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Applying the Hospitalist Model of Care to Cardiovascular Acute Care Delivery

Ginger K. Biesbrock
University Of Alabama At Birmingham

APPLYING THE HOSPITALIST MODEL OF CARE TO CARDIOVASCULAR ACUTE CARE DELIVERY

by

GINGER K. BIESBROCK

AMY YARBROUGH LANDRY, COMMITTEE CHAIR
VANCE CHUNN
LARRY HEARLD
JEFF SZYCHOWSKI

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HEALTHCARE LEADERSHIP

ABSTRACT

The hospitalist model for managing patients in the hospital setting has been in existence for over 20 years. The hospitalist model for non-specialty care has been found to improve the efficiency of care, maintain quality of care, and support a higher degree of guideline adherence. However, there has been little research focusing on the use of the hospitalist model for specialty care. As cardiovascular programs have begun to adopt the hospitalist model, many are asking if this model is more effective than the traditional model. The main concern is the potential disruption to the patient-physician relationship that occurs with the hospitalist model raising the question "does the benefit outweigh the potential risk"?

The Resource-Based View of the Firm (RBV) theory was used to develop the theoretical framework for this study. According to RBV, organizations seek to establish a competitive advantage, and they become more competitive when they have access to the right resources and possess the capabilities to use the resources in the most effective way. In this case, the "resource" is the cardiology

provider workforce, and the "capability" is the development of a stronger care model, which is achieved by applying the hospitalist model to CV care.

This research postulated that a cardiovascular hospitalist model of care would provide better outcomes in three domains: efficiency of care, quality of care, and guideline adherence. A performance measure was selected in each domain that aligned with previous research focusing on the non-CV hospitalist model. The analyses failed to support all three hypotheses. One finding did suggest that there may be some improvement in the efficiency of care for heart failure patients, while another noted worse outcomes related to quality outcomes in patients with acute MI. Finally, organizations' percentage of CV care was associated with improved guideline adherence. Although the results were not as anticipated, this research did provide a framework for future research in this area.

Key words: Hospitalist, Acute Care, Cardiovascular, Efficiency of Care, Quality of Care, Guideline Adherence

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LIST OF ABBREVIATIONS

ACC	American College of Cardiology
ACA	Affordable Care Act
AHA	American Hospital Association
ALOS	Average Length of Stay
AMI	Acute Myocardial Infarction
AOA	American Osteopathic Association
CMS	Center for Medicare and Medicaid Services
COCA	Commission on Osteopathic College Accreditation
CPT	Current Procedural Terminology
CV	Cardiovascular
DH	Definitive Healthcare

DRG	Diagnosis Related Group
FDA	Food and Drug Administration
GEE	Generalized Estimating Equation
GWTG	Get With The Guidelines
HF	Heart Failure
IRB	Institutional Review Board
NCDR	National Cardiovascular Data Registry
PCI	Percutaneous Intervention
PN	Pneumonia
RBV	Resource-Based View of the Firm
SAFs	Standard Analytic Files
SD	Standard Deviation
UAB	University of Alabama Birmingham
VBP	Value-Based Purchasing

CHAPTER 1
DESCRIPTION OF THE PROBLEM
Introduction

The hospitalist model for delivering care to hospitalized patients has been in existence for nearly 20 years. Before the introduction of the hospitalist model, the traditional model of hospital care was the primary care physician rounding on patients daily either before or after clinic. In contrast, the hospitalist model uses a hospital-based physician to deliver care. The hospitalist model of care was developed in the mid-1990s due to increasing cost pressures for hospitals and provider groups (Auerbach, Aronson, Davis, & Phillips, 2003). In addition, increased outpatient volumes and decreased inpatient volumes created a need to keep primary care physicians in the outpatient setting and the need to develop a new model of care for the acute care setting evolved. An increase in patient acuity for hospitalized patients also contributed to the evolution (Auerbach et al., 2003; Kociol et al., 2013). A major driver of growth for the hospitalist model of care has been empirical evidence suggesting that hospitalists provide inpatient care that is more efficient, less costly, and equal or higher quality than traditional models of care (Elliott, Young, Brice, Aguiar, & Kolm, 2014). The efficiency and quality of care are key drivers for hospital performance, creating a competitive environment amongst hospitals to excel in both areas.

Efficiency of care is typically measured based on the hospitalized patient's average length of stay (ALOS). With hospital reimbursement commonly provided at a

flat rate based on diagnosis related group (DRG) model, the need to manage efficiency directly correlates with the cost of care. The longer the patient is hospitalized for a particular condition, the higher the cost to manage the patient and the lower margin generated from the DRG reimbursement rate. In some cases, the cost of care can be higher than the amount reimbursed based on the DRG assigned to the patient's stay. Hospitals are always seeking ways to effectively manage patients in a more cost-effective way. Research as early as 1999 suggested that having a hospitalist available throughout the day would improve the efficiency of the inpatient stay (Wachter, 1999). A more cost-effective delivery model will make the hospital more financially competitive. Contemporary reimbursement models often take into account the cost of care, providing incentives or penalties for organizations that are more expensive ("CMS Hospital Value-Based Purchasing Program Results for Fiscal Year 2020," 2019). Payers actively measure and seek organizations with a lower-cost delivery model.

Quality of care is measured in various ways. Readmission rates, patient mortality, and clinical guideline adherence are common measures to gauge the quality of care an organization provides. As with efficiency of care, hospitals are looking to ensure: that the care provided in their facilities is the highest in quality; and that the delivery model they choose supports high-quality performance. Although the research shows mixed results when it comes to the hospitalist model relative to the traditional model for quality of care, the hospitalist model is not inferior with some studies supporting superior outcomes in all three common quality of care measures (White & Glazier, 2011).

The introduction of the hospitalist model of care to acute care delivery was a disruptor. Initial reactions were not necessarily positive, and the early literature did not

support the hypothesis that the hospitalist model of care was superior. One of the main arguments against the model was the disruption of the patient relationship. In the traditional model of care, when a patient is hospitalized, the patient's primary care physician would provide care to the patient while in the hospital. The patient-physician relationship was maintained; however, the physician was typically only at the hospital for a short time and back in his or her office the remainder of the day. Thus, care could be delayed due to limited physician presence. With the increase in the acuity level of patients, there was concern that the primary care physician was not as competent in taking care of higher acuity patients. As the model has evolved and more hospitals have adopted this model, the contemporary literature supports the model being superior in cost and equal in quality compared to the traditional model of care, even though the patient-physician relationship is disrupted (Elliott et al., 2014). By 2014, the hospitalist model had become a widely adopted model of care and accounts for more than half of hospital-based healthcare delivery (Rohde, 2014).

Statement of the Problem

The hospitalist care model has existed for over two decades; however, the expansion to specialty care is a more recent phenomenon, and little has been studied related to the efficiency of care or quality of care outcomes. As hospitals seek to improve performance in the efficiency of care and assure high-quality care, the researcher has noted pressure to transition the hospitalist model of care in specialty areas as well. With the knowledge gap, the question arises if the hospitalist model of care is superior for outcomes representative of care efficiency and quality. Does the hospitalist model of

care for specialty care provide the performance hospitals need to be competitive? This study seeks to fill a gap in the current body of literature assessing the outcomes when applying of the hospitalist care model to specialty care. This research specifically focuses on cardiovascular care.

Purpose of the Study

This study examines three major arguments used to justify initiating a hospitalist model of care for cardiovascular care delivery. The first argument is that the hospitalist model of care supports superior care efficiency compared to the traditional model of care. This study seeks to address this argument by evaluating the ALOS for several common cardiovascular DRGs between hospitals that provide cardiovascular care in the hospitalist model versus hospitals that do not. The second argument is that the hospitalist model of care offers superior quality to the traditional model of care. This study seeks to address this argument by evaluating readmission rates for the same common cardiovascular DRGs between hospitals that provide cardiovascular care in the hospitalist model versus hospitals that do not. The third argument is that the hospitalist model of care supports a higher level of guideline adherence than the traditional model of care. This study seeks to address this argument by comparing the rate of adherence of a class Ia recommendation for cardiovascular patients between hospitals that provide cardiovascular care in the hospitalist model versus hospitals that do not. Class Ia recommendations are defined as clinical recommendations that always provide benefit and never harm to patients. They are clinical recommendations that deserve 100% adherence from a clinical perspective. As noted, with many hospitals seeking to

transform cardiovascular acute care delivery into the hospitalist model, it will be important for them to understand if they are likely to achieve superior outcomes which creates a competitive advantage over other hospitals.

Research Questions

Although the original hospitalist model was directed at general medicine, the benefits may apply to specialty care. Cardiovascular (CV) care delivery in the acute care setting has been under similar pressures as relates to costs, high acuity patients, length of stay, and continuity of care (Berwick & Hackbarth, 2012; VanLare & Conway, 2012). The data from this research shows that many hospitals have adopted the hospitalist model for their CV acute care services while others have not. The researcher has found that those who have not are questioning the model's effectiveness for CV care. Although the hospitalist model for managing general medicine patients has been proven to provide more effective care by improving efficiency of inpatient stays, improving length of stay, assuring appropriate discharge support, and reducing readmissions, many organizations, and cardiologists question if a hospitalist CV model of care will realize the same benefits. This study aims to answer the following questions:

1. Is the hospitalist model of care for CV acute care services associated with a decreased length of stay compared to a traditional model of care delivery?
2. Is the hospitalist model of care for CV acute care services associated with a decrease in readmission rate compared to a traditional model of care delivery?

3. Is the hospitalist model of care for CV acute care services associated with a higher level of cardiac rehabilitation referral compared to a traditional model of care delivery?

CHAPTER 2

LITERATURE REVIEW

Background

Evolution of the hospitalist model

As noted, the hospitalist model has been in existence for over 20 years. Hospitalists are physicians who specialize in caring for hospitalized patients, with the majority of these physicians being general internists (Dynan et al., 2009). Caring for hospitalized patients has become more complex, with patients presenting with increased acuity and pressures to decrease the length of stay. The hospitalist model was initially developed to relieve pressures on clinical practice (Auerbach et al., 2003). In addition, academic hospitals have adopted the hospitalist model due to patient-volume concerns that developed at the time when resident hours and patient volumes were restricted and additional care delivery was needed to fill in the gap (Dynan et al., 2009). The model typically consists of a physician based solely in the acute care setting that becomes the patient's physician during the hospitalization. The outpatient physician resuming care of the patient after discharge (Auerbach, Davis, & Phillips, 2001). This hand-off to the outpatient setting is the defining characteristic of the hospitalist model. Historically physicians managed their inpatients while maintaining an active outpatient clinic. This model provided both physicians and patients with continuity of care - allowing for the

continuation of the patient-physician relationship and less hand-offs, allowing for a better understanding of the patient's medical history and patient wishes.

