one study aspirin administration was discovered to have had the largest impact on decreasing 30 day mortality of AMI patients (Heidenreich & McClellan, 2001).

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Table 1. Quality of Care Indicators

Quality of Care Indicator
Confirmation of an acute myocardial infarction
Thrombolytics
Aspirin during hospitalization
Heparin
Transfer or catheterization of recurrent angina
Intravenous nitroglycerin for persistent chest pain
Timing of thrombolytics
Timing of aspirin
Aspirin at discharge
Beta blockers at discharge
Angiotensen converting enzyme inhibitors for low LVEF
Smoking cessation advice
Exercise stress testing

For the purpose of measuring performance in the outpatient environment, the Center for Medicare and Medicaid Services (CMS) has established core measures. In the ED, performance can be measured on patients presenting with an AMI/CP. According to an expert consensus document, a universal definition of myocardial infarction is when there is evidence of myocardial necrosis consistent with myocardial ischemia in a clinical setting (Thygesen, Alpert & White, 2007). Electrocardiogram (ECG) changes consistent with ischemia, ST elevation, is

still considered a reliable diagnostic tool for detecting acute myocardial infarction (Sarafoff, Vochem, Fichtner, Martinoff, Schwaiger, Schomig & Ibrahim, 2011). Those core measures for the AMI/CP patient are aspirin administered within 24 hours of admission and an ECG being done within 10 minutes of admission.

Quality

Defining and measuring the quality of medical care has been under study for many years and understandably evolving with time. In 1949 and 1954 the Health Insurance Plan of Greater New York authorized studies of the quality of medical care, these focused on case record reviews and assignment of an impression by the reviewer of good, fair or unsatisfactory care (Daily & Morehead, 1956). The Health Insurance Plan of Greater New York requires physicians to submit a preliminary diagnosis on each claim; the form used for this is called a "Med 10". From the "Med 10's" cases were selected for review, one assumption based on their experience was that when a physician manages one type of case well they manage all cases well (Daily & Morehead, 1956). As a result of this study several physicians were removed from the panel of physicians providing services for the plan and this was based on the outcome scoring of good, fair or poor medical care.

Taking the concept of observing a narrow range of medical care delivered and drawing conclusions about the quality of care delivered by the practitioner or group was also studied by Kessner and reported on in 1973. Dr. Kessner stated that "…… how a physician or team of physicians routinely administers care for common ailments will be an indicator of the general

quality of care and efficacy of the system delivering that care" (Kessner, Kalk & Singer, 1973). The method described is called a "tracer method", and in this studies case the tracer will be patients discharged from the ED with symptoms of an AMI/CP.

In 1933 Lee & Jones studied the concept of good medical care and described "articles of faith" that the studied concept was based upon: good medical care is limited to the practice of rational medicine based on the medical sciences; good medical care emphasizes prevention; good medical care requires intelligent cooperation between the lay public and practitioners of scientific medicine; good medical care treats the individual as a whole; good medical care maintains a continuing and close relation between physician and patient; good medical care is coordinated with social welfare work; good medical care coordinates all types of medical services; good medical care implies the application of all the necessary services of modern, scientific medicine to the needs of all the people (Lee & Jones, 1933).

These "articles of faith" are still used today when assessing the quality of medical care. The authors also acknowledge that although good practitioners are required for the delivery of good medical care, how the care is organized and the facility where the care is rendered is also important for achieving good medical care (Lee & Jones, 1933). Measuring medical care is often subjective and unreliable as a definitive measure that is reproducible. Finding standards of care for specific diagnoses are known today as evidenced based practices and they serve as guidelines for how to approach care. When an evidence based practice is available those elements of care can be measured and used to judge the quality of care (Sheps, 1955). For this study the standard of care, using evidence based practice, is the administration of aspirin within 24 hours of discharge and acquiring an ECG within 10 minutes of arrival to the ED.

Donabedian, when defining quality, divides the management of care into two domains; technical and interpersonal (Donabedian, 1980). He further describes the technical domain of care as that which would fit into the reference to evidence based care, applying the science and technology of medicine (Donabedian, 1980). In another paper, Donabedian discusses the literature with respect to methods used to evaluate the quality of medical care and introduces his hallmark theoretical framework of structure, process and outcome (Donabedian, 1966).

In 2006 Rangachari et al demonstrated that quality improvements can be made without having to add new technology (Rangachari & Hutchinson, 2006). They discovered how a CAH could improve their facility by collecting data and analyzing it in a useful way. It has been said that change can be terrifying, does not come easy or without a cost, however this study demonstrates how a CAH was able to use internal resources to improve their existing organizations framework successfully.

Recently there have been some very ambitious plans and strategies for bringing CAH's together to create a balanced healthcare system. The Pennsylvania Critical Access Hospital Consortium (PCAHC) is a collaborative of 12 CAH's that are leading a charge to improve processes and support performance improvements for their rural healthcare system. Baronner et al said that the PCAHC is succeeding because of their vigorous data collection and reporting practices that allow them to compare performance. These tools make it easier to identify weaknesses to be improved upon (Baronner & Wolf, 2006).

While conducting this literature review the researcher did not discover any study evaluating the ED physician staffing model and its impact on outcomes. The types of physicians used to staff small and rural ED's has been described but not assessed in terms of performance. Current examples of additional care being provided by Hospitalists in small and rural hospitals

did reveal that 17% of the 329 surveyed were also covering the ED (Casey & Moscovice, 2012). It is important for patients and hospital administrators to understand the options available to them when considering how to staff their ED's. This study evaluates three ED physician staffing models outcome performance when treating AMI/CP, important when considering staffing options.

CHAPTER III

METHODOLOGY

Purpose of the Study

The researcher is interested in determining if the quality of care delivered in the ED to those patients presenting with AMI/CP is compromised by the physician staffing model. In this case, the researcher was interested in whether or not the primary care ED physician staffing model compromises the quality of core measures, because these physicians are easier to recruit and can fulfill an additional task, that being a hospitalist role. If quality measures are not compromised then hospital executives may have alternatives to consider when staffing their ED.

The purpose of this study is to determine if there is any significant association between ED physician staffing models and the management of patients presenting to the ED with symptoms of an AMI/CP. In order to answer the research question the following hypotheses were developed.

Hypotheses

H1: There is a significant association between the ED physician staffing models used in a CAH and aspirin administration documented as done within 24 hours of a patient admission with symptoms of an AMI/CP from the ED.

Dependent Variables: Aspirin Administered Within 24 Hours of Admission

Independent Variables: Model A, Model B and Model C

H2: There is a significant association between the ED physician staffing models used in a CAH and an EKG being done within 10 minutes of a patient admission with symptoms of an AMI/CP from the ED.

Dependent Variable: EKG Administration within 10 Minutes of Admission

Independent Variables: Model A, Model B and Model C

The rationale for the above hypotheses is to determine if any of the physician staffing models performs better when caring for an AMI/CP in the ED. This can be accomplished by testing for any significant difference in meeting the two outpatient core measures for AMI/CP.

This quantitative study's objective is to quantify relationships among variables. It utilized quantitative research methods, descriptive and an inferential statistical approach to investigate factors associated with ED physician staffing models, AMI/CP as well as outpatient core measures. This study evaluates three different physician staffing models for the ED of a CAH that has less than 10,000 visits in the ED per year. The diagnosis observed during this period was acute myocardial infarction (AMI) and chest pain (CP) and the observation was whether the outpatient core measures were met for these diagnoses.

