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An Analysis of Hospitalist Programs in Critical Access Hospitals

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AN ANALYSIS OF HOSPITALIST PROGRAMS IN CRITICAL ACCESS HOSPITALS

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ABSTRACT

Hospitalists are physicians specially trained in the care of hospitalized patients. In critical access hospitals (CAHs), the annual cost of a physician-based hospitalist program is approximately $1M. The high cost of hospitalist programs must be offset by the hospitalists' ability to reduce the cost of inpatient care and/or by their ability to generate additional inpatient volume and revenue. Two well-established metrics are used to measure hospitalist performance: the average inpatient length of stay (ALOS) and the average daily census (ADC). Well-performing hospitalist programs are expected to *reduce* ALOS and *increase* ADC. The most pressing question for CAH administrators is whether sufficient cost saving and revenue enhancement opportunities exist at CAHs to offset the high cost of the programs. Little is known regarding hospitalist performance at CAHs specifically. This study was designed to address that gap in the literature.

This study posited that due to very low inpatient census levels, relatively low inpatient acuity, and small rural populations, hospitalists at CAH's do *not* have a statistically significant impact on either ALOS or ADC when compared to non-hospitalist models of inpatient care. The study used five-year, multivariable, longitudinal, random-effects panel data analysis to reach its conclusions. The analysis first studied variances in

two groups of hospitals: those that exclusively used hospitalists over the five-year study period and those that did not use hospitalists at all during the same period. To provide additional analytic sensitivity, the study sample was then expanded to include hospitals that started the five-year period not using hospitalists but converted to a hospitalist model during the study period. The analysis was then repeated, and the results were compared.

Both analyses confirmed that despite low inpatient census levels, low patient acuity, and low rural population levels, hospitalists in CAHs reduce the ALOS by approximately one full day per patient and increase the ADC by approximately three patients per day when compared to hospitals that used alternative models of inpatient care.

DEDICATION

I dedicate this dissertation to my late grandfather, Clarence R. “Cap” Peterson (1894-1982). My grandfather never attended high school or college. Like many of his generation, military service was the only option for further education and training. He proudly served our country in the United States Navy during World War I and learned a trade. He was a principled man with strong convictions, a strong work ethic, and an appreciation for higher education. He was very proud when I graduated from college and was pleased that I expressed a desire to pursue additional degrees. He died one year after I graduated. In his last year, each time I visited him, he asked me, “Are you a doctor yet?” He asked me this one more time during my last visit with him shortly before he died. Until today, I have held lingering regret that I had let him down. I look forward to visiting his gravesite soon and telling him: “I know it took me a while Gramp, but yes, I am a doctor.”

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ADC	average daily census
AHA	American Hospital Association
ALOS	average length of stay
ANOVA	analysis of variance
CAH	critical access hospital
CEO	Chief Executive Officer
CI	confidence interval
CMO	Chief Medical Officer
CMS	Centers for Medicare and Medicaid Service
COO	Chief Operating Officer
DRG	diagnostic-related group
DV	dependent variable
HCRIS	Healthcare Cost Reporting Information System
HMO	health maintenance organization
IHA	Iowa Hospital Association
IRB	Institutional Review Board
IV	independent variable
PCP	primary care physician
OR	odds ratio
SD	standard deviation

UAB	University of Alabama at Birmingham

CHAPTER 1

DESCRIPTION OF THE PROBLEM

Introduction

Hospitalists are physicians specially trained in the care of hospitalized patients. Hospitalists assume responsibility for the care of patients upon hospital admission and then return the patient to their primary care provider for follow-up care upon discharge. Prior the advent of the hospitalist specialty, primary care physicians were responsible for the inpatient care of their own patients. Very early in the evolution of the hospitalist model of inpatient care, several arguments were made to support the need for the specialty.

First, it was suggested that hospital medicine specialists, in the hospital and readily available throughout the day, would improve the quality and efficiency of inpatient care (Wachter, 1999). Reducing the cost of care by reducing the average length of stay (ALOS) was a critical goal as payment models had transitioned from a fee-for-service model to a flat-rate, diagnostic related group (DRG) model. In this revised payment model, hospitals receive a fixed payment amount based on the patient's diagnosis. If the cost of providing care is *lower* than the payment amount, the hospital profits. If the cost of providing care *exceeds* the payment amount, the hospital loses money. Thus, the lower the cost of providing care, the higher the profit margin per patient. To that end, ALOS became a critical benchmark of hospitalist programs with the premise—the less time the patient is in the hospital, the less resources are expended and the greater chance of profitability under the DRG payment system.

A second argument to support the need for the hospitalist specialty focused on primary care physician recruitment and retention. In the late 1990s, primary care physicians were concerned about burnout due to burdensome inpatient responsibilities, call coverage, weekend coverage, and unassigned patients (patients without primary care physicians requiring hospitalization). A common reason for pursuing a hospitalist program was "that primary care physicians either *requested* that the hospital set up a hospitalist program or *required* that the hospital do it by refusing to provide inpatient coverage" (Casey et al., 2014). There was speculation that if relief wasn't provided, retention of primary care physicians would soon become an issue. Other primary care physicians argued that by relieving primary care physicians of inpatient responsibilities and allowing them to maximize their out-patient practices, average daily inpatient census (ADC) would *increase*, as more medical issues would be identified and more patients would be found to be in need of hospitalization (Hoffman et al., 2016).

As the hospitalist evolution gained momentum, reducing the ALOS and increasing the ADC became two very prominent arguments for starting a hospitalist program. This study specifically examines these two arguments at critical access hospitals where low patient volume and low patient acuity may negatively affect the ability to realize meaningful improvement in these two metrics.

This study suggests that hospitalists at critical access hospitals do *not* have an appreciable effect on lowering the ALOS. As the number of patients to care for on any given day averages less than ten and the acuity of those patients is typically lower than at larger hospitals, this study argues that regardless of the model of inpatient care used, the ALOS is relatively constant and is not appreciably lessened by the presence of hospitalists ("AHA Survey Data 2013-2017").

Similarly, this study suggests that due to the rural, low population nature of the catchment areas served by critical access hospitals, the ability for primary care physicians (after being relieved of inpatient responsibilities) to significantly increase out-patient practice volume and generate more inpatient admissions cannot be realized.

Inconsistencies in the Literature

More than twenty years after the birth of hospitalist specialty, research on the performance metrics and financial viability of hospitalist programs continues to produce mixed results. In a 1999 article, hospitalist pioneer Dr. Robert Wachter stated that "preliminary data suggests that hospitalists can shorten the length of stay and lower costs without compromising clinical outcomes or patient satisfaction," but then countered by saying that "although hospitalist programs can benefit hospitals and medical groups financially, they rarely become self-supporting through professional fees alone" (Wachter et al., 1999). Twenty years later, there is still not clear consensus on the overall impact of hospitalist programs.