In contrast to the traditional model, the hospitalist model uses physicians that provide attention to all routine medical needs throughout the hospitalization but maintain minimal responsibility for outpatient or follow-up care once the patient is discharged (White & Glazier, 2011). Those in support of the hospitalist model describe advantages that include on-site availability. This improves patient throughput by providing more consistent support to answer questions, order tests, follow-up on test results, streamline the process of care, and follow-up on condition changes for either discharge or urgent needs. By definition, these providers focus only on inpatient care which allows them the potential of a higher level of expertise for the common inpatient conditions compared to physicians who provide a broader scope of care. In addition, hospitalists may have a greater commitment to hospital quality improvement than community primary care physicians. However, several disadvantages also exist. One disadvantage is the discontinuity of care where patients are being taken care of by a physician with no previous relationship and may not always provide effective shared-decision making for management decisions (White & Glazier, 2011). Patients may not be satisfied being treated by someone other than their primary care physician (Jungerwirth, Wheeler, & Paul, 2014). Hospitalists may be prone to burnout due to the acuity level of their work and potential workloads. And finally, a potential loss of hospital skills by traditional primary care physicians may be a dissatisfier. The tension between the advantages and disadvantages creates a potential risk versus benefit of the hospitalist model compared to

traditional care. Fortunately, empiric research on the hospitalist model exists to better understand if the advantages outweigh the disadvantages.

Literature Review

Outcomes of the Hospitalist Model

With the introduction of the Affordable Care Act (ACA), there has been an increase in focus on improved quality of care coupled with reduced cost. Multiple studies have proven superior patient outcomes of the hospitalist model compared to the traditional model of care, including a reduction in length of stay, lower healthcare costs, decreased mortality, and improved guideline adherence (Blecker et al., 2014; Cabana & Jee, 2004; Jungerwirth et al., 2014; Kociol et al., 2013; O'Donnell, Stern, Leong, Molitch-Hou, & Mitchell, 2019; St Noble, Davies, & Bell, 2008). A review of each of these areas will provide insights into the potential application to CV acute care delivery.

Reduced Length of Stay

Since the initiation of the Diagnosis Related Group (DRG)-system of payment for hospital reimbursement, there has been pressure to limit the length of stay for hospitalized patients. The typical hospitalization is usually reimbursed based on the assigned DRG, which covers the cost of care based on the patient acuity and diagnosis, not on the length of stay. Therefore, the need to maintain a reasonable length of stay becomes an economic driver. White et al., published a systematic literature review that

evaluated process, efficiency, and outcome measures for the hospitalist model of care compared to traditional care. Most studies in their review showed a reduction in the length of stay, which also included a reduction in total hospital costs (White & Glazier, 2011). Forty of fifty-eight studies found that patients managed by hospitalists had significantly shorter hospital stays compared to the traditional model of inpatient care. Similar findings were noted for the cost of care per hospitalization.

A study by Kuo et al., performed on a Medicare patient population from over 5,000 hospitals showed that significant reductions in length of stay were noted for patients managed by a hospitalist model. These reductions in length of stay were specific to older, complicated, non-surgical patient populations cared for at community hospitals (Kuo & Goodwin, 2010). Of note, the reduction in length of stay increased over time. The longer the hospitalist model was in existence, the shorter the length of stay.

Although the Kuo study seemed to show a linear relationship between the length of stay and hospitalist model existence. Another study, by Epane et al., agreed that the use of hospitalists did decrease the length of stay but noted a nonlinear relationship between the length of stay and the intensity of the hospitalist model. The intensity was defined as the number of hospital days per physician which was a measure of the number of patients that a physician was responsible for. As the number of hospital days per physician increased, the length of stay also increased. This study tied the effectiveness of the model to physician workload. In addition, the length of stay benefit did not remain constant regardless of staffing coverage, suggesting that staffing coverage models may play a role in overall benefit (Epané & Weech-Maldonado, 2015). Similar findings were noted in another study evaluating hospitalist workload. This study defined workload as

the percentage of hospital bed occupancy. The higher occupancy levels were associated with a higher length of stay across similar patient populations (Elliott et al., 2014). These studies support the findings that a hospitalist model may decrease length of stay, which aligns with a key hospital indicator for maintaining or even decreasing costs of care. However, the benefit is not constant or consistent. Variables including physician workload and physician coverage models exist that may also have impact on length of stay and cost of care.

In addition to the length of stay, time to treatment has been a metric of patient throughput measurement. Several studies measuring time to treatment showed that the hospitalist model decreased the time from admission to surgery compared to the traditional model.

Although none of the studies reviewed assessed why hospitalists may decrease the length of stay compared to traditional care, Dynan et al., presented two possibilities. First, throughput can be enhanced through superior clinical skills that will reduce the number of tests and procedures. Second, throughput can be enhanced through superior care coordination skills and familiarity with the institution by avoiding delays in scheduling and results (Dynan et al., 2009). Both are challenging to measure; however, the hospitalist model concentrates the time the physician cares for patients in one setting, which theoretically should improve both skillsets and have an impact on patient throughput and decrease the length of stay.

Quality

Although there are economic savings and potential competitive advantage if the hospitalist model decreases the length of stay, there is no value if the decrease in length of stay does not improve or at least preserve quality compared to a traditional model of care. Common quality measures studied include readmission rates, mortality rates, and guideline adherence.

Readmission Rates

Readmission rate is a common measure of quality assessing the effectiveness of the initial hospitalist by whether the patient returns to the hospital for more care. Typically, the readmission rate is defined as the percentage of hospitalized patients returning to the hospital within a certain time period post-discharge. It is a measure commonly assessed by payers, registries, and credentialing organizations. The concept is that readmissions may be a product of a poorly managed index hospitalization and, therefore a surrogate measurement for quality of care. The Centers for Medicare and Medicaid Services (CMS) have identified heart failure (HF), acute myocardial infarction (AMI), and pneumonia (PN) as high-cost disease states and introduced financial penalties for 30-day readmissions for institutions with excessive readmission rates - making these

three diseases a common target for readmission management or reduction. Not all studies evaluating readmission rates between the hospitalist model and traditional model have found the hospitalist model to be superior. The White et al., systematic review highlighted a total of thirty-four studies that evaluated readmission, and only three of these studies showed an improvement in readmissions, with three other studies showing an increase in readmission for the hospitalist-treated group (White & Glazier, 2011). However, a large study that included 3,029 hospitals comparing those with a hospitalist model of care to those with a traditional model of care did find that risk-standardized readmission rates were significantly lower for all three CMS-tracked conditions for hospitals employing hospitalists (Jungerwirth et al., 2014). Another analysis by Goodrich et al., performed a similar study looking at heart failure readmission and found superior outcomes for those hospitals that used a hospitalist model (Goodrich, Krumholz, Conway, Lindenauer, & Auerbach, 2012). So, although findings are mixed, there appears to be some consistency for superior outcomes of the hospitalist model of care when looking at the Medicare patient population specific to HF, AMI, and PN.

Mortality

Like readmission rate performance, mortality performance between the hospitalist model of care and the traditional model of care has been found to be variable. In addition to performance variability, the literature reviewed had several different definitions of mortality, some using in-hospital mortality and others using 30-day, all-cause predicted excess mortality. Both definitions seem to be important but answer different questions. In-hospital mortality reflects care focused on the immediate need of the patient. The 30-

day measure demonstrates the effectiveness of care that prevents disease progression or effectiveness of care to limit complications leading to death post-hospitalization. A systematic review of hospitalist quality outcomes found that 95% of the studies that evaluated mortality defined mortality as occurring 'in-hospital.' Only seven of the studies evaluated post-hospitalization mortality measures (White & Glazier, 2011).

For in-hospital mortality the same literature review found that only seven of the thirty-five studies reported significant declines in mortality rates among hospitalists leaving the authors to summarize that no statistically significant difference in mortality outcomes exists between the two models (White & Glazier, 2011). In contrast, Dynan et al., showed that hospitalists had fewer in-hospital mortalities relative to traditional care. However, the traditional care model was noted to be an academic model and the measure was not risk-adjusted, potentially reflecting a difference in patient population versus a difference in the quality of care (Dynan et al., 2009).

For 30-day mortality, Jungerwirth et al., in a large review of Medicare data, noted that the presence or absence of hospitalists was not associated with an increase or decrease in case mix-adjusted, risk-standardized, 30-day all-cause predicted excess mortality rates. The review focused only on Medicare patients and used CMS-reported data for acute myocardial infarction, heart failure, and pneumonia (Jungerwirth et al., 2014). Mortality measures were not found to have a significant difference between the two models of care. Another study found similar results when evaluating the care of a large Medicare population of patients and care outcomes related to acute myocardial infarction, heart failure, and pneumonia mortality. They found that the presence of hospitalists was not an independent predictor of mortality performance for any of these

conditions (Goodrich et al., 2012). Regardless of the definition, mortality rates appear to have no statistically significant difference between the two models of care.

Guideline Adherence

There appears to be limited research comparing the hospitalist model of care and traditional model of care as related to guideline adherence. This literature search produced only one study that evaluated guideline adherence. The study evaluated the adherence to acute ischemic stroke guidelines and found that the hospitalist model of care was superior to the traditional model of care, with a significantly higher rate of adherence to Get With The Guidelines (GWTG) inpatient stroke measures with acute ischemic stroke patients (Hassan et al., 2016). With only one study found, more research on the impact a hospitalist model of care may have on guideline adherence is warranted. The absence of research on this topic suggests that there are challenges in measuring these outcomes in a meaningful way.

In summary of all the studies reviewed, current evidence suggests that hospitalists provide a level of clinical care comparable to non-hospitalists. The on-site presence and additional time spent on service suggest that the primary hospitalists' value stems from their ability to provide the same quality of clinical care in shorter periods of time. The increased presence leads to a reduction in the length of stay and reduction in overall costs of care which supports an economic benefit in the DRG-reimbursement model for hospital care delivery.

Liability

Several other aspects of the hospitalist's model of care have been evaluated, including liability and coverage models. One of the main disadvantages of the hospitalist model of care is the discontinuity in patient care from the patient's established physician during a hospitalization episode. Concerns have been raised about malpractice risk. There has been minimal data published on this topic. However, a study published in 2014 reviewing over 52,000 malpractice claims against internal medicine physicians found that hospitalists in internal medicine are subject to medical malpractice claims less frequently when compared to other internal medicine physicians and specialties. The authors provide a possible explanation for the lower rate of claims. The hospitalists are at a lower risk of missing a diagnosis which is the most common reason for a malpractice claim (Schaffer, Puopolo, Raman, & Kachalia, 2014). The lower risk of missing a diagnosis may be related to most hospitalized patients having a diagnosis when they present to the hospital. Another potential reason is that the quality of care provided by the hospitalist is higher. However, improved quality is not supported by other literature. Regardless of why hospitalists have a lower rate of claims, the study does support that the hospitalist model is as safe as a traditional model from a liability perspective.