Study Independent Variables

ED physician staffing models were described by how they are organized, board certification, additional certifications and primary residency training. Additional certifications include Advanced Cardiac Life Support (ACLS), Advanced Trauma Life Support (ATLS), Pediatric Advanced Life Support (PALS) and Basic Life Support (BLS); all of these elements are considered characteristics of the model. Table 2 organizes the ED physician staffing characteristics and provides the reader a glance at what characteristics each model has; the characteristics are not all necessarily desirable just descriptive for model differentiation. In the Donabedian structure-process-outcome framework, the ED physician staffing model is the process; the work done by the physician when assessing, diagnosing and treating the patient (Donabedian, 1980).

Table 2. Emergency Department Physician Staffing Models

Characteristic	Model A	Model B	Model C
Family Medicine Boarded	X		X
Internal Medicine Boarded	X		X
Emergency Medicine Boarded		X	
Emergency Medicine Resident	X	X	X
Allergist	X		
Obstetrics Gynecology	X		
Pediatrician	X		
Hospital Employed, Local Physicians	X		
Contracted Through Staffing Group, Visiting Physicians	X	X	X
Provide Hospitalist Service Also			X
ACLS, ATLS, PALS, BLS Certified		X	X

Model A

This model represents a mixed physician staffing pattern that is reminiscent of how many rural Ed's were staffed, and in some cases still are today (Williamson, Rosenblatt & Hart, 1992). This model required hospital employed primary care physicians to cover the ED from 0800 – 2000 each Monday through Friday and they could cover from their primary care practice office. The ED was staffed by nurses 24 hours per day 7 days per week and they would contact the primary care physician on call when a patient presented to the ED. A large national staffing agency was contracted by the hospital to provide coverage during the remaining 12 hours each week day and provide coverage on holidays and weekends. The staffing agency contracted with any physicians in the area that wanted to cover the ED, including many of the local employed primary care physicians.

Model B

Model B was a significant departure from Model A by the hospital contracting with a large national staffing agency for all of the physician coverage of the ED. The contract also

required the physicians to provide hospitalist coverage for inpatients. Because the staffing agency focused on providing only board certified emergency medicine physicians, the hospitalist coverage component was never fulfilled. The board certified emergency medicine physicians felt it was unsafe for them to perform the hospital component of the contract and refused to do so.

Those physicians who were in an emergency medicine residency program did not view the hospitalist component as problematic. The contracted service was for 24 hours per day 7 days per week and was required to provide a Medical Director for the service. The Medical Director would communicates with the hospital President/CEO, review all candidates and make recommendations for those candidates deemed suitable and worthy of credentialing.

Model C

The last model C was similar to Model B accept that the hospitalist component must be provided in addition to covering the ED. This model is also provided to the hospital by contract with a large national staffing agency. This group focused on providing physicians that are primary care certified, have always worked in rural ED's or urgent care facilities. Due to the primary care component no objections to covering the hospitalist care has risen. The service is contracted for 24 hours per day 7 days per week and a Medical Director for the service is provided. As with Model B, the Medical Director communicates with the hospital President/CEO, reviews all candidates and makes recommendations for those deemed suitable and worthy of credentialing.

Study Dependent Variables

As discussed earlier, AMI has ranked high as a leading cause of death in U.S. and chest pain (CP), which can be a symptom of an AMI, accounts for 5-8% of ED visits (French, 2000). A universal definition of myocardial infarction (MI) is when there is evidence of myocardial necrosis consistent with myocardial ischemia in a clinical setting (Thygesen, Alpert & White, 2007). An electrocardiogram (ECG) is considered to be a reliable diagnostic tool for detecting AMI (Sarafoff, Vochem, Fichtner, Martinoff, Schwaiger, Schomig & Ibrahim, 2011). It is therefore understandable why obtaining an ECG on patients presenting to an ED with symptoms consistent with an AMI is important. CMS has recommended that patients presenting to an ED with AMI/CP symptoms have an ECG done with 10 minutes of arrival (CMS-2, 2011). Patients presenting to the ED with symptoms of an AMI/CP were coded as receiving an ECG if it has been documented in the EMR as done within 10 minutes of arrival in the ED.

Aspirin is considered the most appropriate treatment for patients presenting to an ED with symptoms consistent with AMI/CP. The evidence for aspirin administration is grounded in the reduction in adverse events and the impact on mortality is similar to fibrinolytic therapy (CMS-1, 2011). Patients presenting to an ED with symptoms of an AMI/CP were coded as receiving aspirin if aspirin has been documented in the EMR as given within 24 hours of admission or before being transferred to another hospital for additional treatment.

Study Control Variables

Demographic data were collected and analyzed to control for patient characteristics when measuring the association between staffing models and quality outcomes. Those demographic data elements are age, gender, race and health insurance type; it is important to analyze these

variables to avoid biases when testing the hypotheses. If the control variables were not assessed, the study may presume significance with a physician staffing model when the difference in the outcome is associated with a population demographic like age.

Data Sample and Data Sources

All of the diagnostic codes in table 3 for an AMI/CP patient presenting to the ED, from 2008 through 2012, were used to identify the population for this study. The codes are defined by CMS and are discharge diagnosis codes. The diagnosis codes are listed under the National Quality Measures Clearinghouse (NQMC), which is part of the Agency for Healthcare Research and Quality (AHRQ), which is part of the US Department of Health and Human Services (HHS).

Table 3. ICD-9-CM Diagnosis Codes

ICD-9-CM Diagnosis Codes For Acute Myocardial Infarction and Chest Pain			
Code	Description	Code	Description
410.00	AMI Anterolateral Unspecified	410.01	AMI Anterolateral Initial
410.10	AMI Anterior Wall Unspecified	410.11	AMI Anterior Wall Initial
410.20	AMI Inferolateral Unspecified	410.21	AMI Inferolateral Initial
410.30	AMI Inferoposterior Unspecified	410.31	AMI Inferoposterior Initial
410.40	AMI Inferior Wall Unspecified	410.41	AMI Inferior Wall Initial
410.50	AMI Lateral NEC Unspecified	410.51	AMI lateral NEC Initial
410.60	True Posterior Infarct Unspecified	410.61	True Posterior Infarct Initial
410.70	Subendo. Infarct Unspecified	410.71	Subendo. Infarct Initial
410.80	AMI NEC Unspecified	410.81	AMI NEC Initial
410.90	AMI NOS Unspecified	410.91	AMI NOS Initial
411.10	Intermediate Coronary Syndrome	411.89	Acute Ischemic Heart Disease NEC
413.00	Angina Decubitus	413.10	Prinzmetal Angina
413.90	Angina Pectoris NEC/NOS	786.50	Chest Pain NOS
786.52	Painful Respiration	786.59	Chest Pain NEC

Study Data and Sampling Methodology

This study utilizes secondary data collected by McKenzie Health System (MHS). MHS is a CAH founded in 1959 and it is dedicated to providing the highest quality healthcare in an efficient and companionate manner to its rural community in Michigan.

The researcher intends to utilize secondary data that resides in the hospital's electronic medical record (EMR) system; see Table 4. The total time period under study was 5 years beginning January 1st, 2008 and ending December 31st, 2012. Emergency department physician staffing Model A was in place from January 1, 2008 through August 20, 2009 and this period was 598 days. Emergency Department physician staffing Model B was in place from August 21, 2009 through April 10, 2011 and this period was 598 days. Emergency department physician staffing Model C was in place from April 11, 2011 through December 31, 2012 and this period was 631 days.