Many studies concluded that hospitalists generate significant cost savings by better managing inpatient care, reducing the ALOS, reducing complications, and preventing re-admissions, thus reducing the overall cost of care (Auerbach et al., 2001; Davis et al., 2000; Gregory et al., 2003; Hackner et al., 2001; Halpert et al., 2000; Iannuzzi et al., 2015; Showstack et al.,1999; Vinh et al., 2019). Other studies concluded that the savings generated by hospitalists are not sufficient to cover the salary costs of the programs and thus, hospitalist programs add significant expense and contribute to weakening hospital financial performance (Dynan et al., 2009; Salim et al., 2019; Stefanacci, 2015).

A review of empirical literature demonstrates that most studies evaluating the performance metrics and financial viability of hospitalist programs are either site-specific controlled studies at single hospitals *or* include hospitals of all sizes from the very large (greater than 1000 beds) to the very small (25 beds and fewer) to make generalized conclusions. No studies were identified that specifically research the performance and financial viability of hospitalist programs at critical access hospitals (CAH). This gap in the literature is significant, as there are currently 1,350 critical access hospitals in the United States (Flex, 2019). Many of these small, rural hospitals are financially vulnerable, and many have costly hospitalist programs.

The financial vulnerability of critical access hospitals is illustrated by an alarming number of closures since 2005. 162 rural hospitals have closed since 2005, and the problem is escalating. 120 hospitals have closed since 2010, with 2019 having the most closures of any year in the ten-year period (19) (The Cecil Sheps Center for Health Services Research, 2019).

Critical access hospitals experiencing diminishing financial performance have limited options available to them. The most common turnaround strategies deployed in response to a weakening financial condition include a sharp reduction in services and expenses, merger with larger hospitals and systems to recognize economies of scale, and outright closure, as illustrated above. The health and well-being of rural citizens is negatively affected when access to healthcare services is diminished or eliminated.

To avoid a reduction of services, merger, or closure, critical access hospitals must control expenses and assure an appropriate return on investment from all *optional* services and specialties. The annual labor cost of a physician-based hospitalist program in a critical access hospital approaches $1M annually and may be contributing to the financial vulnerability of these hospitals. It is imperative to critical access hospital leaders who have hospitalist programs (and to those considering adding programs) to clearly understand the clinical benefits and financial performance of these programs.

Further justifying new research, critical access hospitals are unique in several ways that complicate the analysis of hospitalist programs. First, critical access hospitals are capped at 25 inpatient beds, and most have an ADC of less than ten patients ("CAH Financial Indicators Report," 2017). Aligned with CAH designation, the patient population of the primary and secondary service areas served by critical access hospitals live in rural and remote areas is limited in number, and it remains relatively constant from year-to-year. This is a salient point, as the volume of inpatients dictates whether adequate care savings or revenue enhancements can be generated by hospitalists to cover program costs.

Second, inpatients at critical access hospitals tend to be of lower acuity than inpatients at larger institutions (CMS-HCRIS Data Files, 2017). Sicker patients are often stabilized and transferred to larger urban hospitals, and many critical access hospitals do not have intensive care units, further limiting the acuity level of their patients. An inpatient census comprised of lower acuity patients may lessen the ability of hospitalists to significantly reduce the ALOS and other costs.

Third, payer mix analysis demonstrates a high percentage of CAH inpatients as having governmental insurance as their primary coverage (Medicare and Medicaid). The Flex Monitoring Team reported that in 2017, 72.33% of critical access hospital *inpatients* were Medicare patients ("CAH Financial Indicators Report," 2017). This is a critical statistic, as CAHs are not reimbursed on a fee schedule or via flat-rate diagnostic-related group (DRG) payments for patients with governmental insurance. Rather, CAHs are paid on a cost-based system for Medicare and Medicaid patients. Hospitalist labor costs are *not* an allowable cost under Medicare guidelines and therefore cannot be reported on the Medicare cost report. As such, hospitalist labor costs have no positive impact on Medicare and Medicaid revenue. Thus, improving the efficiency and reducing the cost of inpatient care on Medicare and Medicaid patients does not translate to enhanced profitability.

Statement of Problem

This study posits that due to low ADC levels and low patient acuity levels, the ability for hospitalists to sufficiently decrease ALOS may not be possible at critical access hospitals. Similarly, this study posits that sufficient untapped out-patient volume may not exist in the rural population served by critical access hospitals to allow primary care physicians to increase their current *out-patient* volume or have any appreciable effect on increasing *inpatient* volume (ADC).

Financial vulnerability is affecting small rural hospitals across the country. The state of Maine, for example, has 16 critical access hospitals; two declared bankruptcy in 2019, and a third merged with a larger urban system to survive. Hospital closures result in lifesaving services no longer being available to the people living in these areas. The closures in Maine create a situation in which lifesaving medical care may be 75 miles to 200 miles away depending on which hospital closes. In the case of cardiac care, stroke care, trauma care, and obstetrics, this added time and distance can lead to devastating outcomes. This problem is growing at an alarming rate, with 2019 having the highest number of closures (19) of any single year in the study period (2010-2019) (The Cecil Sheps Center for Health Services Research, 2019).

Administrators at failing critical access hospitals are facing difficult decisions in 2020. For critical access hospitals to be financially viable and survive, *all* services must be scrutinized for financial viability. Given the significant labor expense of hospitalist programs and the fact that other options for inpatient care exist, the hospitalist specialty must be included in this exercise.

The cost for a continuous, physician-based, hospitalist model of inpatient care at a critical access hospital approaches $1M annually. The average salary expense in 2019 of a single hospitalist physician was approximately $275,000 per year (Johnson, 2019). To provide continuous annual coverage, 3.5 hospitalists are required (3.5 x $275,000 = $962,000). Hospitalist programs thus represent a significant expense to CAHs and must be evaluated for both performance and the ability to cover their own costs. If this significant expense is not offset by cost savings or revenue enhancement, hospitalist programs may be contributing to the weakening financial position of small critical access hospitals.

Purpose of Study

This study examined two of the major arguments used to justify the initiation of hospitalist programs: reducing the ALOS and increasing the ADC in critical access hospitals. It is suggested that achieving a sufficient reduction in length of stay and/or a sufficient increase in average daily census is increasingly difficult in CAHs due to low inpatient volume, low acuity, and a reduced rural patient population.

Reducing the ALOS is posited to reduce overall expenses (less diagnostic testing, medications, nursing care, food, and disposables). The less time a patient is in the hospital, the fewer costs are incurred. Proponents postulated that this financial improvement would cover the costs of the hospitalist program. This study will examine the ALOS at critical access hospitals with and without hospitalist programs and determine if a *decrease* in the ALOS is associated with the presence of hospitalist programs.