Hospitalist Model and Continuity

Many of the studies reviewed show a benefit with the hospitalist model related to the efficiency of care with less benefit related to quality. However, none of the studies outline how the hospitalist model was operationalized, and variations in the design of the hospitalist model may impact outcomes. Several studies looking at continuity of care have shown a difference between how the model is set up and the outcomes. Transitions of care between providers have been identified as a source of miscommunication and an area of increased risk for both quality and efficiency (Arora & Farnan, 2008). Most hospitalist models limit the number of consecutive days worked by a physician and may have a separation of rounding and admission roles that lead to several hand-offs throughout the stay (O'Donnell et al., 2019). One study defined continuity as a degree of fragmentation. The less time the primary hospitalist spent with the patient, as defined by the percentage of visits, the higher the degree of fragmentation. The study found a statistically significant association between a greater degree of fragmentation of care and an increase in length of stay for patients that were admitted with pneumonia and heart failure (Epstein, Juarez, Epstein, Loya, & Singer, 2008). The greater number of the hand-offs equated to a longer length of stay.

These findings have prompted hospitals to pursue a higher degree of continuity. Johns Hopkins developed a four-day staffing model to mirror the average length of stay (ALOS) and found improved continuity - provided a decrease in length of stay and a decrease reduction healthcare costs (Chandra, Wright, & Howell, 2012). Another program implemented a seven-day model aimed to improve the continuity between the

admitting and rounding physician. The study found that the ALOS was reduced by more than half a day which spanned both the intensive care unit and the non-intensive care unit patient floors. Overall mortality and readmission rates were not statistically significant prior to the seven-day model implementation. The authors summarized that the seven-day model allowed for fewer handoffs and decreased length of stay without impacting readmissions or mortality. Nearly a quarter of the patients had no hand-offs during their hospitalization, with only one hospitalist providing all their care (O'Donnell et al., 2019).

Maintaining continuity is proven to have better outcomes. Weekends can be a time when continuity is disrupted and care is slowed. It is not uncommon for patients that are admitted on a Friday to wait the weekend for a plan of care due to discontinuity of care with their physician, subsequently increasing their length of stay. Two studies that focused on improving continuity of care across the weekend found a change in staffing coverage to provide continuity across the weekend days; improved the length of stay by almost a day, and increased the likelihood of weekend discharges with no effect on readmission rate. In summary, staffing and coverage models do matter when it comes to the efficiency of care based on these findings (Blecker et al., 2014; St Noble et al., 2008).

Perceptions of the Hospitalist Model

When the hospitalist model was introduced, it was a new model and required a fundamental change in how physicians care for their patients, and how they share the care with other professionals. It meant that when patients were the most ill, their care was

transitioned to another physician with similar training. Reviewing how physicians initially viewed a change in their traditional model will be valuable as this study assesses the application of the hospitalist model to cardiology care and how cardiologists may view this change in care. A study from 2001, performed early in the hospitalists model transition, surveyed 241 internists before implementing a hospitalist service to determine attitudes toward the new model. At that time, only ten percent of the respondents felt a hospitalist model would improve patient satisfaction, and most did not agree that the traditional model of care was an inefficient use of their time. More than half felt that it would hurt patient-doctor relationships (Auerbach et al., 2001). Interestingly, physicians physically located furthest from their inpatient site had more favorable views towards the new model showing the potential need to be more efficient with their time.

After the hospitalist model of care had been implemented, a follow-up study performed by the same author, using the same respondents, found that physician views had changed. More physicians agreed that caring for inpatients was an inefficient use of their time and that use of hospitalist services improved the quality of care. In addition, the respondents' views regarding career satisfaction and relationships with patients had also improved related to the hospitalist model of care (Auerbach et al., 2003).

Hospitalist Model Applied to Specialty Care

With the evolution of the hospitalist model variations are beginning to emerge including an; 1) "nocturnist" model for night-time hospitalist coverage, 2) "externist" model that has the hospitalist providing outpatient care for pre-op evaluations and urgent

care needs, 3) “specialist” hospitalist models in specialty areas of pediatrics, neurology, endocrinology, obstetrics-gynecology, orthopedics and cardiology (Epané & Weech-Maldonado, 2015; Schaffer et al., 2014). Subspecialties in medicine have begun adopting the hospitalist model of care for their inpatients. As with the general hospitalist model, the specialty hospitalist model helps provide hospitalization continuity, potentially decreased cost of care and length of stay, and a better quality of life with a more predictable schedule for specialty hospitalists and their outpatient colleagues. This model also aims to provide more timely consultation for inpatients through increased physician presence, to help improve communication among inpatient caregiver teams through enhanced care coordination, and to reduce redundant tests. All while maintaining or possibly enhancing patient satisfaction.

Although there is limited research in the outcomes of specialty care, several publications highlight the benefits. Zilbermint describes the benefits of an endocrine hospitalist model for enhanced glycemic care that provided a decrease in readmissions of ten percent and a decrease in length of stay by 27 percent for patients (Zilbermint, 2021). Another study reviewing a hospitalist/laborist model for obstetrics-gynecology care showed higher career satisfaction by these physicians (Funk, Anderson, Schulkin, & Weinstein, 2010). A study outlining the value of the hospitalist model of care for procedural subspecialties such as gastroenterology, general surgery, and otolaryngology showed an increase in consults and procedure volumes and a decrease in length of stay. The authors described that these outcomes were related to an increase in the presence of these specialties in the inpatient care setting (Hughes, Sun, Enslin, & Kaul, 2020). Unfortunately, there is limited literature on the outcomes expected from these specialty

models, but rather proposed benefits based on those benefits currently experienced in the general hospitalist model. Further research is needed to assess whether the general hospitalist model outcomes do indeed transfer to the specialty hospitalist model of care.

Hospitalist Model and Cardiovascular Care

Cardiology inpatient care has been compared with general hospitalist care in several studies and was associated with improved adherence to evidence-based therapies and improved outcomes for common cardiovascular conditions such as acute myocardial infarction and heart failure (Kociol et al., 2013; Selim et al., 2015; Uthamalingam et al., 2015). Meaning that those hospitals where cardiology managed these patients compared to a hospitalist managing these patients experienced superior outcomes. Most cardiologists do not admit patients but rather provide consult and follow-up care if needed. The literature suggests that if cardiology managed a greater number of cardiovascular patients, outcomes may be improved. However, that would require improved access to cardiology services in the acute care setting. Developing a cardiology service that provides consistent coverage may be a solution. Just as there has been a shift in the primary care model of hospital medicine, cardiology care has begun to shift to a hospitalist coverage model that includes a cardiologist managing the service for days at a time, providing continuity of coverage and a stronger hospital presence (Fowler & Vargas, 2021; Smith et al., 2021). The model transitions from the traditional model of the cardiologist manages everything for his or her patients, to sharing the care with partners and allowing a partner to manage the care when the patient is hospitalized. Although there has been a shift in hospital coverage models for cardiology, there has

been little research on the effectiveness of a cardiology service run like a hospital service focusing on episode continuity and a consistent hospital presence.

Although no research has assessed the traditional model of care compared to a hospitalist model of care for cardiology, several studies have compared the cardiology hospitalist model of care to the general hospitalist model of care. Smith et al., provided a review of the Non-ST elevated myocardial infarction and percutaneous intervention (PCI) care provided in a cardiology hospitalist model compared to a general hospitalist mode. The study compared 191 patients admitted to a cardiology hospitalist service to 552 patients admitted to the general hospitalist service. There was a difference of more than 10 hours in time from admission to PCI for patients admitted to cardiology versus time to PCI for patients admitted to non-cardiologists. The study demonstrated that patients admitted to cardiology underwent PCI significantly sooner than those admitted to the hospitalists (Smith et al., 2021). Another program focused on heart failure care and developed a cardiology-led inpatient heart failure service modeled after the hospitalist model. When comparing the heart failure hospital service outcomes to the general hospital service outcomes, the heart failure service improved length of stay by more than a half-day and lowered readmission rates to less than half of the hospitalist model (Fowler & Vargas, 2021). There may be insights provided in both these studies related to the benefits of a cardiology hospitalist model of care. Cardiology programs are under increasing pressure to contain costs while maintaining or increasing value. It will be important to identify the best model through outcomes research.

Theoretical Framework and Conceptual Construct

Resource-Based View Of The Firm Theory

RBV Definition and History. Resource-based view of the firm (RBV) theory is one of the most widely accepted theoretical perspectives in the strategic management field (Newbert, 2007). Understanding the history and evolution of the theory is important to better understand how this theory supports the framework developed for this proposal. The theory has evolved from the work of many organizational strategists starting with Edith Penrose in 1959 arguing that a firm's growth, both internally and externally, is due to the way its resources are employed. She describes firms as being made up of a collection of productive resources, and the way in which these resources are exploited drives a firm to have a competitive advantage (Nair, Trendowski, & Judge, 2008). Later in 1984, Wernerfelt described that firms maximize growth through exploiting existing resources and developing or acquiring new ones (Wernerfelt, 1984). Wernerfelt was the first to formalize the Resource-based View of the Firm with the argument that although a firm's performance is directly driven by its products, it is indirectly driven by the resources that go into the production of the products (Newbert, 2007). Jay Barney published a paper in 1991 that added to the work by Penrose and Wernerfelt (and others). Barney added two assumptions. The first assumption was that resources and capabilities are heterogeneously distributed among firms and the second was that they are imperfectly mobile. Therefore firm resources exist and persist over time which can give the firm a competitive advantage (J. Barney, 1991). He further noted, in addition possessing resources that are valuable and rare will give the firm a stronger competitive advantage

and better performance. Mahone and Pandain expanded even further and described that RBV should also include the capability of the firm to make better use of the resources. They suggested that firms that make the most of their resources are those that deploy them in a way that their productivity and/or financial yield are maximized (Mahoney & Pandian, 1992). These authors introduced the concept of capability to resource-based value of the firm by arguing that it is not enough to have the resources, but they must be deployed in a way that is superior to the firm's competitors. Finally, Newberg in an article published in 2008, summarized three key objectives to RBV. The first objective is that if a firm possesses and exploits both resources and capabilities that are valuable and rare, the firm will attain a competitive advantage. The second is that for the firm to sustain the competitive advantage, the resources and capabilities must be both unique and non-substitutable. The third outlines that the firm will improve its short-term and long-term performance if these advantages are attained (Newbert, 2008). According to Newbert, RBV has evolved into a dynamic recipe that explains the process by which these ingredients must be utilized to attain a competitive advantage. Firms seeking competitive advantage must not only attain the necessary resources but have the ability or capability to alter them to allow their full potential to be realized.