Table 4. Variables

Variable	Description	Type
Model_A	Represents data under model A, from January 1, 2008 through August 20, 2009	Binary, coded as 1 for patients served between 1-1-2008 and 8-20-2009 and 0 for others
Model_B	Represents data under model B, from August 21, 2009 through April 10, 2011	Binary, coded as 1 for patients served between 8-21-2009 and 4-10-2011 and 0 for others
Model_C	Represents data under model C, from April 11, 2011 through December 31, 2012	Binary, coded as 1 for patients served between 4-11-2011 and 12-31-2012 and 0 for others
Aspirin	Aspirin administration within 24 hours of admission to the ED	Binary, coded as 1 for patients who received aspirin, and 0 for those who did not

Table 4. Variables (continued)

Variable	Description	Type
ECG	ECG done within 10 minutes of admission to the ED	Binary, coded as 1 for patients who received ECG, and 0 for those who did not
Gender	Male or Female	Binary variables, coded as 0 for Male and 1 for Female
Age	Number of full years at the time of ED admission	Continuous, range 0-99
Race	White	Nominal, coded as 1 for White, 0 for not White
Race	Black	Nominal, coded as 1 for Black, 0 for not Black
Race	Hispanic	Nominal, coded as 1 for Hispanic, 0 for not Hispanic
Race	Asian	Nominal, coded as 1 for Asian, 0 for not Asian
Race	Other	Nominal, coded as 1 for Other, 0 for not Other
Insurance	Blue Cross	Nominal, coded as 1 for Blue Cross, 0 for not Blue Cross
Insurance	Medicare	Nominal, coded as 1 for Medicare, 0 for not Medicare
Insurance	Medicaid	Nominal, coded as 1 for Medicaid, 0 for not Medicaid
Insurance	Other	Nominal, coded as 1 for Other, 0 for not Other

Statistical Tests

Descriptive statistical analysis of the data was conducted to identify appropriate measures of central tendency and manage the data in a meaningful way for the reader by producing graphs and charts that illustrate the data distribution. Because the majority of variables are binary the researcher calculated proportions in order to determine the quality of data. For age, the mean and standard deviation was calculated to assess the distribution. The data was also be checked for reliability,

validity and accuracy. In order to accurately answer the research question, the researcher must determine that the data is appropriate with regard to its applicability, efficacy and concurrent for the purpose.

In this study, most of the data level of measurement is nominal. The data was be categorized by model in terms of how many instances each issue would be identified by each model. Thereafter the descriptive statistics technique was employed for the purpose of computing applicable measures of central tendency for all the models.

For the first hypothesis the researcher conducted logistic regression in order to estimate the effect of staffing models on the quality indicator, measured by aspirin administration within 24 hours of admission to the ED with symptoms of AMI/CP. For the second hypothesis the researcher conducted logistic regression in order to estimate the effect of staffing models on the quality indicator, measured by an ECG being done within 10 minutes of admission to the ED with symptoms of AMI/CP. However, this statistical tool did not perform as anticipated and the researcher defaulted to an odds ratio.

A binomial logistic regression attempts to predict the probability that an observation falls into one of two categories of a dichotomous dependent variable based on one or more independent variables that can be either continuous or categorical. In many ways, it is similar to linear regression, with the exception of the measurement type of the dependent variable. Unlike linear regression, you are not attempting to determine the predicted value of the dependent variable, but the probability of being in a particular category of the dependent variable given the independent variables. An observation is assigned to whichever category is predicted as most likely (Peng & Ingersoll, 2002).

In order to run a logistic regression, the following requirements must be satisfied:

- Two or more independent variables that can be either continuous or categorical.
- One dependent variable that is dichotomous.

If it is an ordinal independent variable, it must be treated as either a continuous or nominal variable.

Many statistical test techniques carry some assumptions and logistic regression is no exception. Some of the logistic regression assumptions are as follows:

- No significant outliers or influential points
- Independence of cases/errors
- Categories are mutually exclusive and exhaustive
- A linear relationship between the continuous independent variables and the logic transformation of the dependent variable
- No multicollinearity

Logistic regression is commonly used as a method in healthcare research. In a recent study ECG monitoring on patients with pulmonary embolism and patients with pulmonary stenosis was analyzed for predictors of right ventricular overload using logistic regression (Can, Ozveren, Betiker, Sengul, Isailk & Kirilmaz, 2013). In another study logistic regression was used to estimate associations between sexual orientation and substance use (Brewster & Tillman, 2012). A paper discussing the use of logistic regression models when investigating birthweight coded as low or not pointed out that logistic regression is often used in quantitative healthcare research, particularly when looking at multiple factor effect on binary outcomes (Bonellie, 2012).

The regression model used is presented below:

Aspirin = β0 + β1*Model_A + β2*Model_B + β3*Model_C +β4*Age + β5*Gender + β6*Race + β7*Insurance.

Primary interest of the study is β1, β2, and β3, as coefficients that measure the effect of each model on the probability that a patient will be given aspirin on time. The coefficients would be considered statistically significant if associated p-value is below 0.05.

For the second hypothesis the researcher used logistic regression in order to estimate the effect of staffing models on the quality indicator, measured by an ECG done within 10 minutes of admission to the ED with symptoms of AMI/CP.

The regression model used is presented below:

ECG = β0 + β1*Model_A + β2*Model_B + β3*Model_C +β4*Age + β5*Gender + β6*Race + β7*Insurance.

Primary interest of the study is β1, β2, and β3, as coefficients that measure the effect of each model on the probability that a patient will have ECG on time. The coefficients would be considered statistically significant if associated p-value is below 0.05.

The researcher utilized statistical software program, Statistical Package for Social Science (SPSS), to calculate expected values. SPSS is considered one of the more powerful tools used for statistically analyzing data. By utilizing SPSS, the researcher was able to conduct an in-depth data assessment, data preparation, and modeling and produce graphic representations, as well as provide for data analytical reporting.

Study Limitations

This study has limitations. This study only analyzed secondary data in one CAH and therefore may not be generalizable to other CAH's. Geographic diversity, community culture and medical staff dynamics may impact the application of any one of the ED physician staffing models described in this study.

This study has limitations related to unknown factors that could affect the quality measures. It is however worth recognizing that unknown factors are a limitation for almost any study and should only be understood to potentially exist.

This study has limitations related to the accuracy of the secondary data used. The researcher has no control over how the secondary data was collected. The researcher has no control over how complete the secondary data captures all ED visits that would have been included in this study. This study however will add to the current body of knowledge particularly as it relates to ED physician staffing model efficiencies in low volume ED's as typically seen in CAH's and/or small rural hospitals.

CHAPTER IV

RESULTS

The purpose of the study was to gain knowledge about the association between ED physician staffing models and the management of patients presenting to the ED with symptoms of an AMI/CP. This study utilized secondary data collected in McKenzie Health System's EMR. As indicated earlier in the study, the data represents a period of 5 years beginning January 1st, 2008 and ending December 31st, 2012. Accordingly, the emergency department physician staffing Model A represents the period of time from January 1, 2008 to August 20, 2009; emergency department physician staffing Model B represents the period of time from August 21, 2009 to April 10, 2011 and emergency department physician staffing Model C represents the period of time from April 11, 2011 to December 31, 2012. Detailed descriptions of the models are provided in Chapter III.