Proponents also posited that if relieved of inpatient responsibility by hospitalists, primary care physicians would spend more time in their offices and be able to see more patients per week, which would result in more patients being identified for inpatient admission. They argued that the ADC would *increase* following the inception of hospitalist programs and that this too would not only help cover the cost of the hospitalist programs but improve the overall financial performance of the hospital. This study will examine ADC at critical access hospitals with and without hospitalist programs and determine if an *increase* in ADC is associated with the presence of hospitalist programs.

Research Questions

Research Question 1

Are critical access hospitals with physician-based hospitalist programs associated with a lower ALOS when compared to critical access hospitals without hospitalist programs?

As the reduction in ALOS is one of the leading justifications for starting a hospitalist program, it is important to determine if CAHs with hospitalists have a significantly lower average length of stay than those CAHs that do not use hospitalists. Dougan et al. reported that after the initiation of a hybrid hospitalist program in a critical access hospital (Winneshiek Medical Center, Decorah, Iowa), the length of stay, while slightly shorter, was *not* significantly different from patients managed by non-hospitalists internally or in Iowa CAH's generally. They wrote:

> At 5 years, the average length of stay for acute admissions to the hospitalist service decreased from a baseline 2.88 days (n = 525) to 2.75 days (n = 2,530), which compared favorably with the average stay of 3.05 days (n = 153,701) for all Iowa CAHs. Assuming a typical length of stay standard deviation of 6.3 days, the difference from baseline at Winneshiek Medical Center was not statistically significant after implementing the hospitalist program (*P* = .66). (Dougan, Montori, & Carlson, 2018)

In theory, as the number of patients to care for in CAHs is small *and* the patients are of relatively low acuity, one could generalize the findings of the Dougan study and argue that regardless of whether a CAH uses hospitalists, primary care physicians, or non-physician advanced practice providers to manage inpatients, the ALOS will not significantly vary. If there is no association between the use of hospitalists and a reduction in ALOS in CAHs, the financial viability of hospitalist programs in CAHs is questioned.

Research Question 2

Are critical access hospitals with hospitalist programs associated with higher ADC levels than critical access hospitals without hospitalist programs?

While reducing the cost of inpatient care was arguably the primary driver in the evolution of hospitalist programs across the country, primary care physicians pressured hospital administrators to adopt this new specialty for different reasons. Citing physician burnout, caused in part by the responsibility for managing inpatients in addition to serving busy out-patient practices, primary care physicians pressured CAH administrators to start hospitalist programs to improve personal lifestyle and promote mental and physical wellbeing (Dougan et al., 2018). Retention of primary care physicians became a serious issue for CAHs. Hospitals with hospitalist programs offered an enhanced lifestyle to primary care physicians compared to those hospitals without hospitalists. Similarly, future recruitment difficulties were predicted. CAHs lacking hospitalists had a less attractive recruitment package to offer primary care physicians, as inpatient responsibilities and on-call responsibilities were required.

During the lobbying phase of the decision-making process, primary care physicians predicted that if they were relieved of inpatient responsibilities and call burdens by hospitalists, then they could see more patients in their offices and identify more pathology, more patients in need of surgical interventions, and more patients in need of hospitalization (Hoffman et al., 2016). In theory, if hospitalist programs remove the responsibility for inpatient management from primary care physicians, CAHs with hospitalist programs should experience an increase in ADC (and thus, inpatient revenue) after the inception of hospitalist programs. In a single critical access hospital study, this notion appeared to be supported. Dougan et.al. reported that, post-hospitalist implementation, patient volumes (acute, skilled, and observation) increased by 15% compared with a 17% *decrease* for statewide CAHs (Dougan et al., 2018). As this study was based on a single critical access hospital, it must be determined if the results are generalizable.

Complicating the prediction of volume growth by the primary care physicians, however, is the fact that critical access hospitals are rural by definition and serve limited populations. It must be determined if incremental volume truly exists in rural service areas in sufficient magnitude to realize an uptick in primary care office volume and subsequent increases in inpatient volume as predicted. This study will determine if hospitalist programs at CAHs are associated with a sustained increase in ADC.

CHAPTER 2

LITERATURE REVIEW

Background

The Genesis of the Hospitalist Specialty

The hospitalist specialty began in 1996 when two physicians, Dr. Robert Wachter and Dr. Lee Goldman, coined the phrase and collaborated to start the first academic hospitalist program in the United States. In 1996, there were virtually no hospitalists in the country. By 2016, the number of practicing hospitalists exceeded 50,000. The first working definition of a hospitalist was "a physician who spent the majority of his/her time in the hospital." By 1999, the definition evolved to physicians who spent 100% of their clinical time caring for patients in the hospital (Goldman, 2016).

As practicing physicians, Wachter and Goldman envisioned a new specialty that would enhance the quality and delivery of inpatient care. The overriding goal was to improve patient care and develop a new specialized model that would replace the current primary care physician-based model of inpatient care. The growth and early acceptance of hospitalists was fueled by the argument that hospital medicine specialists, readily available in the hospital, would lead to improvements in quality and efficiency. Conceptually, they posited that hospital readmission rates, patient mortality, and ALOS would all decrease if hospitalists, physicians specifically trained and focused on inpatient care, assumed the care of hospitalized patients (Wachter, 2001).

The growth of this new model, while sluggish at first, quickly gained momentum. In 1996, it was not clear if there were physicians interested in giving up their outpatient practices and focusing solely on inpatient care. Somewhat unexpected, many physicians came forward who desired to be generalists but *not* office-based generalists. In hospitalist practice, physicians could take care of sicker, more challenging patients than those seen in an office-based practice and care for them in a better and more coordinated manner (Goldman, 2016).

By 1999, hospitals began transitioning from models in which private practice primary care physicians managed their own hospitalized patients (or rotated that responsibility with their partners) to a model that saw inpatients handed off to hospitalists. Hospitalists were predicted to provide added value by being more available to patients, having more inpatient experience and expertise, and having an increased commitment to hospital quality improvement efforts as they were *employed* by the hospital (Wachter, 1999). Positive improvements in patient care were quickly reported under the model. ALOS was reduced without increasing re-admissions, patients were equally or more happy with their inpatient care, patient outcomes were reported to be improved, and inpatient mortality was reduced (Goldman, 2016). These early returns sparked the rapid evolution of the specialty.