Understanding the difference between resources and capabilities is important to applying the RBV theory to organizational strategy. As previously noted, resources are both tangible and intangible assets controlled by a firm that enables it to create and implement strategies. Resources only have the potential to create value if they are used to do something. The ability of the firm to use its resources to do something is referred to as the firm's capabilities (J. B. Barney & Mackey, 2005). Yarborough and Powers note

that resources include those assets that belong to the firm and include brand names, knowledge, skilled labor, trade relationships, equipment, and efficiencies gained through knowledge and capital. Capabilities are skills that organizations use to coordinate resources to perform a task and can include culture, teamwork and trust (Yarbrough & Powers, 2006). As noted, the contemporary definition of RBV is that the competitive advantage requires both resources and capabilities.

The literature takes capabilities one step further and uses the term dynamic capabilities which, according to Eishenhardt et al., are the specific processes that a firm uses to alter its resource base to develop a source of competitive advantage. These authors argue that competitive advantage can exist in dynamic markets only because of the firm's ability to continuously change. In addition, firms that have the most competitive advantage apply their dynamic capabilities "sooner, more astutely, or more fortuitously" in making strategic decisions (Eisenhardt & Martin, 2000).

RBV and Healthcare. The RBV theory has been used in several key areas of business including corporate governance, management buy-outs, venture capital funding, institutional environments, and entrepreneurship (J. Barney, Wright, & Ketchen Jr, 2001). In 2006, Yarbrough and Powers, applied RBV to healthcare organizations and the development of new partnerships. The authors identified their need to use strategic partnerships to obtain a competitive advantage (Yarbrough & Powers, 2006). In 2014, a paper by Burton et al., described the application of RBV to quality improvement in healthcare. These authors argued that quality improvement provides a competitive advantage to healthcare organizations within the political and other contexts in which

they operate (Burton, Malone, Robert, Willson, & Hopkins, 2014). Another publication by Kash et al., in 2013 compared two healthcare organizations and their strategic planning and implementation framework. They found that strategy implementation relies on the RBV perspective as healthcare organizations give considerable attention to developing and deploying talents and capabilities needed to carry the strategic initiatives (Kash, Spaulding, Gamm, & Johnson, 2014). Deployment of internal resources was shown to create a competitive advantage. The healthcare industry is faced with dynamic, competitive market forces and exists in a highly constrained and constantly changing regulatory environment. The combination of both tough market forces and a challenging environment make the capabilities for effectively deploying resources a significant driver to creating a competitive advantage.

Although hospitals typically have a similar set of resources, including facilities, physicians, clinical staff, administrative staff and others. The capabilities within hospitals may differ which leads to different deployment strategies. All hospitals do not perform equally as relates to the efficiency of care and quality. This variability creates an environment where higher-performing hospitals in these areas have a competitive advantage. Specifically, patient throughput processes such as those deployed for inpatients have been described to represent organizational capabilities (Yarbrough & Powers, 2006). This finding provides the foundation for the following question. For organizations that have adopted a CV hospitalist model of care, does this represent the use of organizational capabilities that provide a competitive advantage for patient throughput strategies?

To better understand what type of competitive advantage a hospital may be looking to achieve, it is helpful to outline several key economic pressures that hospitals are currently experiencing. First, CMS and many commercial insurers have developed quality-based payment programs that provide incentives or penalties based on performance related to readmission and key quality outcomes. CMS established its Value-Based Purchasing (VBP) program to establish pay for the quality of care and cost rather than only providing payment for the quantity of care. CMS requires that a certain percentage of the payments for all participating hospitals be withheld and redistributed to the hospitals based on their performance on a previously announced set of quality and cost measures ("CMS Hospital Value-Based Purchasing Program Results for Fiscal Year 2020," 2019). This model creates a zero-sum equation. The dollars that Medicare pays out are the same. They are just distributed differently based on outcomes creating a scenario where those with superior outcomes gain financially and those with inferior outcomes lose financially. Hospitals are in competition with each other as relates to specific performance outcomes. These measures include clinical outcomes, safety, person and community engagement, efficiency, and cost reduction. As noted with the hospitalist model of care, performance outcomes for efficiency and quality of care have been proven to be superior to the traditional model of care. Since little research exists on applying the hospitalist model to CV acute care, this proposal seeks to answer several key questions that would support or refute that the deployment of CV physicians in a hospitalist type model creates a competitive advantage.

In addition to the efficiency of care and quality of care performance, hospital ranking surveys that evaluate and publicly compare hospital performance have become

increasingly common (Wang, Wadhera, & Bhatt, 2018). Hospital rankings create another area for hospital competition. Ideally, hospital rankings should direct the patient to high-quality health care and outcomes. One of the most common ranking organizations is US News and World Report. One area of their ranking methodologies is voluntary reporting for cardiac care quality data. When hospitals submit data to the American College of Cardiology National Cardiovascular Data Registry (ACC-NCDR) and allow for voluntary public reporting of these metrics, hospitals get credit towards overall performance (Olmsted, 2022). Key metrics for the ACC-NCDR registry include several measures of guideline adherence. These performance metrics are reported as a percentile ranking compared to other hospitals creating another area of competition between hospitals. This is the third area that this proposal seeks to support or refute. Does the deployment of CV physicians in a hospitalist-type model create a competitive advantage for guideline adherence and potential hospital rankings?

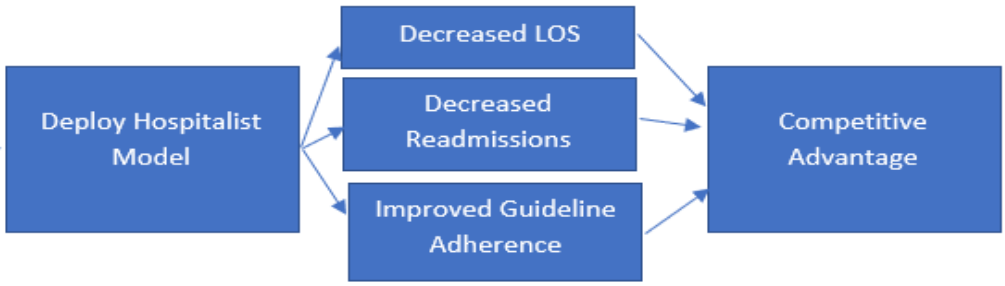
Application of the RBV Theory and Theoretical Framework

As hospitals seek to obtain a competitive advantage, one opportunity may be in the way they deploy their physician workforce. As noted, key performance metrics in the areas of efficiency of care, quality of care, and guideline adherence have been found to be equal or superior in hospitalist models of care. This proposal seeks to assess whether this is true for cardiovascular acute care delivery. Metrics related to the length of stay, readmission rates and guideline adherence have been chosen to assess performance between the traditional models of care versus hospitalists models of care. Based on the RBV of the Firm theory, hospitals that have chosen to implement a hospitalist model

utilize their physician workforce in a unique way that may provide them a competitive advantage compared to their peers. It is the capability of redesigning their delivery model that provides the competitive advantage, not the resource itself. External factors such as CMS Value-Based payment programs and hospital ranking programs are pushing hospitals to perform better. Will improved performance be achieved from working harder or working differently? This research proposal seeks to answer that question and uses the Resource-Based View of the Firm as the basis of the following conceptual framework (See Figure 1).

Figure 1

RBV-Supported Framework



To better understand the possible superiority of the hospitalist model for CV acute care delivery, the following hypotheses presented:

Hypothesis #1 - The hospitalist model of care for CV acute care services is associated with a decreased length of stay compared to a traditional model of care delivery.

Hypothesis #2 - The hospitalist model of care for CV acute care services is associated with a lower readmission rate compared to a traditional model of care delivery.

Hypothesis #3 - The hospitalist model of care for CV acute care services is associated with a higher referral to cardiac rehabilitation referral rate compared to a traditional model of care delivery.

CHAPTER 3
METHODS

Research Design

The research design is a natural experimental design using two cohorts. One group of healthcare organizations (i.e.-hospitals) has adopted a cardiology hospitalist model of care, and one group has not. This research is a nonequivalent group design where the groups identified are similar, but only one of the cohorts experienced the intervention. The design is attractive for this type of research as it mitigates, although does not eliminate, concerns about comparability across patients treated by different teams. The goal of this research design is to account for any confounding variables by controlling for them in the analysis.

This study is a quantitative, retrospective, longitudinal analysis using the cardiovascular program-reported model of care, Medicare-reported common cardiovascular DRG-based average length of stay, Medicare-reported common cardiovascular DRG-based readmission rates, and cardiovascular registry guideline adherence data. The statistical software STATA 17 was used to evaluate responses collected from the outlined data sources and to address the hypotheses. In addressing the hypotheses outlined, the research is to determine whether hospitals that have adopted a hospitalist model have improved outcomes in three distinct performance domains: efficiency of care, quality of care, and care guideline adherence.

Data Sources

The data for this research was obtained from several sources. Cohort identification and participation engagement was derived from the MedAxiom database. MedAxiom is a cardiovascular program service provider and information source exclusively for cardiology groups and organizations that employ cardiologists (Chunn, 2016). MedAxiom was originally developed as a member-only data collection and benchmarking organization in 2001 and now represents 470 CV organization members from across the United States. MedAxiom collects data from approximately 200 of these organizations that includes provider workforce, compensation, and current procedural terminology (CPT) data. CPT data represents the types and volumes of services rendered by the organization. Potential participant organizations were identified through a MedAxiom database query to identify those organizations that render care in the acute care setting.

For the care efficiency and quality measures, this research used Medicare-reported data obtained through Definitive Healthcare (DH). DH is an intelligent commercial platform that owns the Medicare Data Set with proprietary intelligence on hospitals, including hospital profiles, market data at the hospital, practice, and physician level. The Medicare dataset used for the study was obtained through a request to DH based on the current license owned by the researcher's employer.

For the guideline adherence measure, this research used data from the National Cardiovascular Data Registry (NCDR). NCDR is the American College of Cardiology's

(ACC) suite of cardiovascular data registries designed to help hospitals and private practices measure and improve the quality of care they provide. Within the suite of registries, the Chest Pain-MI Registry™ is described as the single, most trusted source for outcomes-based registry for hospitals and health systems application of the American College of Cardiology and American Heart Association clinical guideline recommendations. The registry includes data on patients who are hospitalized and treated for an acute myocardial infarction. The registry is owned by the researcher's employer. A formal request was made, and approval was granted for the use of the NCDR™ Chest-Pain MI registry data.