The initial intention was to use a logistic regression to test the first hypothesis stating a significant association between the ED physician staffing models used in a CAH and aspirin administration documented as done within 24 hours of a patient admission with symptoms of an AMI/CP from the ED, as well as the second hypothesis, that stated a significant association between the ED physician staffing models used in a CAH and an EKG being done within 10 minutes of a patient admission with symptoms of an AMI/CP from the ED. Unfortunately the intended statistical method, logistic regression, in the actual analysis lacked predictive power. Overall, the percentage of correctly predicted outcomes (both aspirin administration and ECG) was around 4%; all improvement techniques did not change this percentage significantly. Given that an adequate logistic regression model would normally produce at least 60% of outcomes correctly predicted, the researched had to change the analytic methods. The study utilized the

odds ratio (OR) test that does predict core measure performance by delivery model. The research is not aiming to find out the predicted value of the responding variable rather it is interested in determining the probability of a predictor variable being in a certain category of the responding variable. Thus, the researcher is interested in finding out the association, if any, between ED physician staffing models and the core measure management of patients presenting to the ED with symptoms of an AMI/CP.

Table 5 displays the number of cases which occurred under each staffing model, including absolute frequency and percentage. Patient records collected under Model C represented 45.4% of the total sample, which is slightly higher than a proportion of time in days under that model (34.5%). The researcher did not attempt to manipulate the data to reach equal representation of the three models; however, it is possible that the difference is related to overall demographic changes in Michigan. According to Michigan Department of Community Health percentage of people over 65 years old increased from 12.91% in 2007 to 14.6% in 2012, which is also reflected in more than 150,000 people (MDCH, 2012). Although the population served by CAH is limited by geographic area and the relationship between aging population and number of AMI/CP patients is not necessary linear, this trend may serve as a possible explanation for higher number of ED patients in the latest model. On the other hand, average age of patients was lower under the model 3.

Table 5. Number and Percentage of Observation under each Model

	Frequency	Percent
Model A	262	18.7
Model B	501	35.9
Model C	635	45.4
Total	1398	100.0

At the initial stage of data analysis a descriptive statistics were performed for all the study variables. Table 6 provides the descriptive statistics of study variables in accordance to the level of measurement: ordinal and nominal variables (such as race, gender, medical insurance status) are presented in terms of frequencies; while for interval variable (age) the table reports the mean, minimum, maximum, and standard deviation. Notably, over 95% of patients were white, which reflects overall demographic composition of the population served. Although the table 6 reported all races, due to a very low number of specific races and for the purpose of analysis the race was defined as a nominal variables with two values as whites and non-whites.

Table 6. Descriptive Statistics for Sample Characteristics under Difference Models of Emergency Department Physician Staffing

	Model A		Model B		Model C	
Average age of patients, years (st.dev)	55.87 (18.371)		55.81 (17.738)		54.59 (18.445)	
Minimum	20		19		20	
Maximum	93		97		101	
Total number of patients	262		501		635	
Model A, B & C Comparison						
Variables	Model A		Model B		Model C	
	#	%	#	%	#	%
Gender						
Males	131	50.0	221	44.1	315	49.6
Females	131	50.0	280	55.9	320	50.4
Race						
White	250	95.4	486	97.0	613	96.5
Black	3	1.15	7	1.4	1	.2
Hispanic	6	2.3	7	1.4	19	3.1
Other	3	1.15	1	.2	2	.2
Insurance						
Medicare	114	43.5	216	43.0	235	37.0
BCBS	63	24.0	80	16.0	114	18.0
Medicaid	35	13.4	87	17.4	156	24.6
Other Insurance	50	19.1	118	23.6	130	20.4

One of common assumptions about AMI/CP is age distribution of the patients; therefore it was important to compare mean age of patients under each model to rule out a possibility of age being a factor in the outcome. The researcher conducted a one-way ANOVA in order to compare the means of the age groups among the emergency department physician staffing models for the purpose of determining if aspirin was administered or an EKG was done in the allotted time for patients presenting to the ED with symptoms of an AMI/CP. As reflected in Table 7 below, there were no statistically significant differences in age among the emergency department physician staffing models ($F_{(2,1395)} = 0.8$, $p = 0.449$).

Table 7. ANOVA

Age					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	529.158	2	264.579	.800	.449
Within Groups	461108.679	1395	330.544		
Total	461637.838	1397			

Besides age, there are other demographic characteristics that may affect probability of AMI/CP. The researcher conducted a chi-square test to check the proportions of BCBS (and other binary variables) between the models. This statistical test was utilized in order to substantiate the significance between the sample proportions. The chi-square test is suitable for association between several ordinal variable, for instance, it can be used to test if two variables that are categorical are associated and to investigate whether categorical variable distribution varies from one another. More specifically, this test is very useful in terms of association or independence between nominal or dichotomous variables. Since this statistical test is also able to determine if two variables are statistically independent, it is also commonly known as the chi-

square test of independence. Additionally, the chi-square test is most typically utilized to test the significance for categorical, ordinal or nominal data (Cooper & Schindler, 2008).

This statistical test was utilized to compare the analytical outcomes in order to accept or reject the null hypothesis. The Confidence level used in this study was 95% in order to avoid the erroneous rejection of the null hypothesis when it is actually true. Therefore at a Confidence Level of 95% for the null hypothesis, the researcher would be 95% confident that the decision to reject the null hypothesis is accurate. Specifically, in order to control the Type 1 error – rejecting a true null hypothesis incorrectly - the significance level was set at $a = 0.05$. On the contrary, accepting a false null hypothesis will create a Type II error according to Cooper and Schindler (2008). Therefore, the chi-square outcome would be considered statistically significant if greater than the critical value – $a > 0.05$. In this case, the researcher would fail to reject the null hypothesis. However, if $a < 0.05$, the researcher would correctly reject the null hypothesis.

The researcher conducted a Kruskal-Wallis statistical test in order to determine if there was a difference in proportion for all variables. This statistical test is a nonparametric test often utilized to determine the statistical significance, or lack-thereof, among groups of predictor variables on continuous or ordinal responding variables. The "sig" column in the Hypothesis Test Summary Table 8 reflects the level of statistical significance. Correspondingly, the statistically significant outcome ($p = .022$) of the distribution of BCBS is different between all the models, therefore the null hypothesis was rejected. In this case, the p-value is less than the significance level .05 ($p<0.5$) for the distribution of BCBS, Medicaid, Aspirin and ECG between

models A, B and C and consequently, the alternative hypotheses were accepted. The rest of the null hypotheses were retained and the alternative hypotheses were rejected because each of their computed p-values are greater than .05 (p>.05).

Table 8. Hypothesis Test Summary

Null Hypothesis	Chi-Square statistics (df=2)	Asymp. significance	Decision
The distribution of gender is the same across models	4.063	.131	Retain
White	1.284	.526	Retain
Medicare	5.615	.060	Retain
Medicaid	17.726	.000	Reject
BCBS	7.620	.022	Reject
Aspirin	24.252	.000	Reject
ECG	15.936	.000	Reject
Null hypothesis	Kruskal-Wallis Test	Sig.	Decision
The distribution of gender is the same across models		.131	Retain
White		.526	Retain
Medicare		.060	Retain
Medicaid		.000	Reject
BCBS		.022	Reject
Aspirin		.000	Reject
ECG		.000	Reject
Other insurance		.281	Retain

The Kruskal-Wallis test in the statistics Table 8 reflects a statistical difference in Aspirin ($\chi 2=24.252$, df=2, $p<0.001$) and ECG between the models, as well as for BCBS and Medicaid insurance, and Medicare ($\chi 2=5.615$, df=2, $p>0.001$) reflected a marginal statistical significance, and, as a result, a change in insurance composition between the models. However, the standards for care quality are same regardless of insurance status. Thus, it should be noted that although there is a difference in insurances between models, an ED physicians is required to provide Aspirin to patients with symptoms of an AMI/CP diagnosis regardless of their insurance type,

status or their inability to pay. Consequently, the difference in in insurance type should not be a factor in outcomes.