In addition to clinical care improvement, hospitalist growth was also fueled by private practice primary care physicians seeking to maximize their revenue-generating outpatient practices, financial pressures of hospitals, and the need to improve communication among all members of the care continuum (Vasilevskis et al., 2009). Despite these clear and meaningful goals, exactly where the specialty was headed remained unclear. Vasilevskis et.al. commented that “the factors that continue to influence leaders’ decisions to use hospitalists and the current and future needs that hospitalists are fulfilling are unknown.” (2009). By the late 1990s, data suggested widespread adoption and acceptance of hospitalist programs. Vasilevskis et al. identified 114 hospitals that were using hospitalists in 1999. In 2009, these same hospitals were re-surveyed and none reported plans to eliminate or reduce their hospitalist programs in any manner (Vasilevskis et al., 2009).

As early as 2000, researchers began studying the effects of hospitalist programs. Halpert et.al. compared the following metrics at Brigham and Women’s Hospital in Boston before and after the initiation of its hospitalist programs: ALOS and total charges, outcomes related to the quality of care, primary care physician satisfaction, and house staff satisfaction. They concluded that the implementation of hospitalists decreased resource utilization while maintaining or improving the quality of care and that satisfaction with the hospitalist program was high among primary care physicians (Halpert et al., 2000).

Health maintenance organizations (HMOs) embraced the hospitalist model and began converting to the standard that “all inpatient management be formally directed by hospital-based, inpatient physicians instead of by the patient’s primary care physician” (Halpert et al., 2000). Despite the rapid acceptance of the new hospitalist model and the endorsement of the HMOs, concerns began to surface. Critics questioned the training process for hospitalists and raised concerns of patient safety. To answer these concerns, researchers started to examine the effect hospitalists were having on inpatient care.

The Growth of the Specialty

Prior to 1996, the incumbent model of inpatient care consisted of primary care physicians managing their own patients who were hospitalized. On average, primary care physicians had only one or two inpatients in the hospital at any given time. The volume of sicker patients managed by each individual primary care physician was arguably insufficient to become an “expert” at inpatient management (Goldman, 2016).

By 2002, hospitalists were being labeled as a “novel paradigm in health care delivery in the United States” (Baudendistel & Wachter, 2002). At this point, the definition and expectations of a hospitalist were still largely undefined, and most hospitalists acted as site-specific in-house specialists. After only six years of existence, published research was concluding that the specialty was upholding its original promises. Hospitalists were indeed improving the efficiency of care by reducing ALOS and reducing hospital costs without compromising quality or safety. Researchers recognized, however, that the future focus and contribution of hospitalists was unknown. Baudendistel et al. (2002) commented that future hospitalist research would be required to elucidate the role of hospitalists moving forward and suggested that future competencies and benchmark performance measures would need to be developed.

Hospitalists dealt with patient care issues expeditiously and reduced the elapsed time necessary to care for patients. Hospitalists became internal experts on how hospitals worked and used that knowledge to make inpatient care more efficient and timelier. They became adept at working with other hospital departments to expedite testing and procedures on inpatients to reduce delays and move the patients through the system faster. They developed special consultative networks that aligned them with the best specialists to work with on challenging patients (and which individuals to avoid). The hospitalist model clearly addressed the shortcomings of the primary care-based model and had immediate success. As early as 2002, "published research upheld the promise of the hospitalist model: improving the efficiency of care by reducing ALOS and hospital costs without compromising quality or patient satisfaction" (Baudendistel & Wachter, 2002).

While urban hospitals were the early adopters of hospitalist programs in the late 1990s, rural CAHs experienced significant growth in the use of hospitalists from 2008-2013. American Hospital Association annual survey data showed that the number of urban hospitals with hospitalist programs grew from 41% in 2008 to 49% in 2013 (relative growth, 19%), whereas hospitalist programs in rural CAHs increased from 12% in 2008 to 22% in 2013 (relative growth, 82%) (AHA Annual Survey Database).

In 2004, the author was the Vice President of Operations at a 130-bed community hospital and was tasked with starting a new hospitalist program. Prior to 2004, primary care physicians at the author's hospital would typically round on their patients early in the morning before their offices opened for business. They would then round again after their offices closed for the day. The primary care physician was not involved with the patient's care between rounds unless the patient became significantly unstable during the day. Often, follow-up on diagnostic testing results, medication issues, and care plan modifications that ideally should have been taken care of in real time waited hours to be addressed until the primary care physician next rounded. This observation was confirmed by Dougan et al., who reported that when relieved of inpatient responsibilities, primary care physicians "noted a welcome decrease in interruptions from the inpatient realm. This was a marked change from the traditional primary care model, which required them to divide their attention between outpatient and inpatient care, and time allowed for hospital work was largely limited to early morning and evenings" (Dougan et al., 2018).

In 2006, ten years after the hospitalist specialty originated, Wachter et al. reported that the growth of hospitalists was fueled by strong evidence that they improve the efficiency of inpatient care without compromising quality. Hospitalists unexpectedly evolved as leaders in quality improvement, patient safety, the use of electronic health records, palliative care, and medical education. The positive aspects of hospitalist programs were tempered with the following statement:

> The hospitalist field was founded on the premise that inpatient generalists could improve the care of hospitalized patients and systems of inpatient care. In the early years, the challenge was to determine whether the field was indispensable. We now know that it is. The challenge now is that hospitalists are often seen as the solution to all sorts of knotty problems – virtually none of which are associated with significant professional fee reimbursement. Managing this demand will be the greatest challenge of the field's second decade. (Wachter, 2006)

This observation is particularly relevant to the current study, as the specialty is now at the end of the second decade and embarking on the third. Are hospitalist programs at CAHs reducing the ALOS, generating additional volume, increasing the quality and efficiency of care, and still viewed as indispensable? And if so, how is "indispensable" now defined?

Due to a focus solely on inpatient care, hospitalists have acquired enhanced experience above and beyond that of conventional primary care physicians. Additionally, they have developed networks of physicians to call upon for consultation when necessary—further enhancing the quality of inpatient care delivered. Dynan et al. (2009) confirmed this notion by studying all patients admitted to the University Hospital in Cincinnati from June 2006 to July 2007. 2,383 inpatients were assigned to hospitalists and 3,160 to non-hospitalists. Dylan et al. found that the hospitalist-managed patients had lower costs and a reduced ALOS and determined that hospitalists demonstrated a more efficient use of diagnostics. More important, they determined that while hospitalists varied in their diagnostic approach, they consistently outperformed non-hospitalist physicians (Dynan et al., 2009).

Primary Care Physician Retention

The majority of primary care physicians in the late 1990s and early 2000s were in private practice. At the author's hospital in 2004, *all* primary care physicians were in private practice—none were employed by the hospital. Office out-patients were the primary source of revenue for these practices. Many primary care physicians felt that if relieved of inpatient responsibilities by hospitalists, they could schedule more out-patient appointments and improve practice cash flow.