A request for determination of *Not Human Subjects Research* was submitted to the University of Alabama at Birmingham (UAB) Institutional Review Board (IRB). A protocol number **IRB Protocol Number IRB-300008506** was assigned, and the IRB designated the research *Not Human Subjects Research*.

Operationalization of Variables

This research dissertation includes independent, control, and dependent variables. Table 1 outlines the variable, type, definition, and reference source.

Table 1. ***Variable Listing, Type, Definition, Reference Location***

Variable		Type	Definition	Reference Source
Dependent Variables				
Average Length of Stay (ALOS) DRGs – 291-293, 273-274, 281-283		Continuous	The average number of days an inpatient is hospitalized at each hospital	Definitive Healthcare – CMS data set 2019-2020
Readmission Rate (RR) DRGs – 291-293, 273-274, 281-283		Continuous	The percentage of patients readmitted within 30 days of discharge from initial hospitalization	Definitive Healthcare – CMS data set 2019-2020
Cardiac Rehabilitation Referral Rate		Continuous	Percentage of patients that received a cardiac rehab referral defined by patients hospitalized with acute coronary syndrome divided by the number of patients that received a cardiac rehab referral	National Cardiovascular Data Registry – Chest Pain MI Registry – 2019-2020
Independent Variable				
Cardiovascular Acute Care Hospitalist Rounding Model	X_1	Binary	A dichotomous variable of the presence or absence of a CV hospitalist program defined as having the same cardiologist(s)	Researcher executed program survey

			assigned to provide care to all hospitalized patients for a minimum of contiguous 4 days; Hospitalist (1,0): 1 = Hospitalist model, 0 = Traditional model	
Control Variables				
Percent of CV Care Provided	X_2	Continuous	The percentage of cardiology services provided by the group provider at that particular hospital	Self-reported through program survey
Academic Status	X_3	Binary	A dichotomous variable that delineates a for profit status (1,0): 1 = academic, 0 = not academic	Definitive Healthcare
For Profit Status	X_4	Binary	A dichotomous variable that delineates a the program is For Profit status (1,0): 1 = For Profit, 0 = not For Profit	Definitive Healthcare
Percent Charge Medicare	X_5	Continous	Percentage of hospital charges attributed to Medicare	Definitive Healthcare
Year	X_6	Ordinal	Year the data represents – 2019 through 2020	Definitive Healthcare

Independent Variable

The primary independent variable will be a dichotomous measure of whether the cardiovascular service is functioning in a hospitalist model of care with cardiologists assigned to service for a minimum of four contiguous days. Service assignment is defined by the Cardiologist being in the hospital to provide hospital care to all patients requiring cardiovascular care, not just his or her own patients. The MedAxiom database

produced 202 cardiology professional organizations that rendered care in the acute care setting in 2020. Of those 202, 94 had accurate contact information. The researcher sent emails to these 94 organizations to invite them to participate in the research study and ask them to self-report their use of a hospitalist model for providing cardiovascular care. The goal for participating organizations was a minimum of 30 for each cohort or a total of 60 between the two cohorts. The first cohort is those that use the hospitalist model of care and second cohort is those that do not. A copy of the email sent to the organizations is included in the appendix.

The self-reported survey was returned by 55 cardiovascular delivery organizations and represented 134 hospitals. The 134 hospitals were then identified by which hospitals used the hospitalist model of CV acute care delivery versus which ones used the traditional model of care. The organizations were asked to self-assign which model they used.

Control Variables

The following control variables were used to better understand and account for the variation of ALOS, RR, and guideline adherence between hospitals that use a CV-hospitalist model of care and those that do not:

- Percent of cardiovascular care provided
- Academic status
- Ownership (for profit or not for profit)
- Percent charge from Medicare
- Year

The control variables are described below and represent other factors that may influence ALOS, RR, and Cardiac Rehabilitation referral rates.

The *percent of cardiovascular care provided* may influence the ALOS, readmission rate and guideline adherence. According to the literature, continuity of care and minimizing hand-offs is associated with superior care efficiency with a decrease in the length of stay compared to those with a higher degree of fragmentation. As CV organizations self-report the percent of cardiovascular care they provide, they are identifying with the amount of cardiovascular care they own for that hospital organization. Multiple providers owning a particular type of care may lead to care variability and inefficiency. The data for this variable were obtained through the organizational survey. The organizations were asked to self-report the percentage of care their provider team contributed to the overall CV care of the hospital. Those that were the sole provider reported one hundred percent.

Academic status is another factor that may influence ALOS and readmission rates. Academic facilities tend to provide advanced cardiovascular services and care for patients with higher acuity conditions. Higher acuity may increase ALOS and readmission rates which requires the need to control for academic status. Definitive healthcare provided the academic status. They describe this metric as a propriety metric that they put together based on Liaison Committee on Medical Education and American Osteopathic Association (AOA) Commission on Osteopathic College Accreditation (COCA). The hospital affiliates are the hospitals the medical schools use for clinical rotations. These hospitals receive the academic status allocation. DH then uses the

Association of American Medical Colleges Council of Teaching Hospitals and Health Systems designation to provide a quality verification check.

The *ownership* of a hospital may also influence ALOS and the readmission rate. For profit facilities are likely to be more sensitive to the need to contain costs and provide high-quality care in the most efficient manner. Thereby creating an environment that advocates for a lower ALOS and lower readmission rate. Both of which create a competitive advantage compared to other hospitals. Differences in ownership may result in variation of ALOS and RR that is not associated with CV-hospitalist performance and needs to be controlled. DH also provided the ownership type to include those with a for-profit status versus all other types of ownership models.

Finally, as Medicare has programs specifically aimed at incentivizing low readmission rates or penalizing high readmission rates, those hospitals with a higher Medicare patient population may have adopted specific programs aimed at transitional care with the objective of improving readmission. These programs may not be directly related to CV acute care delivery but rather a systematic approach to hospital discharge and readmission rate reduction. Therefore, controlling for the *percentage of charges from Medicare* was included in the model. DH provided the percentage of charges broken down into three categories: percentage of charges from Medicare, percentage of charges from Medicaid, and percentage of charges from private payers. As noted above, the researcher chose to use only the percentage of charges from Medicare.

Dependent Variables

The following dependent or outcome variable structure is based on each of the three hypotheses. The variables are outlined in Table 2 and described in the following paragraphs. Two of the three dependent variables represent differing DRG groups, Table 3 describes the DRG groups and the diagnosis and acuity levels of patients they represent. The researcher sought to assess ALOS and RR using different types of cardiovascular patients. Using three distinct DRG groupings allowed for that analysis.

Table 2. Dependent Variables

Variable	Type	Source	Date
Length of Stay for DRGs – 291-293; 273-274; 281-283	Dependent	Medicare data obtained from Definitive Healthcare	2019-2020
Readmission Rate for DRGs – 291-293; 273-274; 281-283	Dependent	Medicare data obtained from Definitive Healthcare	2019-2020
Cardiac Rehabilitation Referrals rate percentile	Dependent	National Cardiovascular Registry Data – Cath-PCI	2019-2020

Table 3. DRGs for Common Cardiovascular Conditions

Diagnosis	MS-DRG	Description
Heart Failure and Shock	291	Heart failure and shock with major complication/comorbidity
	292	Heart failure and shock with complications
	293	Heart failure and shock without complications/comorbidity
Percutaneous Intracardiac Procedures	273	Percutaneous intracardiac procedures with major complication/comorbidity
	274	Percutaneous intracardiac procedures without major complication/comorbidity
Acute Myocardial Infarction	281	Acute myocardial infarction, discharged alive with major complication/comorbidity
	282	Acute myocardial infarction, discharged alive with complication/comorbidity
	283	Acute myocardial infarction, discharged alive without complication/comorbidity or major complication/comorbidity

Hypothesis #1 - The hospitalist model of care for CV acute care services is associated with a decreased length of stay compared to a traditional model of care delivery.

To measure the average length of stay outcomes, this research protocol uses the following common CV DRGs (Diagnosis Related Groups) – 291, 292, 293 (Heart Failure); 273, 274 (Inpatient Percutaneous Intracardiac Procedures); and 281, 282, 283 (Acute Myocardial Infarction) and the CMS reported ALOS measures. The researcher specifically chose these DRG groups as they each represent a different, distinct patient population. Heart Failure is the most common reason patients over 65 are admitted to the hospital and typically this is a medically managed patient population. The inpatient percutaneous intracardiac procedure patient population is a procedure-defined DRG group that requires a catheterization procedure performed by a Cardiologist. These

patients may present with a myocardial infarction that requires a percutaneous intervention, or they may be an intracardiac procedure that requires an inpatient stay. Either way, these patients require significant cardiac care that can only be delivered by a cardiologist. The last DRG group represents patients diagnosed with an acute myocardial infarction. These patients are medically managed and do not require procedural care. As these are three distinct patient types with different treatment requirements, the researcher chose to use all three to better understand if a hospitalist model has an impact on the care for these patients and if that impact may differ depending on the patient population cared for. These ALOS measures are aggregated across the Medicare fee for service patients managed by that hospital in a 12-month period for each DRG group. The researcher has chosen to use data from both calendar years, 2019 and 2020. With the pandemic in 2020 and disrupting care delivery, it was decided to look at both years to increase the sample size and increase the generalizability of results not focusing on a single year. Definitive Healthcare is the source of CMS-reported ALOS data for healthcare organizations in each cohort. ALOS is an important outcome measure and a common measure of efficiency of care that may impact the competitive position of the hospital. It is also a common measure used in previous literature related to the general hospitalist model. According to AHA, the standard calculation for ALOS is as follows:

$$ALOS = \text{number of inpatient days/number of admissions}$$

The researcher has access to the data set through the researcher's employment organization.

DRG-specific outcome/dependent variable data was obtained from Definitive Healthcare. DH uses the Medicare standard analyst files (SAFs) which are released on a yearly and quarterly basis by CMS. SAF includes one hundred percent of Medicare fee-for-service claims data for inpatient claims. SAF does not include Medicare Advantage data. According to DH, the claims in the annual SAF have an approximate 99% maturity. CMS reports the data at the individual DRG level. The researcher chose to aggregate the data across DRG groups for this study. The DH analytic team calculated the aggregated group DRG level data metric. They describe their calculation as the calculated ALOS across the DRGs for each group per hospital.