Frequency Table 9 below reflects the results of grouping variable Model A, Model B and Model C analysis using frequencies.

Table 9. Description of the Outcomes by Three Models

	Model A		Model B		Model C	
	#	%	#	%	#	%
Total cases or patients	262	100.0	501	100.0	635	100.0
Aspirin provided	89	34.0	264	52.7	296	46.6
Aspirin not provided	173	66.0	237	47.3	339	53.4
ECG performed	124	47.3	311	62.1	375	59.1
ECG not performed	138	52.7	190	37.9	260	40.9

The data utilized in this study was segregated into subgroups of differing proportions. Therefore the researcher used control charts because the size of the subgroup varies and the control charts demonstrate a proportion of nonconforming features instead of the precise count. Accordingly, the control charts are used in this study to illustrate how the process changed over time and the time interval is monthly. Explaining specific causes of variation in models is accomplished using the control charts shown below in Figure 4 and 5. Upper and lower control limit lines on the charts serve as indicators for evaluating when aspirin or ECG values fall outside pre-defined control parameters.

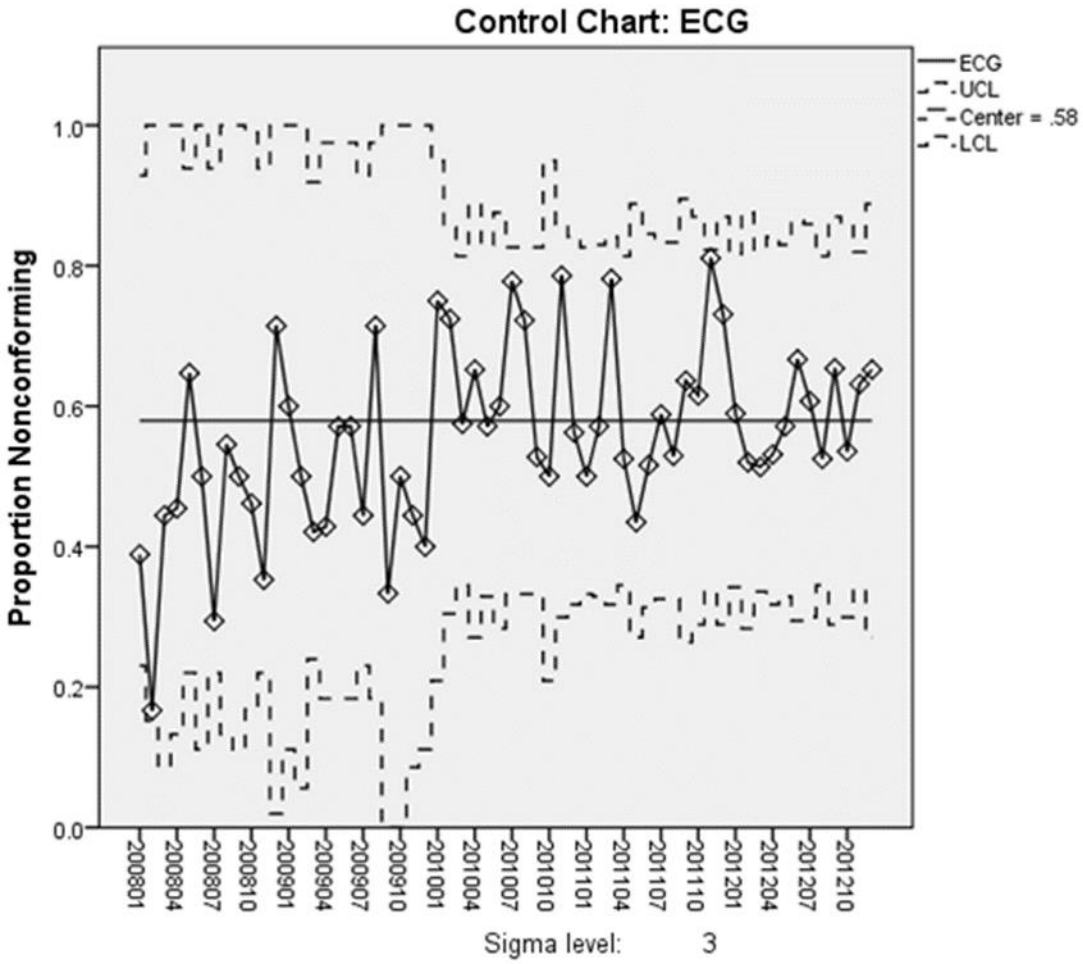

Figure 4. Control Chart of Cases when Electrocardiogram was Performed

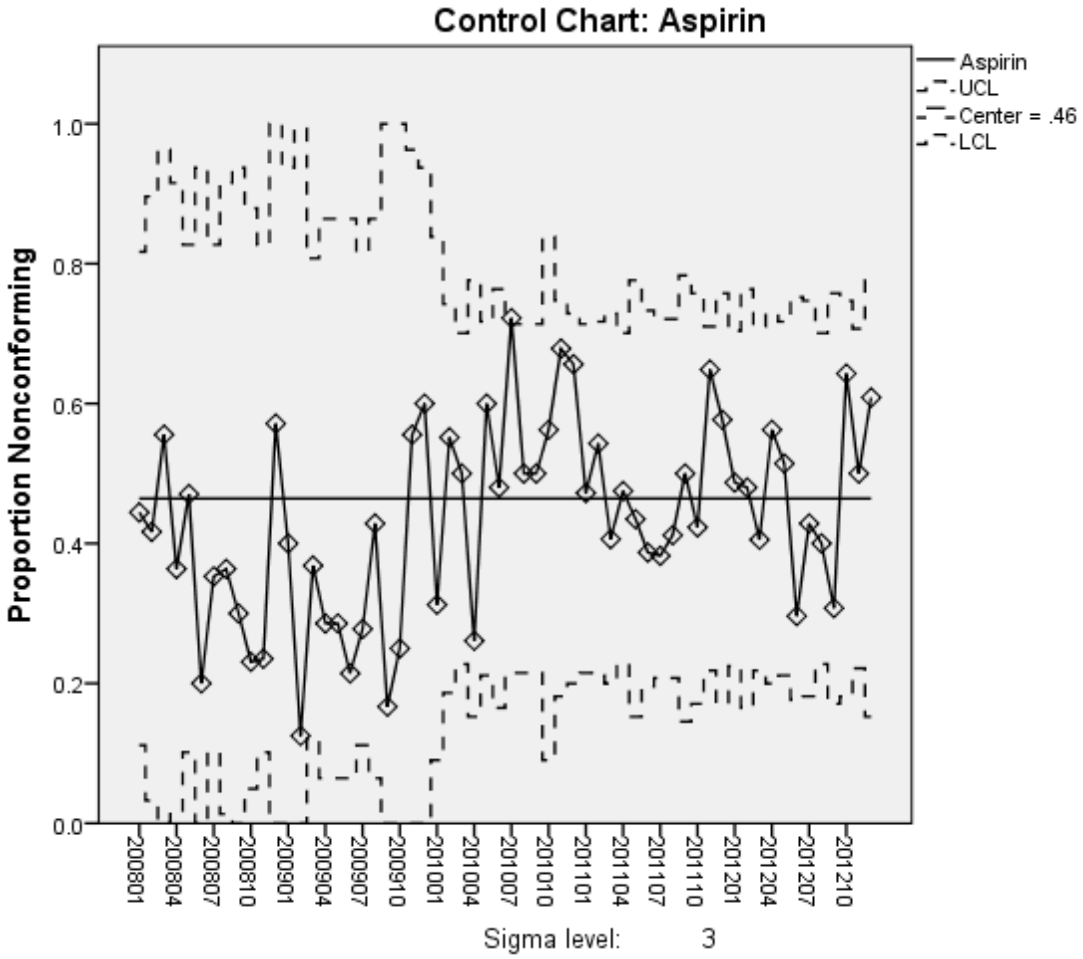

Figure 5. Control Chart for Proportion of Cases when Aspirin was administered to the Patients Presented to Emergency Department between January 2008 and December 2012