Critical to this study is the evolution from private practice physicians to hospital employed physicians. From 1996 to the present, a large shift from the private practice model to the hospital employment model occurred—especially at rural, critical access hospitals. This is another salient point for this study. In 1996, private practice primary care physicians were looking for ways to increase volume and make their practices more financially sound. In 2019, as in the author's current hospital, critical access hospitals employ most physicians and they draw a paycheck. The incentive to work harder and see more patients is diminished, as physicians are essentially paid the same amount each week regardless of the volume of patients seen (incentive plans in some physician contracts notwithstanding).

Despite the financial and lifestyle enhancement arguments, not all primary care physicians embraced the hospitalist model readily. Continuity of care was an early concern for doctors and patients alike. Some primary care physicians were initially hesitant to relinquish inpatient responsibilities. Auerbach et al. (2001) reported that early on, many primary care physicians "disagreed that inpatient care is an 'inefficient use of my time'; only 10% felt a hospitalist service would improve patient satisfaction; and 54% felt it would hurt patient-doctor relationships." The author recalls physicians in the early 2000s lecturing their colleagues that inpatient care was an integral part of primary care practice and was not only a responsibility, but a duty. They contended that only a primary care physician would know the patient's complete history well enough to render appropriate inpatient care and that it was irresponsible to think that a hospitalist who had never met the patient would be able to match the quality of care provided by one's own physician. Similarly, primary care physicians were concerned with multiple handoffs between doctors caring for the same patient. They felt that this was a significant safety concern and that vital information was going to be lost during handoffs.

At the author's previous hospital, many physicians initially refused to turn their patients over to hospitalists for inpatient care. They predicted that their patients would not respond well to a new doctor they had never met—especially when they were sick and lacked the analytic ability and filters needed to deal with a change of this magnitude. They were also concerned that their patients may leave their practices and migrate to physicians associated with hospitals that did not use hospitalists to maintain continuity with their primary care physician if ever admitted to the hospital. Younger physicians at the time, however, had fewer concerns. They embraced the model and even lobbied for it because it improved physician lifestyle—no call coverage, no weekends, and no assignment of patients that they did not know.

The Next Generation of Hospitalists

In the early years, hospitalists focused their efforts on the care of inpatients with medical issues. Over the past twenty years, sub-specialist hospitalists have become commonplace. Larger hospitals and systems now employ intensivists: physicians specially trained to care for intensive care patients, the sickest of the sick. Pediatric hospitalists and pediatric intensivists have assumed care for hospitalized children. Laborists have assumed responsibility for monitoring labor and performing uncomplicated deliveries to reduce Ob-Gyn physician call burden. General surgery and orthopedic trauma surgeons are now hospital-based and handle unexpected and emergent surgical cases, freeing other surgeons to maintain office practices and a focus on elective surgery. Neurologic hospitalists have recently become prevalent in larger hospitals as well (Goldman, 2016).

The specialization and sub-specialization of physicians has been a natural progression in medicine for generations. As inpatients represent a large sub-section of patients with unique needs, it was inevitable that physicians would ultimately seek to gain specialized skills to care for this population of patients and create this new specialty.

A Review of the Relevant Literature

The literature search revealed that specific studies on the impact of hospitalist programs in CAHs specifically were extremely limited. PubMed and Google Scholar were used as the predominant search engines. Previous empirical research that did include CAHs also included hospitals of significantly larger size. Despite the lack of specific CAH research, the available literature was examined to identify information and data that may be generalizable to CAHs and applicable to the current study. The current study addresses the lack of specific CAH research and represents a new contribution to the body of knowledge on hospitalist programs.

The literature review is organized into four sections. The first two sections examine the two major foci of this study: ALOS and the effect of hospitalist programs on primary care productivity and ADC. The last two sections attempt to establish if any studies exist that examine the effect of hospitalist programs on Medicare and Medicaid revenue and on overall financial performance.

Section 1: Length of Stay

This section of the literature search focused on identifying studies that examine the notion that hospitalists improve inpatient management, reduce ALOS, and, in so doing, drive the cost of providing inpatient care down. As the reduction in ALOS is the primary driver of cost reduction, it is imperative to determine if hospitalist programs consistently accomplish this goal.

In 2001, Robert Wachter reported that the growth of hospitalist programs is fueled by the promise of increased efficiency (specifically, a reduction in ALOS) and reduced costs. Wachter reported that inpatient care in 2001 represented one third of U.S. healthcare expenditures and that any innovation that that would address these costs would assume tremendous significance. He reported that eight studies had been performed to-date that examined the hospitalist model for evidence of its impact on efficiency and cost reduction. He concluded that six of the eight studies found significant reductions in cost and ALOS, with reductions averaging approximately 15%. Only two studies failed to show impressive improvement. In the two failed studies, both demonstrated ALOS reductions, but they also demonstrated increases in costs due to high labor costs (Wachter, 2001).

The current literature search demonstrated additional variation in research conclusions. Eight studies correlated with the original Wachter research, indicating that hospitalists reduced both the ALOS and the direct cost of care (Auerbach et al., 2001; Davis et al., 2000; Gregory et al., 2003; Hackner et al., 2001; Halpert et al., 2000; Iannuzzi et al., 2015; Showstack et al., 1999; Vinh et al., 2019).

In a 2019 study, Vinh et. al. conducted a retrospective cohort study examining multiple years of data on the same hospitals to determine the effect of hospitalists on ALOS. The analysis used multivariable generalized estimating equations (GEE) with robust standard errors to account for repeated measures. The statistical significance was evaluated at the 0.05 alpha level, and the primary independent variable was the use of hospitalists. The researchers concluded that hospitalist-managed inpatients average a 0.08-day reduction in the ALOS (a 1.92-hour reduction per day) over inpatients managed by primary care physicians. Utilizing an estimated average inpatient cost per day of $2,271, Vinh et al. (2019) concluded that hospitalists save $182 per patient *per day*. Davis et. al. conducted a retrospective cohort study in a single hospital on 2,124 patients who had the ten most common diagnostic categories (DRGs). 443 of these patients were managed by hospitalists; the remaining 1,681 were managed by primary care internists. The hospitalist-managed patients had a shorter ALOS (4.1 ± 3.0 days) when compared to the primary care-managed inpatients (5.5 ± 4.9 days), $P < 0.001$. The researchers also concluded that the hospitalist-managed patients demonstrated a decreased cost *per discharge* of $560 ($4,098 ± $2,455 for hospitalist-managed patients versus $4,658 ± $4,084, $P < 0.001$) (Davis et al., 2000).