Hypothesis #2 - The hospitalist model of care for CV acute care services is associated with a decrease in readmission rate compared to a traditional model of care delivery.

To measure readmission rate outcomes, this research protocol used the same common CV DRGs as the ALOS data. For these DRGs, the CMS data obtained from DH will be used. As with the ALOS data, the DRG data was provided by DH at the individual DRG level and then aggregated across the DRG group to be used in the model. As with ALOS, data from both 2019 and 2020 will be used. Definitive Healthcare is the source of CMS reported readmission data for healthcare organizations in each cohort. The researcher has access to the data set through the researcher's employment organization.

Hypothesis #3 - The hospitalist model of care for CV acute care services is associated with a higher level of cardiac rehabilitation referral rate compared to a traditional model of care delivery.

To measure guideline adherence, the rate of cardiac rehabilitation referral adherence will be assessed. This measure was chosen as most patients hospitalized with a cardiac event are candidates for cardiac rehabilitation based on current evidence-based guidelines. This measure is collected as part of the NCDR Chest Pain/MI registry. NCDR Chest Pain/MI registry data will be used to provide the rolling 12-month average referral rate metric for each program. As with the CMS data, both 2019 and 2020 will be included. NCDR reports the metric as the following:

Cardiac Rehabilitation Referral Rate = Number of patients with cardiac rehabilitation referral/Number of patients hospitalized with a diagnosis of CAD

Cardiac rehabilitation referral is an American College of Cardiology/American Heart Association class Ia recommendation. All patients who are hospitalized with a diagnosis of coronary artery disease should have a cardiac rehabilitation referral based on current guidelines of care for this patient population (Braunwald et al., 2000). This includes all patients that are represented by DRGs 273-274 and DRGS 281-283. The researcher has access to this data through the researcher's employment organization.

Analytic Strategy

Descriptive statistics of the dependent and independent variables are used to illustrate trends across hospitals with and without cardiology hospitalist models of care. First, univariate analyses are performed on each variable. Descriptive statistics for the categorical and continuous variables are reported. For categorical variables, frequencies and percentages are reported. For continuous variables, means and standard deviations are reported. All are presented in table 3.

Bivariate statistics were used to identify differences between the two groups. A combination of T-tests and chi-square tests was performed on each dependent variable which included ALOS at the group DRG level, RR at the group DRG level and Cardiac rehabilitation referral rate with the independent variable which is the presence or absence of a CV hospitalist model. In addition, bivariate statistics were run between the dependent variables and the control variables, including percent of Medicare charges, percent of Medicaid charges, percent of private payer charges, academic medical center status, ownership model, and percent of CV care provided. T-tests were used when the variables included the dichotomous independent variable and a continuous dependent variable. Chi-square tests were used when the variables included the dichotomous independent variable and a dichotomous dependent variable.

A multivariable generalized estimating equation (GEE) model was performed to examine the effect hospitalist models have on the ALOS, RR, and cardiac rehabilitation referral rate. The GEE model was selected for its ability to account for repeated

measures. The analyses were performed on data that includes two years of ALOS, RR, and cardiac rehabilitation referral rates. Both years, 2019 and 2020, were included due to 2020 being the year of COVID. There was concern that using 2020 alone may not ensure an accurate representation of the data. Using two years of data was thought to normalize the data minimizing any impact of the pandemic. The hospitalist model and other independent variables remained the same for the two-year period. The following outlines the models used for each hypothesis.

Hypothesis 1. Hypothesis 1 investigated whether hospitals that utilized the cardiovascular hospitalist model of care will have a lower ALOS for common CV DRGs than hospitals that utilized the traditional model of care. The GEE model is as follows:

$$\textit{ALOS DRG 291-293} = \beta_0 + \beta_1 * \text{Hospitalists} + \beta_2 * \text{percent or care provided} + \beta_3 * \text{academic medical center} + \beta_4 * \text{for profit status} + \beta_5 * \text{percent charges Medicare}$$

$$\textit{ALOS DRG 273-274} = \beta_0 + \beta_1 * \text{Hospitalists} + \beta_2 * \text{percent or care provided} + \beta_3 * \text{academic medical center} + \beta_4 * \text{for profit status} + \beta_5 * \text{percent charges Medicare}$$

$$\textit{ALOS DRG 281-283} = \beta_0 + \beta_1 * \text{Hospitalists} + \beta_2 * \text{percent or care provided} + \beta_3 * \text{academic medical center} + \beta_4 * \text{for profit status} + \beta_5 * \text{percent charges Medicare}$$

Hypothesis 2. Hypothesis 2 investigated whether hospitals that utilized the cardiovascular hospitalist model of care will have a lower RR for common CV DRGs than hospitals that utilized the traditional model of care. The GEE model is as follows:

$$\textit{RR DRG 291-293} = \beta_0 + \beta_1 * \text{Hospitalists} + \beta_2 * \text{percent or care provided} + \beta_3 * \text{academic medical center} + \beta_4 * \text{for profit status} + \beta_5 * \text{percent charges Medicare}$$

$$\textit{RR DRG 273-274} = \beta_0 + \beta_1 * \text{Hospitalists} + \beta_2 * \text{percent or care provided} + \beta_3 * \text{academic medical center} + \beta_4 * \text{for profit status} + \beta_5 * \text{percent charges Medicare}$$

$$\textit{RR DRG 281-283} = \beta_0 + \beta_1 * \text{Hospitalists} + \beta_2 * \text{percent or care provided} + \beta_3 * \text{academic medical center} + \beta_4 * \text{for profit status} + \beta_5 * \text{percent charges Medicare}$$

Hypothesis 3. Hypothesis 3 investigated whether hospitals that utilized the cardiovascular hospitalist model of care will have a higher Cardiac Rehabilitation Referral Rate for patients hospitalized with an active diagnosis of coronary artery disease as captured by the ACC-NCDR Chest Pain MI^{TM} Registry than hospitals that utilized the traditional model of care. The GEE model is as follows:

Cardiac Rehabilitation Referral Rate = $\beta_0 + \beta_1$*Hospitalists + β_2*percent or care provided + β_3*academic medical center + β_4*for profit status + β_5*percent charges Medicare

CHAPTER 4
RESULTS

Sample Size

The data analyzed came from various sources based on the data required for each hypothesis. The independent variable data, hospitalist model of care, was derived from the self-reported survey of MedAxiom member organizations. Surveys were returned by 55 cardiovascular delivery organizations and represented 134 hospitals. The sample size for the independent variable is 134. For hypothesis #1, ALOS was evaluated and the data were obtained from Definitive Healthcare. With the three DRG groups evaluated, a different sample size for each DRG group was produced. CMS does not include hospitals with low sample sizes in the data they provide third parties for the DRG data. Therefore, hospitals with a small number of patients for the DRG would not be included. In addition, two years of data was included in the sample set. For ALOS DRG 291-293, the sample size was 264. For ALOS DRG 273-274, the sample size was 91. For ALOS DRG 281-283, the sample size was 205. Of note, DRG 273-274 is a procedural DRG and requires the patient to undergo an intracardiac procedure. Hospitals without this capability would not manage patients that qualify for this DRG group. For hypothesis #2, RR was evaluated. The data was also obtained from Definitive Healthcare. For RR DRG 291-293, the sample size was 264. For RR DRG 273-274, the sample size was 104. For RR DRG 281-283, the sample size was 211. For Hypothesis #3, the data were

obtained from the ACC-NCDR Chest Pain-MI Registry™. In order for organizational-level data to exist, the hospital would need to participate. Participation in the Chest Pain-MI Registry™ registry is voluntary. For the 134 hospitals included in the study, 76 programs participated in the Chest Pain-MI Registry™ and had cardiac rehabilitation referral rate data available.

Demographic Characteristics

The primary independent variable for this study is hospitals that utilize a CV hospitalist model of care and those that use a traditional model of care. Of the 134 hospitals represented in the data, 89 (66.4%) of the hospitals reported using a CV hospitalist model of care, while 45 (33.6%) reported using a traditional model of care. Table 4 describes the descriptive statistics for all variables used for this study.

Table 4. ***Descriptive Statistics – Univariate and Bivariate***

Variables	**Hospitalist model 89 (66.4%)**	**Traditional model 45 (33.6%) Mean (SD) /Frequency(%)**	**P -Value**
Dependent Variables	Mean(SD)/frequency (%)		
Average Length of Stay in Days (ALOS) DRG 291-293	4.41 (0.72)$^{+}$	4.69 (0.78)$^{++}$	<0.01
Average Length of Stay in Days (ALOS) DRG 273-274	2.57 (0.81)$^{+++}$	2.94 (1.13)$^{++++}$	0.07
Average Length of Stay in Days (ALOS) DRG 281-283	2.60 (0.72)*	2.80 (0.72)**	0.06
Readmission Rate (RR) in Percent DRG 291-293	0.24 (0.06)$^{+}$	0.22 (0.06)$^{++}$	0.05
Readmission Rate (RR) in Percent DRG 273-273	0.17 (0.15)***	0.16 (0.10)****	0.56
Readmission Rate (RR) in Percent DRG 281-283	0.21(0.18)$^{+++++}$	0.20 (0.13)$^{++++++}$	0.94
Cardiac Rehab Referral in Percent Rate	87.9 (15.60)*****	86.9 (15.30)******	0.78
Control Variables			
Percent Medicare	0.26(0.06)	0.28 (0.08)	0.02
Academic Medical Center	12(13.48%)	0(0.00%)	0.01
For profit	0(0.00%)	4(8.89%)	0.01
Percent Care Provided	96.12 (11.57)	82.29(2.65)	<0.01

Number of Beds	240.52 (196.57)	278.42 (322.12)	0.23

*n=136; **n=71; ***n=67; ****n=39; *****n=45; ******n=31; +n=176; ++n=90; +++n=57; ++++n=36; +++++n=139; ++++++n=745

Bivariate Analysis

Bivariate analyses were performed using both t-tests and chi-square tests. See column four in Table 4. The analyses demonstrated lower ALOS for DRG Group 291-293 of 0.28 days per admission (4.41 days per admission vs. 4.69 days per admission) for hospitals that use a CV hospitalist model of care. Hospitals that use a CV hospitalist model of care had a decrease in the percentage of Medicare Charges by 2 percent (26% vs 28%). In addition, in hospitals that use a hospitalist model of care, the CV providers provide a higher percentage of the CV care for the organizations by almost 14% (96.12% vs 82.29%). All other t-tests failed to show any significant correlation between the dependent variable and the other continuous independent/control variables.