Although both outcome variables were categorical at the patient level, for the purposes of further analysis they were converted into continuous variables of rates of positive outcome cases per month and are displayed in Table 10. For each variable a proportion of positive outcomes were calculated for each month of data, resulting in 60 monthly rates. Average proportion of cases when aspirin was administered within 24 hours of admission to the ED was 43.5% and ranged from 13% to 73%. Average proportion of cases when an ECG was done within 10 minutes of admission to the ED was 55.6% and ranged from 17% to 81%.

Table 10. Monthly Proportion of Positive Outcome Variable for Patients presented in Emergency Room

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
ASA_Percent	60	13%	72%	43.5%	.13754
ECG Percent	60	17%	81%	55.6%	.12778
Valid N (listwise)	60				

While the average percentage of Aspirin administration during the study period was 43.5%, the research question is focused on possible differences of the rates between the three staffing models employed during the study period. Table 11 below presents a description of both rates (aspirin and ECG) under three staffing models.

Table 11. Monthly Proportion of Positive Outcome Variable by Model

	Model A	Model B	Model C
Aspirin rate, months	20	20	20
mean (sd)	34.5% (.11763)	49.0% (.14718)	47.0% (.10101)
min	13%	17%	30%
Max	57%	72%	65%
ECG rate, months	20	20	20
mean (sd)	49.0% (.13384)	59.0% (.13227)	59.3% (.08644)
min	17%	33%	43%
Max	71%	79%	81%

An analysis of variance was performed again in order to compare the means of the groups as indicated in Table 12 below. The F statistic of the ANOVA test ($F_{2, 57} = 8.134$, p-value<0.01) allowed the researcher to state that a difference in the mean aspirin rates among the three models was statistically significant. The F statistic of the ANOVA test ($F_{2, 57} = 5.198$, p-value<0.05) allowed the researcher to state that a difference in the mean ECG rates among the three models was statistically significant as well.

For further data analysis, the researcher performed a post-hoc test referred to as Tukey's Honest Significant Differences (HSD) after an analysis of variance test (ANOVA) was conducted and produced statistically significant result. Since the researcher was interested in determining actual differences in groups performance, further analysis of data needed to determine which groups differ. Consequently, Tukey's HSD test was conducted in order to delineate which groups among the sample show significant variation. As shown in Table 13 below, when the percentage of patients who received aspirin and had an ECG done is calculated by month there is a difference between models 1 and 2, and 1 and 3 however, there is no significant or statistical difference between models 2 and 3.

Table 12. Groups Means Comparison (ANOVA)

ANOVA						
		Sum of Squares	Df	Mean Square	F	Sig.
asp_percent	Between Groups	.248	2	.124	8.134	.001
	Within Groups	.868	57	.015		
	Total	1.116	59			
ecg_percent	Between Groups	.149	2	.074	5.198	.008
	Within Groups	.815	57	.014		
	Total	.963	59			

Table 13. Tukey Honest Significant Differences Test

Multiple Comparisons							
Turkey HSD							
Dependent Variable	(I) Models ABC	(J) Models ABC	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
asp_percent	A	B	-.14514*	.03903	.001	-.2391	-.0512
		C	-.12538*	.03903	.006	-.2193	-.0315
	B	A	.14514*	.03903	.001	.0512	.2391
		C	.01975	.03903	.869	-.0742	.1137
	C	A	.12538*	.03903	.006	.0315	.2193
		B	-.01975	.03903	.869	-.1137	.0742

Table 13. Tukey HSD Test (continued)

Multiple Comparisons							
Tukey HSD							
ecg_percent	A	B	-.10415*	.03781	.021	-.1951	-.0132
		C	-.10694*	.03781	.017	-.1979	-.0160
	B	A	.10415*	.03781	.021	.0132	.1951
		C	-.00279	.03781	.997	-.0938	.0882
	C	A	.10694*	.03781	.017	.0160	.1979
		B	.00279	.03781	.997	-.0882	.0938

Note: *The mean difference is significant at the 0.05 level.

The proportion chart below, Figure 6 Control Chart N-BREAK, demonstrates the fraction nonconforming of a different sample size in a given perpetual area of each period observed. Because of the sample variation, the control limits were calculated for each time period. The limit lines on the control charts show dispersal of data – outliers or data that fell outside the control lines between 2009 and 2010. The observed change is aligned with Model A ending and Model B beginning and may be reflective of AMI/CP cases not being diagnosed during the model A period.