Similarly, Iannuzzi et.al. studied 13,553 inpatient discharges at a single hospital during a three-year period, 2010-2013. A bivariate analysis was performed using chi-squared analysis for categorical variables and *t*-tests for continuous variables. Factors with 2-tailed *P* values < 0.05 were considered statistically significant. The analysis demonstrated that hospitalist managed patients had an ALOS 1.26 days shorter than non-hospitalist-managed patients ($P < 0.001$). The researchers also reported that the decrease in ALOS resulted in a cost savings in direct costs per discharge of $617 (Iannuzzi et al., 2015).

Gregory et. al. conducted a crossover comparison with historical controls study at a single hospital (Tufts-New England Medical Center) to determine the effect of hospitalists on ALOS. Hospitalists admitted and managed all inpatients for a defined six-week period. Three other six-week periods that did not use hospitalists were used as control groups: the six weeks prior to the study, the six weeks after the study, and the same six-week period from the year before the study. The researchers reported a reduction in ALOS from 3.45 days in the control groups to 2.19 days in the hospitalist-managed patients ($P < 0.001$), and cost per admission reduced from $2,332 in non-hospitalist-managed patients to $1,775 per admission in hospitalist-managed patients ($P < 0.001$) (Gregory et al., 2003).

Halpert et. al. performed a crossover cohort study with historical controls and multivariate adjustment. The researchers compared ALOS pre- and post-implementation of their hospitalist program. The post intervention ALOS decreased from 3.5 days to 3.0 days ($P < 0.001$). In a multivariate analysis, ALOS was reduced by 0.3 days ($P = .008$). Halpert et al. (2000) concluded that implementation of the hospitalist program at their hospital significantly reduced resource utilization.

As the hospitalist movement rapidly progressed north into Canada, Canadian researchers were also researching hospitalist effectiveness. In 2012, a retrospective analysis compared in-hospital mortality, 30-day readmission rates, and the ALOS of patients served by hospitalists versus traditional primary care providers. Hospitalist patients demonstrated lower mortality, lower readmission rates, and lower ALOS (Yousefi & Chong, 2013). Similar to studies in the United States, Canadian hospitalist programs appeared to be associated with a lower ALOS when compared to primary care based inpatient care. This study also suggests that the hospitalist model is effective under differing payment models. While Canada has a government-sponsored healthcare system, the findings on hospitalist program performance are consistent with those found in the more commercial-based payment system found in the United States.

Interesting but less relevant, other researchers reported that a reduction in ALOS lead to a *reduction in charges*. As noted above, Halpert et. al (2000) used a longitudinal study to illustrate a reduction in ALOS from 3.5 days to 3.0 days but also reported that the reduction in ALOS resulted in a reduction *in charges* of $426 per discharge post initiation of hospitalist programs. Showstack et.al. reached a similar conclusion. In a multivariate analysis, they reported a 12% decline in ALOS (3.56 to 3.14 days) and that hospital *charges* were similarly reduced per admission (Showstack et al., 1999).

Other research, however, did *not* correlate with the findings above and did not demonstrate a negative association between hospitalists and ALOS (Carek et al., 2008; Dynan et al., 2009; Elliot, 2014; Salim et al., 2019; Stefanacci, 2015).

Carek et. al. used descriptive statistics to characterize which service an inpatient was assigned to family medicine, primary care, or hospitalists. The descriptive statistics were examined using a retrospective cohort study using analysis of variance (ANOVA) and chi-square distributions. 6,416 hospital admissions were analyzed, and multiple control variables were used to account for the differences in patients assigned to the various specialties. A total of 14 DRGs that were common to all three specialties was analyzed. Regression analysis demonstrated that the hospitalist-managed patients and the primary care managed patients had significantly *longer* ALOS than those patients managed by family medicine physicians ($P < 0.01$) (Carek et al., 2008).

Salim et. al. conducted a comprehensive systematic review and meta-analysis to examine the impact of hospitalists on ALOS and costs. The researchers examined the assumption that both metrics were inherently linked—namely, that a reduction in ALOS would result in an associated decrease in costs. The meta-analysis used 46 studies that aggregated to 563,268 patients. Hospitalist-managed patients demonstrated a lower ALOS than those managed by non-hospitalists (-0.67 days, 95% CI [-0.78, -0.56], $P < 0.001$). That reduction in ALOS, however, did not translate to a sustained decrease in costs. The cumulative meta-analysis showed that *pre*-2008, hospitalist-managed patients demonstrated reduced costs of care compared to patients managed by non-hospitalists. *After* 2008, however, the researchers noted *no* significant difference in costs between hospitalist-managed patients and non-hospitalist managed patients (Salim et al., 2019).

Dynan and colleagues used qualitative and quantitative data collection to examine the effect of hospitalists on ALOS and cost of care. Multivariate regression demonstrated a reduction in ALOS from 4.596 ± 5.063 to 4.200 ± 4.634 in patients managed by hospitalists ($P < 0.01$). The regression also illustrated that hospitalist-managed patients averaged $3,097 less *charges* than those patients managed by non-hospitalists (from $21,208 ± $29,761 to $18,111 ± $26,135, $P < 0.01$). Interestingly, however, they concluded that hospitalist-managed patients had a significantly lower ALOS (1.5 days less) *if* they were admitted as *intensive care* patients, but *no* appreciable difference in ALOS for patients admitted for *general care* (Dynan et al., 2009). (This finding is particularly applicable to the current study given the relatively low acuity of CAH inpatients and low ADC levels).

Elliot et. al. concluded that an increase in hospitalist workload is associated with statistically significant *increases* in ALOS and costs. Benchmark recommendations for hospitalist workload average between 10 and 15 patients per shift (Lurie, 1999). The researchers used a retrospective cohort study of more than 20,000 hospitalizations assigned to hospitalists between 2008 and 2011. The outcomes measured were ALOS and costs. The researchers calculated daily hospital occupancy separately for each hospital in the study measured as the average of the hourly occupancy of all non-intensive care unit inpatient medicine beds. The results were categorized into three groups: low, medium, and high occupancy. Low occupancy was defined as less than 75% occupancy, medium occupancy 75% to 85%, and high occupancy greater than 85%. Multivariate regression demonstrated that increased hospitalist workload is associated with reduced efficiency and higher costs. The range of ALOS increased by as much as two days from low occupancy to high occupancy, and similarly, costs increased between $5,000 and $7,500. The regression for ALOS illustrated a linear one-day increase in ALOS per 5.5 census units at occupancy levels less than 75%. At occupancy rates between 75% and 85%, however, the researchers noted a non-linear exponential increase in ALOS at census levels above 15. At occupancy rates greater than 85%, an exponential increase in ALOS was associated with census levels greater than 17. Costs followed the same pattern. A $262 increase per patient in cost was associated with a one census unit increase at occupancy rates less than 75%. This increase grew to a $1,634 increase in per patient costs at occupancies greater than 85% (Elliot, 2014). Not unexpected, this research suggests that there are diminishing returns on efficiency and costs as workload increases. Further complicating the analysis and bringing a different perspective on hospitalists forward, Stefanacci posited that hospitalists should shift their focus from reducing the ALOS and preventing payment denials to *decreasing re-admissions*. This study suggests that hospitalist programs would be more effective if they focused on *increasing* the

ALOS to better prepare the patient for the transition out of the hospital and prevent re-admissions. This study further suggests that hospitalist medicine should evolve to become an integral part of population health rather than functioning as hospital-centric providers. Stefanacci posits that this approach would have a greater overall positive financial impact than merely reducing the inpatient length of stay (2015).