Bivariate analyses performed through the use of Chi-square tests demonstrated that hospitals that use a hospitalist model of care are more likely to be academic programs (13.48% vs 0.00%). Hospitals that use a hospitalist model of care are less likely to be for profit (0.00% vs 8.89%). All other Chi-square tests failed to show any significant correlation between the dependent variable and the other dichotomous independent/control variables.

Multivariate Analysis

Multivariate analyses were performed with each dependent variable (ALOS by DRG group, RR by DRG group, and cardiac rehabilitation referral rate), the independent variable (use of CV hospitalist model), and all control variables (ownership, payer mix, academic status, percent of CV care provided). A generalized estimating equation produced the following results for each hypothesis.

Table 5. GEE Results for Hypothesis #1

Variables	**ALOS 291-293**	**ALOS 273-274**	**ALOS 281-283**
	N= 264	**N=91**	**N= 205**
Physician Based Hospitalist Program			
Yes	-0.24(0.13)	0.19(0.29)	-0.23(0.14)
No - reference			
Ownership			
For Profit	-0.68(0.51)	0.10(0.65)	-0.64(0.46)
Not-for-Profit and all others – reference			
Payer Mix			
Percent of Charge from Medicare	-0.00(0.01)	0.03(0.02)	-0.00(0.01)
Academic Status			
Academic Center	0.45(0.28)	-0.39(0.33)	0.51(0.25)*
All Others - reference			
CV care provided			
Percentage of CV care provided	-0.01(0.00)*	-0.02(0.01)*	-0.00(0.00)

P-Values for coefficients are based on generalized estimating equations *p</=0.05

For hypothesis #1, the GEE failed to show a significant correlation between ALOS in all three DRG groups and the use of the CV hospitalist model of care. The analysis did show a correlation between the percentage of care provided for both DRG groups 291-293 and 273-274. However, the magnitude in difference in length of stay for hospitals with a higher percentage of CV care provided was between one hundredth and two-hundredths of a day or less than 30 minutes which is not a meaningful impact.

Table 6. GEE Results for Hypothesis #2

Variables	**RR 291-293**	**RR 273-274**	**RR 281-283**
	N= 264	**N=104**	**N=211**
Physician Based Hospitalist Program			
Yes	1.78(0.92)*	4.61(4.34)	-2.31(2.42)
No - reference			
Ownership			
For Profit	0.79(3.57)	4.56(9.93)	4.58(8.25)
Not-for-Profit and all others – reference			
Payer Mix			
Percent of Charge from Medicare	0.02(0.07)	-0.02(0.29)	-0.54(0.17)*
Academic Status			
Academic Center	0.86(1.92)	-7.46(5.07)	-3.74(4.41)
All Others - reference			
CV care provided			
Percentage of CV care provided	-0.02(0.02)	-0.06(0.09)	0.09(0.06)

P-Values for coefficients are based on generalized estimating equations *p</=0.05

For hypothesis #2, the GEE failed to show a significant correlation between RR for DRG groups 273-274 and 281-283 and the use of the CV hospitalist model. However, the GEE did show a significant correlation between RR and DRG 291-293 and the use of the CV hospitalist model. On average, hospitals with a hospitalist model of

care experience a 1.78% higher readmission rate. The analysis failed to support hypothesis #2 with no statistical significance. In addition, the slight impact was actually opposite of that hypothesized. The readmission rate was actually higher, not lower with the hospitalist model of care.

However, the GEE did show a correlation between the percent of charges from Medicare and the readmission rate for DRG 281-283. For every one percent higher level of Medicare charges, the readmission rate for DRG was 0.54% lower for DRG group 281-283.

Table 7. GEE results for Hypothesis #3

Variables	CP_MI (CRR) N= 76
Physician Based Hospitalist Program	
Yes	-2.31(3.65)
No - reference	
Ownership	
For Profit	0 (Omitted)
Not-for-Profit and all others – reference	
Payer Mix	
Percent of Charge from Medicare	-0.65(0.24)*
Academic Status	
Academic Center	-3.15(7.53)
All Others - reference	
CV care provided	
Percentage of CV care provided	1.03(0.19) *

P-Values for coefficients are based on generalized estimating equations *p</=0.05

For hypothesis #3, the GEE failed to show any correlation between cardiac rehabilitation referral rate and the use of the CV hospitalist model of care. However, the

analysis did show a correlation between the cardiac rehabilitation referral rate and the percent of charges from Medicare and the percentage of CV care provided. For every percent increase in Medicare charges, the cardiac rehabilitation referral rate was 0.65% lower. And for every percent increase in the percent of cardiovascular care provided, the cardiac rehabilitation referral rate 1% higher.

CHAPTER 5
REVIEW OF FINDINGS

In review, the primary independent variable for this study was hospitals that utilize a CV hospitalist model of care and those that use a traditional model of care. There were 134 hospitals represented in the data, with two-thirds representing organizations that use the CV hospitalist model and one third that do not. There were three hypotheses put forth in this research with separate dependent variables for each. This section will outline the findings for each to include any significant findings as relates to the control variables for each.

Hypothesis #1 - The hospitalist model of care for CV acute care services is associated with a decrease length of stay compared to a traditional model of care delivery.

For hypothesis #1, of the three DRG groups, the bivariate analysis only demonstrated a reduction in the ALOS for Heart Failure patients. The reduction was 0.28 days which equates to over 6 hours. Unfortunately, the multivariate analysis failed to show a statistically significant association with a p-value of 0.07. An argument could be made that the p-value is close enough to significance that this would be considered a legitimate association. From a healthcare administrator's standpoint, 6 hours is a significantly shorter length to stay. One that would increase capacity of the facility and decrease the cost of care for those hospitalizations. If an organization had 100 admissions with the DRGs 291, 292, or 293, there would be a 600-hour reduction in

hospital bed need or 25 days. Further investigation of this potential association is warranted. A larger sample size may provide a p-value that is significant.

Additional findings noted with the analysis for hypothesis #1 included a positive association between the average length of stay for acute myocardial infarction patients and academic medical centers. The analysis showed an increase in the length of stay by a half-day. This is significant and may suggest that academic organizations are less efficient. However, the finding was only noted for one of the DRG groups, and the number of academic centers in our sample was small, with a total of 12. Additionally, all 12 were noted to have a hospitalist model of care which is also opposite of what was expected based on the hypothesis. This finding requires further investigation for both validity and to better understand the strength of the impact.

The last finding with statistical significance was the percentage of CV care provided by a provider group within the hospital and the impact on ALOS. In this case, all three DRG groups noted a negative association between the percent of CV care provided and the ALOS. However, the impact to the length of stay was less than a 15-minute reduction. From a hospital administration standpoint, a 15-minute reduction is not likely enough to advocate for a change in organization ownership of CV care. A larger sample size may show a larger impact. This finding does make sense as physician groups likely have similar behavior within the group compared to other groups. Standardized patient care models that provide consistent support and timing of care could impact ALOS. Unfortunately, there is not enough of an impact noted to allow this finding to be considered significant.

Hypothesis #2 - The hospitalist model of care for CV acute care services is associated with a decrease in readmission rate compared to a traditional model of care delivery.

Findings for hypothesis #2 included a bivariate analysis that demonstrated a significant association between the hospitalist model of care and the readmission rate for patients with heart failure. However, the association was a positive association meaning that the readmission rate went up with the hospitalist model compared to the traditional model of care. The multivariate analysis supported this finding with a positive association of 1.78% increase in average readmission rate for heart failure for hospitals that use a hospitalist model of CV care compared to those that do not. Although 1.78% seems like a relatively small number, the difference between a CMS reimbursement penalty and an incentive could be as little as 1.78% difference. In addition, the penalty or incentive is calculated across the entire reimbursement rate for all CMS-reimbursed hospital activities. This could equate to thousands if not millions of dollars. However, the analysis only supported this finding for one of the three DRGs. The statistical significance is limited to only one patient population. However, it is completely against the hypothesis that a hospitalist model of care is associated with a decreased readmission rate and may potentially provide a higher quality of care than a traditional model.

The only additional statistically significant finding supported by the analysis for hypothesis #2 was a negative association between the percent of charges from Medicare and the readmission rate for patients admitted with an acute myocardial infarction. In this case, the negative association equated to a 0.54 percent reduction in readmissions for every percent increase in Medicare charges for the hospital. In one way, this makes sense. Organizations need to be competitive in readmission reduction for patients with

Medicare because Medicare readmissions are associated with significant penalty in Medicare reimbursement if organizations perform more poorly than others. It is quantified as part of a budget-neutral comparison. Those who perform better receive an incentive, and those who perform worse receive a reduction. Therefore, it makes sense that the more charges from Medicare, the better an organization seeks to perform. However, this finding was only noted in one of the three DRGs which represented acute myocardial infarction. And in this case, acute myocardial infarction that is medically managed (versus procedurally managed). Therefore, the care may be more likely to be provided by hospitalists versus cardiology. In addition, with only one of three DRGs noting a significant association, it seems less relevant.

Hypothesis #3 - The hospitalist model of care for CV acute care services is associated with a higher level of cardiac rehabilitation referral rate compared to a traditional model of care delivery.

Findings for hypothesis #3 failed to show any association between the hospitalist model of CV care and cardiac rehabilitation referral rate in either the bivariate or the multivariate analysis. The percentage from Medicare Charges did show a statistically significant negative correlation. However, the -0.65% decrease in referral rates for every 1% higher Medicare charges would not be a significant finding from an administrative perspective. The finding is interesting as theoretically it would be anticipated that those with higher charges from Medicare would have a higher rate of cardiac referral rate. This is purely from a reimbursement perspective. Medicare reimburses cardiac rehabilitation consistently across the United States, while private payers and Medicaid plans are variable. Although ideally reimbursement should not influence rate of referral for a class

Ia recommendation, conceivably it could. However, this finding did not support the hypothesis as the referral rate actually went down for organizations with higher charges from Medicare.

The second finding was the positive association between the percentage of CV care provided and the cardiac rehabilitation referral rate. For every 1% increase in CV care provided, the cardiac rehabilitation rate increased by 1%. This finding is significant as the range of CV care provided was from as low as 30% to as high as 100%. If the cardiac rehabilitation referral rate increased by 1% for every 1% increase in the percentage of CV care provided, this could be significant for some hospitals. Likely this finding signifies improved care standards at the group level and a decrease in variation when a single group manages a patient population. Certainly, operationalizing standard care is simpler with fewer key stakeholders.

In summary, the analysis of the sample population used for this study failed to support all three hypotheses as outlined. However, there were several interesting findings that would support future research.