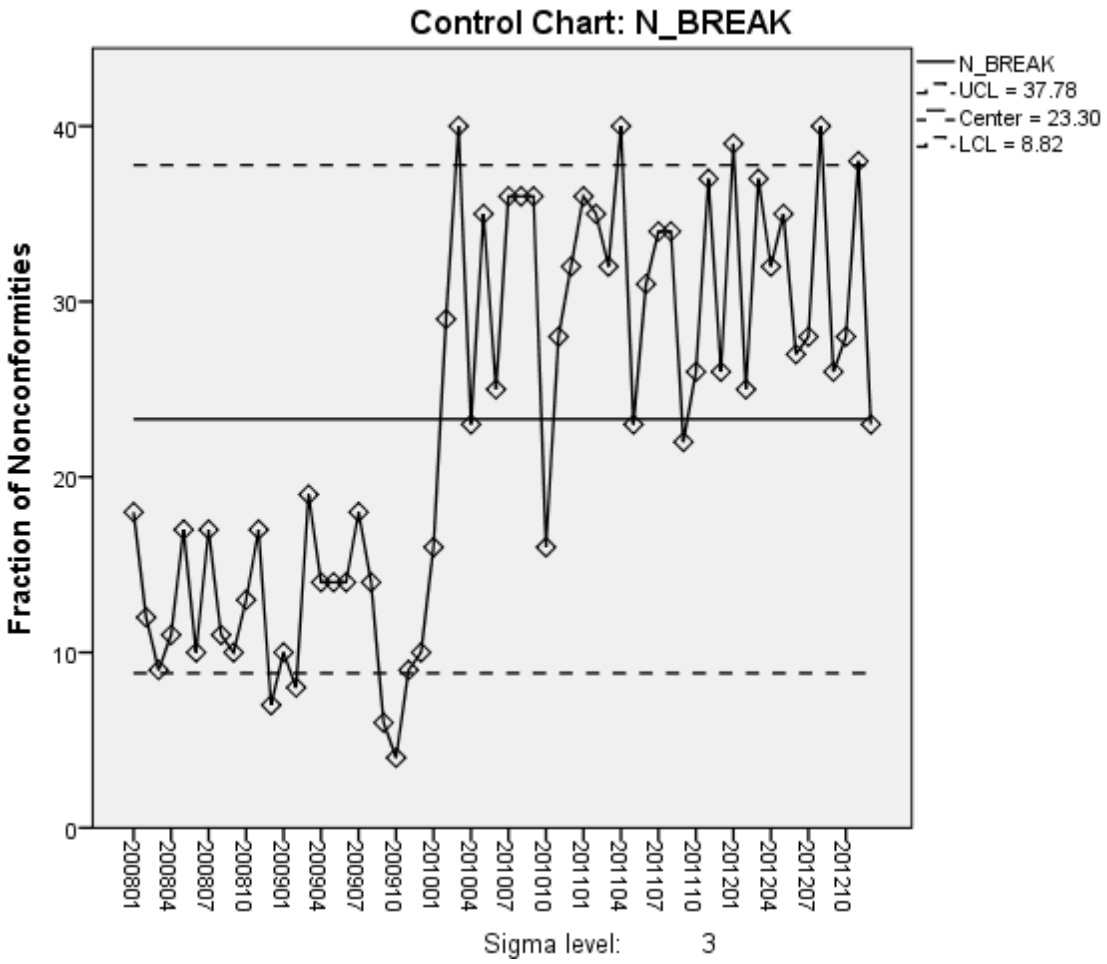

Figure 6. Depiction of Variation Control Chart for the Fraction of Nonconforming Units

As illustrated in the previous chapter, appropriate statistical tests were employed to evaluate the significant difference, if any, in completing the two outpatient core-measures for AMI/CP. The researcher was interested in determining if there is an association between the ED physician staffing models and the management of patients presenting to the ED with symptoms of an AMI/CP, therefore the statistical outcomes were compared and contrasted. The researcher performed Frequency Analysis for the initial examination of the data set. Descriptive statistics were utilized to demonstrate the essential characteristics of the data and provide clarity about the similarities of sample populations included in the study. A one-way ANOVA was conducted for the purposes of comparing the means of the age groups among the emergency department

physician staffing models to determine if aspirin was administered or an EKG was done in the allotted time for patients presenting to the ED with symptoms of an AMI/CP. The differences in age among the emergency department physician staffing models was not statistically significant $F(2,1395) = 0.8$, $p = 0.449$.

Additionally, the chi-square test was performed to establish significance between the sample proportions, the proportion results of BCBS, as well as other binary variables between the models were examined, the analytical outcomes were compared accordingly in order to accept or reject the null hypothesis. In order to check for a difference, or lack thereof in proportion for all variables, the researcher employed a Kruskal-Wallis statistical test. Consequently, the outcomes of the distribution of BCBS was different between all models ($p = 22$) indicating a statistical significance.

Subsequent to the analysis of variance test, the researcher performed a Tukey's Honest Significant Differences post-hoc test for further data analysis. The ANOVA test outcomes indicated that there were variations among the groups and because one of the assumptions for using Tukey's HSD is that there is independence within and among the groups, the Tukey's HSD test could be used to reveal which groups had significant variation (Brillinger, 1984). The Tukey's test results, when the percentage of patients who received aspirin and had an ECG done calculated by month, recorded a difference between models A and B, and A and C but not a significant or statistical difference between models B and C. The researcher also compared the group means by performing the ANOVA test again and the difference in the mean aspirin rates among the three models was statistically significant ($F_{2, 57} = 8.134$, p-value<0.01). In addition the difference in the mean ECG rates among the three models was statistically significant as well ($F_{2, 57} = 5.198$, p-value<0.05).

Appropriately, the first hypothesis: There is a significant association between the ED physician staffing models used in a CAH and aspirin administration documented as done within 24 hours of a patient admission with symptoms of an AMI/CP from the ED was accepted. The analytical outcomes indicated the relationship among the variables was statistically significant and as a consequence, the null hypothesis was rejected. In regards to the second hypothesis: There is a significant association between the ED physician staffing models used in a CAH and an EKG being done within 10 minutes of a patient admission with symptoms of an AMI/CP from the ED, the analytical results demonstrated the relationship among the variables was statistically significant as well. Therefore the second null hypothesis was rejected accordingly and the alternate hypothesis was accepted.

In summary, this study supports the association between ED physician staffing models and the management of patients presenting to the ED with symptoms of an AMI/CP. As indicated in previous chapters, the study utilized secondary data located in McKenzie Health System's EMR. Statistical tests such as Logistic Regression, Chi-square, ANOVA, Independent Sample Kurskal Wallis test and Tukey's Honest Significant Differences were conducted to compare the analytical outcomes in order to accept or reject the null hypothesis.

CHAPTER V

DISCUSSION

Insurance companies, consumers and providers of healthcare are becoming increasingly interested in meeting quality expectations. Quality measures are being reported and when minimum standards are not achieved, payment is decreased. Consumers are able to view quality performance more easily than ever before and compare how their local hospital and provider is doing. This level of transparency on quality performance may become an important aspect of consumer decisions about where to seek healthcare in the near future. Rural populations are no different when it comes to providing quality care, however, achieving quality scores that are competitive can sometimes be challenging.

The intent to perform at the highest level is less of an issue than having the resources needed to offer all the services often seen in an urban hospital. Although rural community hospitals are frequently smaller, and some services are not offered, those services that are offered can be performed very well. To overcome some of the scarce resource issues often seen in small rural community hospitals, CAH designation was established and that at least provides for cost-based reimbursement on the Medicare population being served. Given the need to provide high quality service regardless of the setting, the ongoing need to provide the service within the facilities space and resources, this study highlights one important service where such an opportunity exists.

This research study examined the relationship between emergency department physician staffing models and performance on outpatient core measures when treating a patient presenting with symptoms of acute myocardial ischemia and/or chest pain. The administration of aspirin within 24 hours of ED admission and the administration of an electrocardiogram within 10 minutes of admission were selected for this study as commonly accepted outpatient core measures for patients with ED discharge diagnoses consistent with an AMI/CP.

The research utilized the Donabedian's Structure-Process-Outcome model (Donabedian, 1980), and viewed critical access hospital (CAH) as a structural component of quality, while emergency department physician staffing models were representing the process component. The outcome was measured as the successful completion of the process of care core measures for AMI/CP. The researcher used age, race, gender and insurance type as control variables for the three emergency physician staffing models that were examined over a 5 year period beginning in 2008 and ending in 2012. Some of the control variables (age, race and gender) supported similarity in populations among the ED physician staffing models used.

While the insurance type did show a difference over the five years studied with a decline of Blue Cross Blue Shield coverage and an increase in Medicaid coverage, that difference can be explained by overall economic changes. In addition, the outcome measures are the same for all patients regardless of the type of insurance, and therefore the change in proportion of BCBS should not be affecting the quality of care. Same increase in BCBS can explain a slight downward shift in Medicare coverage during the physician staffing model C time period. Due to a significant economic shift in the United States that began in 2008 and is only now improving to pre 2008 measures of the economy, declining employment, employee loss of health benefits and

a shift of Blue Cross Blue Shield coverage down, may lead to Medicaid increases (Gokay, 2009). Medicaid is a state managed healthcare benefit plan that people qualify for when their income has declined to predetermined levels, this is seen when unemployment rises as we have seen during the period studied (BLS, 2014).