This review suggests that the association between hospitalists and a reduced ALOS and a reduction in care costs is under-researched and highly variable. Hospital administrators may move forward with the hospitalist programs more in response to rising pressure from primary care physicians than based on evidence of the reduction in ALOS.

Section 2: The Association Between Primary Care and Inpatient Volume

This section focuses on the effect hospitalist programs have on primary care physician productivity and inpatient volume (ADC).

Two studies were identified that linked hospitalists programs to primary care performance. In addition to the efficiencies and cost benefits hospitalists are purported to bring to inpatient care, the first study concluded that the use of hospitalists frees primary care physicians from inpatient responsibilities and allows them to see more patients in their offices. The Hoffman study estimated that each primary care physician can see an additional nine patients per week if relieved of inpatient care responsibility (Hoffman et al., 2016).

Another study examined primary care physicians who had varied use of hospitalists to manage their inpatients when hospitalized (Park & Jones, 2015). First, the researchers calculated the decrease in the number of hospital visits by primary care physicians depending on the extent of hospitalists utilization. Compared to nonusers, the predicted number of hospital visits per week *declines* by 4.6 for low users (from 15.6 to 11, $P < 0.001$), by 9 for medium users (15.6 to 6.6, $P < 0.001$), and by 12.9 for high users (15.6 to 2.7, $P < 0.001$), respectively. The study then examined the impact a decrease in inpatient visits had on office visit productivity. The high users saw an additional 8.8 office patients per week (from 87.0 to 95.8, $P = 0.05$), compared to nonusers.This translates to a 10% increase in productivity (Park & Jones, 2015).

The researchers then tied these findings to an anticipated shortage of primary care physicians predicted in the next ten years. Of the 208,807 non-hospitalist, primary care physicians practicing in 2010, 33% (68,906) were listed in the study as "high hospitalist users" and, as stated above, would expect an average of 8.8 additional office encounters per week over the current average of 87 (Park & Jones, 2015). This finding is pertinent to the current study. If primary care physicians use hospitalists extensively and see additional patients each week, it is predicted that this additional volume will identify additional patients in need of hospitalization. Hoffman et. al. posits that ADC levels will increase when hospitals convert inpatient care to a hospitalist model (2016). The incremental inpatient revenue generated by this phenomenon must be factored into the overall financial contribution of hospitalist programs.

Similarly, Casey et. al. concluded that the savings directly generated by hospitalists may not be sufficient to cover their own salary costs—especially in small rural hospitals with low inpatient volumes and significant numbers of uninsured and Medicaid patients. The researchers used American Hospital Association (AHA) survey data and primary data derived from a national survey of 402 rural hospitals that were under 100 beds in size and used hospitalists. The survey used close-ended and open-ended questions to determine the impact of hospitalists on primary care practices, ADC levels, and hospital finances. From the AHA data, the researchers determined that nationally, small rural hospitals that used hospitalists had significantly higher ADC levels. 1,448 hospitals were studied (459 with hospitalists and 989 without hospitalists). The average annual inpatient days for hospitals with hospitalists was 7,633 compared to 3,723 for hospitals that did not have hospitalists ($P < 0.001$). Even with this statistically significant positive association between hospitalists and inpatient census levels, the researchers concluded from financial data that hospitalist program costs exceeded the additional inpatient revenue (and/or savings) that hospitalists could generate. However, the authors advise hospital administrators to consider the overall financial impact of the programs and that using hospitalists may allow small rural hospitals to increase their volume of inpatients due to the effect hospitalist programs have on primary care physician productivity (Casey et al., 2014).

Section 3: Effect on Medicare and Medicaid Revenue

The third segment of the literature review focused on identifying empirical research that studied the influence hospitalist programs have on Medicare and Medicaid revenue in critical access hospitals that are cost-based reimbursed. As stated earlier, the salary cost of hospitalists is not an allowable cost under the current rules and cannot be submitted on the annual Centers for Medicare and Medicaid Services (CMS) cost report. Hospitalists are charged with reducing the cost of inpatient care. If they are successful, *less* costs can be reported to CMS, and, therefore, Medicare and Medicaid revenue would be predicted to *decrease* in subsequent years (volume and acuity levels held constant). New search terms were added to expand the literature search: effect of hospitalist programs on Medicare revenue, hospitalist program cost reporting, and economics of hospitalist programs in cost-based hospitals. Similar to the lack of available research on hospitalist programs in critical access hospitals in general, no literature was identified that researched the effect of hospitalist programs on Medicare and Medicaid revenue. As cost-based reimbursement is unique to CAHs, this gap in the literature is predictable.

Section 4: Overall Financial Performance

The final segment of the literature review delved deeper into the analysis of financial viability. Several studies indicate that hospitalist programs do not cover costs and are therefore not financially viable (Carek et al., 2008; Epane et al., 2015; Gregory et al., 2003; Kaboli et al., 2004).

Gregory et al. examined the financial viability of the hospitalist program at their institution (Tufts-New England Medical Center), utilizing a crossover comparison with historical controls and the following variables: ALOS, total hospital costs per admission, and costs per day. In patients managed by hospitalists, the ALOS was reduced from 3.45 days to 2.19 days ($P < 0.001$), and total cost per admission was reduced from $2,332 to $1,775 ($P < 0.001$). Costs per day, however, *increased* from $679 per day to $811 per day when compared to patients managed by non-hospitalists. Accounting for all financial inputs, the researchers concluded that their hospitalist program produced a net *loss* of

$1.44 per discharge. The authors concluded that the hospitalist program at their institution was *not* economically viable (Gregory et al., 2003).