Strengths and Limitations

Strengths

As hospital organizations seek to develop a successful delivery model that produces the desired outcomes while creating a competitive advantage, findings such as those provided by this study are valuable. Based on the organizations who participated in this study, two-thirds have adopted a significant change to the traditional model of CV acute care delivery. This research suggests that the benefits they were hoping to achieve may not be realized through care delivered by a hospitalist model alone. One key strength of this study is that it attempted to align key outcomes (efficiency of care, quality of care, and guideline adherence) to those studied over the last two decades as to the impact of the non-CV hospitalist model (care provided by an intern). The outcomes assessed are commonly measured and hold validity in the industry for measures that represent the specific areas. Historic literature was used to support the hypothesis put forth in this study which creates a level of legitimacy in the findings. These are the same measures used in previous literature with the same definitions. In this case they failed to show a significant association. It may be that the CV hospitalist model of care is not superior to the traditional model of care for these areas.

Another strength of this study is the level of interest in the information as shown by the high level of engagement by the participants. There were a total of 94 CV professional organizations engaged to participate and a total of 55 agreed. That is an acceptance rate of 59%. The researcher received significant feedback describing this study as much needed and that the findings would be valuable to them. Many of them had the same questions the researcher was seeking to answer.

The final strength of this study is the impact that the information could have on the delivery of CV care across this county. Most hospital organizations describe CV care as number one or number two for care delivery in both volume and revenue. This means that a significant portion of the services rendered in hospital organizations is specific to CV disease and patients presenting with care needs. The research question is an important one and the answers are valuable to every acute care hospital that manages CV patients.

Had this study showed a significant impact to care by one model versus the other, the implications to CV care delivery would have a profound effect on most organizations and create a competitive advantage for those who adopted the superior model. Although the findings did not support of the CV hospitalist being the superior model for the outcomes measured, the answer may still be a valuable one. Maybe it is less about how the physicians are organized and more about other care model attributes that make one hospital organization a higher performer than another. Maybe organizations should spend less time on developing the 'right' provider deployment strategy and more time on the resources CV providers need to manage these patients effectively.

Limitations

The limitations of the study are related to the study size and scope. Although the number of study participants supported a statistically significant study, they are far from representing most hospitals that provide CV care. Several key findings were just short of being statistically significant. A higher volume of participants may have deemed those findings significant. In addition, due to data availability, the study focused only on fee for service Medicare data. As the data shows, Medicare charges represented less than half of the charges of any of the organizations included in the study. In addition, the data did not include Medicare Advantage patients which may be a high portion of Medicare patients in certain markets. The study did not take into account the market penetration of Medicare Advantage. The ability to create an analysis that included all patients may have provided different findings.

Another limitation to this study is the timeframe. Both years 2019 and 2020 were used in the analysis. The COVID pandemic was a significant disruptor to care delivery in 2020. Several key shifts in care delivery were noted that included elective cardiovascular procedures delayed, a significant reduction in patients presenting to emergency rooms with cardiac events, and a change as to how providers were deployed to minimize provide and patient exposure. The research committee contemplated how best to manage data from the year 2020. It was decided to include two years of data with the objective of normalizing any impact 2020 may have had. It is challenging to know if this was the right methodological decision without providing two side-by-side anlayses. Future research is warranted that does not include 2020 in part of the assessment for the reasons outlined above.

Finally, as noted in the literature review, not all hospitalist models are created equal as far as effectiveness. Hospitalist intensity and length of coverage also played a role. This study did not take into account patients per physician or days the physician was assigned to the service. Both workload and coverage models may deem the model less effective in the three domains assessed in this study. The research question and data did not take into account these potential variables.

Implications

Although the findings did not support of the CV hospitalist being the superior model for the outcomes measured, the answer may still be valuable. There are two potential ways to interpret the findings.

First, maybe it is less about how the physicians are organized and more about other attributes to the care model that make one hospital organization a higher performer than another. Maybe organizations should spend less time on developing the 'right' provider deployment strategy and more time on the resources CV providers need to manage these patients effectively. Future research should focus on other differences in organization attributes that influence an organization's outcomes and lead to superior care. Example attributes could be leadership structure, organizational culture, use of team-based care models, and care pathway adoption. The study captured data to identify physician organization type, the use of APPs to deliver hospital care and the length of time physicians were assigned to the hospital service. For purposes of this dissertation,

it was decided not to include those variables in this analysis. However, opportunities for future research are defined and partially operationalized.

Second, several other significant findings were noted from the analyses with the control variables. The percent of CV care provided by the participating organization had a significant positive association with the cardiac rehabilitation referral rate. This measure was chosen to represent guideline adherence. The higher rate of guideline adherence associated with a higher portion of care provided by a single organization could suggest that there is a decrease in the variation of care. Although that may seem a stretch. The concern for care variation leading to suboptimal care delivery is not a new one. The research related to care fragmentation noted a similar effect (Epstein et al., 2008). When continuity of care was maintained, outcomes were superior. Although this finding is not describing provider-patient continuity but rather organization-patient continuity, this may be a significant finding noting that minimizing care fragmentation even at the organizational level may have benefits. As with the other findings, more research is warranted.

Conclusion

Cardiology care is evolving, and many organizations have adopted the hospitalist model of care for acute care services. Literature suggests that a hospitalist model should improve care efficiency, guideline adherence, and possibly quality of care. As noted, little research has looked at the impact of applying the hospitalist model of care to specialty care. With three hypotheses, each postulating a different benefit of the hospitalist model of care compared to the traditional model, improved efficiency of care, quality of care, and guideline adherence, the goal of this research was to assess the superiority of the hospitalist model in these three domains. Unfortunately, the data did not support any of the three hypotheses. However, several key areas were identified as possible benefits with opportunities for future research.

As hospitals continue to find themselves in a competitive environment vying for patient volumes, better reimbursement, and an engaged provider workforce, it is important to understanding specific practices that lead to high performance compared to their peers. The RBV theory outlines the need to not only ensure that resources are available, but to possess capabilities that allow for optimal resource use. In fact, the latter is imperative to driving performance and being the highest performer in a competitive market. A brief review of program outcome data often shows significant variation across organizations. This is interesting as patients are usually fairly homogenous and the objectives of care are often dictated by national guidelines. Therefore, it leads to the belief that it is the way care is delivered that leads to superior outcomes. The capabilities an organization possesses to adjust its care delivery models may be the key that allows

them to achieve superior outcomes. For that reason, this type of research is valuable in understanding which delivery models provide better outcomes.

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APPENDIX I

IRB APPROVAL

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM
Office of the Institutional Review Board for Human Use

470 Administration Building
701 20th Street South
Birmingham, AL 35294-0104
205.934.3789 | Fax 205.934.1301 |
irb@uab.edu

NHSR DETERMINATION

TO: Biesbrock, Ginger Kaye-Stewart

FROM: University of Alabama at Birmingham Institutional Review Board
Federalwide Assurance # FWA00005960
IORG Registration # IRB00000196 (IRB 01)
IORG Registration # IRB00000726 (IRB 02)
IORG Registration # IRB00012550 (IRB 03)

DATE: 07-Jan-2022

RE: IRB-300008506
Applying the Hospitalist Model of Care to Cardiovascular Acute Care Delivery

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The Office of the IRB has reviewed your Application for Not Human Subjects Research Designation for the above referenced project.

The reviewer has determined this project is not subject to FDA regulations and is not Human Subjects Research. Note that any changes to the project should be resubmitted to the Office of the IRB for determination.

if you have questions or concerns, please contact the Office of the IRB at 205-934-3789.

APPENDIX II

COHORT ENGAGEMENT EMAIL

Email subject line - Applying the Hospitalist Model of Care to Cardiovascular Acute Care Delivery

Dear XXXXX

As the EVP of Care Transformation for MedAxiom, I often ask why we do the things we do when it comes to patient care delivery. Do we develop and adopt certain practices because they are clinically effective to allow us to achieve the outcomes we desire or because other hospitals follow these practices and so they must work? Part of my role is to assist in gauging clinical effectiveness and identify best practices that are truly clinically effective and provide superior results.

For this reason, I have chosen an important topic for my DSc in Healthcare Leadership dissertation, providing CV services in the acute care setting. My research is seeking to assess if providing hospital-based care using the hospitalist model of care is superior to the traditional model of care in the areas of care efficiency and care quality.

As a MedAxiom member who submits MedAxcess data, your program has been identified as one that provides cardiovascular care in an acute care setting. I am seeking to identify two cohorts, one that delivers acute care using a physician-led hospital service with physician rounding assignments for a minimum of 4 days and one that delivers acute care through the traditional model where each physician rounds on his or own patients while they are hospitalized. If you agree to be part of this study, all that is required from you is to answer a 9 question survey. No additional data is required from you. The dependent variable data is available to me through data sources for which MedAxiom has access.

Data metrics will include –

Independent Variable – Use of Hospitalist model to delivery cardiovascular care in the Acute Care setting

Dependent Variable #1 - Medicare Reported - Length of Stay for DRGs 273-275, 291-293 – 2019- 2021

Dependent Variable #2 - Medicare Reported - Readmission Rate for DRGs 273-275, 291-293 – 2019-2021

Dependent Variable #3 - NCDR (Cath/PCI) reported – Rate of Cardiac Rehabilitation referral for qualified patients

Submission of the following 9-question survey is your approval to be part of this study. The results will be aggregated at the cohort level with no identifiable data or metrics included at the organizational or hospital level.

1. Your name and title
2. Name of organization and number of Cardiologists
3. Do the Cardiologists in your organization provide hospital services? Yes/No (No you are excluded)
4. Which hospital support model does your organization currently use for hospital rounding?
    a. Hospitalist model of care (A cardiologist is assigned to a formal cardiology hospital service for a minimum of 4 days in a row to manage all admissions, consults, rounding and discharges (may be provided with several physicians and/or APPs)

   b. Traditional model of care (Each cardiologist rounds on his or her own patients daily while they are hospitalized while new patients to the practice may be managed by a physician of the day or call physician)

5. For programs that use the hospitalist model of care – have you used this model since January 2019? If no, when did you start – please provide estimated month and year
6. For programs that provide the hospitalist model of care – how many sequential days are physicians assigned to the service
   a. 4
   b. 5
   c. 6
   d. 7
   e. >7
7. For programs that provide the hospitalist model of care – do you use APPs to assist in providing hospital professional services?
   a. Yes
   b. No
8. What hospitals do you currently provide hospital services and what percentage of cardiology services does your group provide? (If your group is the sole provider you would answer 100%. If there are other programs that provide CV care, please estimate the percentage of CV care your group provides).
   a. Hospital 1 – Name, Address, Percentage of Care
   b. Hospital 2 – Name, Address, Percentage of Care

c. Hospital 3 – Name, Address, Percentage of Care

d. Add up to 10 hospitals

9. If we have additional questions, may we contact you directly? Please include email.