The three different physician staffing models for the ED of a CAH that has less than 10,000 visits in the ED per year were evaluated, the diagnosis observed were (AMI) and chest pain (CP) in order to establish whether the outpatient core measures were satisfied for these particular discharge diagnoses. The data supported both hypothesized associations of this CAH study. There is a significant association between the ED physician staffing models and both aspirin administration within 24 hours of a ED patient admission with symptoms of an AMI/CP from the ED ($F_{2, 57} = 8.134$, p-value<0.01), and an EKG being done within 10 minutes of a ED patient admission ($F_{2, 57} = 5.198$, p-value<0.05). In addition, assuming similarity in the patients during the study period, the analysis of the outpatient core process of care measures showed a significant difference between emergency department physician staffing model B & C as compared to model A.

The performance measures support improvement with both emergency department physician staffing model B and C. The major difference between model A and models B/C lays in the training requirements for physicians working in the ED. Model A physicians did not need to have any specific training or board certifications before serving in the ED, in both model B and C physician staffing models everyone is board certified. In model B emergency medicine board certification was required, similarly under model C, primary care board certification was required; primary care is either family medicine or internal medicine board certification. In both model B and C senior emergency medicine residents were also used for staffing.

Under healthcare reform, cost and quality will be very important to hospital executives. The emergency department is a primary point of entry for a hospital and therefore the assessment of the type of care delivered in the facility can be an extension of the emergency department experience. In addition, the quality of care delivered and reported can impact revenue, which in turn is needed to off-set the cost of service. Due to the importance of meeting both cost and quality metrics, this studies results lead to several important practice implications.

Health Administration Implications

Healthcare executives must ensure that quality services are delivered to CAH patients regardless of the financial problems they manage every day. In part, providing high quality services with fewer resources is difficult unless efficiencies are discovered. In this study, three different ED physician staffing models were assessed by how they performed on quality process of care measures. Although there was a difference in performance on the quality process of care measures, that difference was model A not performing as well as model B & C. The overall cost of models B & C are higher than model A, however the better performance on quality measures is worth the expense. Because the CAH program does provide for cost based reimbursement, the need for that program to continue in CAH low volume environments is further substantiated when quality service is considered important.

When healthcare executives in CAH facilities are evaluating how to organize ED physician staffing, this study provides important insight into the staffing options. The low volume CAH ED also provides an additional opportunity not previously considered, the provision of a hospitalist service with the same providers. A hospitalist service is an evolving physician specialty that only covers inpatient medical management. The hospitalist service does

not compete with outpatient primary care providers for patients because they do not have outpatient practices. Primary care providers are increasingly less interested in managing inpatients and recruiting the primary care provider to the rural community will require competing with offers that are outpatient only. This study highlights the performance similarities between a board certified emergency medicine environment, model B, and a board certified primary care environment, model C. In this case model B physicians were unwilling to perform as a hospitalist also because of their discomfort with medically managing an inpatient, whereby model C physicians did not find this to be problematic at all. So the added value of being able to offer outpatient only opportunities to potential new primary care providers in the community, providing a consistent solution to impatient medical management and offer an uncompromised ED physician staffing service based on quality measure performance to the community, is clear in this study.

Limitations

As with any health services research this study has certain limitations related to the data and methodology. These limitations include:

- The study utilized secondary data residing in an EMR, therefore a possibility of user entry errors exists;
- The researcher has no control over how the data was collected, and if all ED visits that would have been included in this study were accurately captured;
- Although the data validation indicates the data was reliable, there may be possible abstraction errors;

- The inability of the researcher to control factors such as ED physician or patient preferences, the AMI/CP case volume;
- The unmeasured presence of one or more additional illnesses or symptoms co-occurring with AMI/CP that were not available from the EMR;
- The data utilized was from one critical access hospital, it was limited to only two quality measures and the researcher has no control over racial composition of the sample, therefore the study outcomes may not be representative of all critical access hospitals. Geographic diversity, community culture and medical staff dynamics may impact the application of any one of the ED physician staffing models described in this study;
- The data was collected over the time period of 5 years beginning January 1st, 2008 and ending December 31st, 2012, consequently there may be more recent changes that can possibly impact the quality of AMI/CP care and quality measures since 2012;
- In regards to the statistical limitation, the analytical method had to be changed to odds ratio because the intended statistical method, logistic regression, in the actual analysis lacked predictive power. In this study, the percentage of correctly predicted outcomes was approximately 4%; all improvement techniques did not change this percentage significantly. An adequate logistic regression model generally produces at least 60% of outcomes correctly predicted. Therefore the

odds ratio test predicting core measure performance by delivery model was employed;

- Finally in terms of the methodological limitation; since the study was based on actual staffing models, the findings are relevant to these models only, therefore it cannot be assumed with certainty how quality of care would be impacted by any changes in any of the models.

Nonetheless, despite the described limitations, the study offers an important input in the field of healthcare administration, specifically in the CAH environment. Most importantly, it demonstrated a possibility of positive quality changes in a CAH as well as providing administrators the ability to have some control over that. Overall, healthcare quality and safety improvements are very important to the viability of hospitals serving rural communities. Furthermore, CAHs offer distinguished factors that are not always taken into consideration by national hospital patient safety initiatives, since most of the patient safety standards are generally stemming from studies that are conducted in large urban hospitals. This study contributes positively in regards to the ED physician staffing model specifically, and how the models impact improvements in efficiency and quality of care for rural populations.

Recommendations for Future Research

Although the study found support for the hypothesized effect of staffing models on patient quality outcomes, the data was limited to one CAH. The study could be replicated among a broader population of critical access hospitals serving rural communities within a region, state or nationally to make the finding more generalizable. While outcome measures used in this study are commonly accepted indicators, quality is a multidimensional concept and future

research could also be expanded to include other diagnoses that present to an emergency department and have core measures that could be analyzed for performance. Another important issue that was beyond the scope of this study, but can potentially be included in future research, is focus on the leadership traits of the medical director and his/her influence on expanding coverage including the hospitalist component in low volume emergency departments. In order to determine the quality of care in rural environments, future studies have to consider several factors such as broader racial composition, geographic diversity, community culture, more quality measures as well as more CAHs.

Finally, the researcher described the methodology and rationale for determining the relationships between the ED physician staffing models and the management of patients presenting to the ED with symptoms of an AMI/CP. The study findings demonstrated that it can be applied to other critical access hospitals as well as laying the groundwork for similar future studies. Consequently, it is critical that future studies examine the area of ED physician staffing models and the management of patients presenting to the ED with symptoms of an AMI/CP from a broader scale. More research studies need to focus on presenting a broader perspective on this subject since the existing literature is highly repetitive, insufficient and narrow in scope.

Conclusion

In conclusion, this study highlighted the similarity in performance between two different physician staffing models as viewed by board certification. Being able to determine that CAH performance in treating ED patients presenting with AMI/CP is not negatively impacted by changes within ED physician staffing composition is important when a decision to use an alternative staffing model is made by administrators. Quality of care and patient safety are

always considered when hospital executives make decisions about staffing, however the emergency department is one area that is very visible to the community served, and therefore requires special attention. Emergency medicine training and board certification certainly is desirable for staffing the emergency department, however the cost associated with this staffing pattern may not be warranted in a low volume environment.

When the same outcomes can be achieved with a different physician staffing model without compromising quality of care, and the model supports other assignments, the model adds value. In the age of healthcare reform where emphasis is placed on value added service, this study demonstrated no difference in core measure performance, and the primary care physician staffing model can do other tasks for the hospital. This study provides healthcare executives in CAH's with a demonstrated alternative to ED physician staffing coverage that typically was only provided by emergency medicine trained physicians.

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