Kaboli and colleagues reached a similar conclusion in 2004. They conducted a prospective cohort, multi-variable adjustment, quasi-experimental observational study at a single academic teaching hospital. The study examined 1,706 consecutive, directly admitted patients over a one-year period. 447 patients were assigned to hospitalists, and 1,259 were assigned to non-hospitalists. A multivariate linear regression was performed using the following continuous variables: ALOS, total cost per admission, and cost per day. Because of skewness and non-normality on cost and length of stay, the researchers performed a log base 10 transformation prior to analysis. The ALOS was one day shorter in hospitalist-managed patients (5.5 days vs. 6.5 days in non-hospitalist managed patients, $P = 0.009$). The mean total cost per admission was $917 less for hospitalist-managed patients, $P = 0.08$. The mean cost per day, however, was $122 higher in the hospitalist-managed patients, $P = 0.003$. The researchers concluded that hospitalists increase the intensity of care each day (thus increasing costs) and may have the greatest impact on specific patients or specific classes of hospital costs (Kaboli et al., 2004).

Carek et al. (2008) and Epane et al. (2019) reached similar conclusions, stating that hospitalist programs are generally associated with a reduction in the ALOS and a reduction in direct costs but have higher overall costs per day when program expenses are factored in and, as a result, are *not* financially viable on their own merits.

Carek et al. used a retrospective cohort study to examine all inpatient admissions at a 290-bed for-profit hospital over a one-year period. Using ANOVA, the researchers concluded that the ALOS was shorter in the hospitalist-managed patients (5.4 days ± 5.8) vs. those managed by primary care physicians (5.7 days ± 5.4), ($P < 0.001$). Costs, however, were greater in the hospitalist-managed patients ($2,638 ± $3,519 vs. $2,382 ± $2,843 in non-hospitalist managed patients, $P < 0.001$) (Carek et al., 2008).

The Epane study used a longitudinal sample of acute care hospitals from 2007-2014 and analyzed the data using a panel design with facility and fixed effects regression to study the financial performance of hospitalist programs. As with the other studies, the researchers concluded that hospitals using predominantly hospitalists to manage inpatient care had both increased revenue ($P < 0.0001$) *and* higher operating costs per patient day ($P < 0.001$). They went on to conclude that the higher operating costs are offset by the increased patient revenues and result in a *marginally* significant increase in operating profitability ($P < 0.1$). This study used a broad-based sample of all medical/surgical acute care hospitals in the United States from 2007-2014, resulting in a sample size of 34,835 hospital years. To meet normality assumption for the dependent variables and adjust for the skewness of the data, the researchers log-transformed the revenue and cost data (Epane et al., 2019).

In contrast to the studies above, Harrison and Ogniewski concluded that hospitals that use the hospitalist model for inpatient care have higher occupancy rates and higher returns on assets than hospitals that use alternative models of inpatient management. The researchers used a logistic regression model to examine the effect of hospitalists on return on assets. Data were obtained from the AHA Annual Survey database and the Area Health Resource File (AHRF). 264 hospitals (66 with hospitalist programs and 198 without hospitalist programs) were included in the study. The study demonstrated a strong positive relationship between the use of hospitalists and an increase in hospital profitability, as measured by return on assets (Harrison & Ogniewski, 2004). Significant to the current study, however, they further reported that the hospitalist model is more prevalent in larger, more complex hospitals. Through multivariate regression analysis, they concluded that there is a positive association between profitability, hospital bed size, and the presence of hospitalists, and they posited that “smaller hospitals may lack the resources or expertise to (successfully) implement (a profitable) hospitalist model” (Harrison & Ogniewski, 2004).

Molinari and Short (2001) used a pre- and post-crossover study with multivariate adjustment to conclude that inpatient stays were statistically lower when patients were managed by hospitalists vs non-hospitalists ($P < .05$) and that hospitalists maintained a daily assignment of approximately eleven patients. They concluded that a patient load of 11 to 15 patients created a sustainable job description that allowed hospitalists sufficient time to see patients twice a day, meet with consultants, and organize an efficient care planning process that decreased resource utilization and overall ALOS. They further concluded, however, that this daily volume of patients is insufficient to generate enough incremental revenue (or cost savings) to cover the hospitalist’s salary (Molinari, 2001). Relevant to the current study, Molinari et al. (2001) went on to state, “not surprisingly, many financially strapped hospitals are growing weary of providing 100% of the yearly support of hospitalists without contributions from other parties who benefit from hospitalists” (i.e., managed care organizations and primary care practices).

The Casey study suggests that hospitalist programs may need to be considered a pure expense that must be justified by other contributions rather than by conventional financial considerations. They reported that the cost of their hospitalist program exceeds the incremental revenue and savings generated by the program. In recognition of the shortfall, they budget for a $100,000 supplement for each employed hospitalist (Casey et al., 2014). The same article quoted one hospital administrator who advised that despite the many positive contributions of a hospitalist program, the programs do not cover costs and administrators should be prepared to financially supplement them. He went on to say that despite the financial deficit, hospitals cannot go backwards and eliminate hospitalist programs, as elimination would negatively impact the ability to recruit new primary care physicians. Further, the number of primary care physicians willing to provide inpatient care (in addition to their office practice) is predicted to be decreasing exponentially (Casey et al., 2014).

This review suggests that hospitalist programs may not be financially viable when all program costs are accounted for. This represents a significant concern for critical access hospitals that are financially vulnerable and have limited volume on which to capitalize on the savings generated.

Identified Gap in the Literature

The literature search did not identify any peer reviewed publications examining hospitalist programs specifically at critical access hospitals. No studies were identified that examined either the clinical and operational performance of the programs or the financial performance of the programs at CAHs.

Only one article specific to a critical access hospital was identified. Dougan et al. studied the effect of a “hybrid rotating hospitalist program” at a single critical access hospital in Iowa. The researchers used primary data extracted from surveys of primary care physicians, hospitalists, nurses, internal hospital data, and Iowa Hospital Association (IHA) annual survey data. The results for the researcher's hospital were then compared to all Iowa critical access hospitals utilizing IHA annual data and simple linear regression. The findings were remarkable, specific to a critical access hospital, and pertinent to the current study. This study found that the ALOS decreased from 2.88 days to 2.75 after initiation of a hybrid hospitalist program. The researchers concluded that this decrease was not statistically significant ($P = 0.66$). During the study period, all other Iowa CAHs had an average length of stay of 3.05 days. When compared to the state average, the researcher's hospital did demonstrate a statistically significant decrease in ALOS ($P = 0.02$). ADC increased during the study period by 15% (compared to an average 17% reduction in volume at CAH's statewide). There was no measurable deterioration in core quality measures or patient satisfaction scores (Dougan et al., 2018). The study did not extend to financial performance. As this study was performed at a single hospital in 2008 and used a hybrid hospitalist model, the results are not generalizable to all critical access hospitals in 2020. It should be noted that the authors did perform a follow-up survey in 2013, and hospital leaders remained satisfied and committed to the hospitalist model.

No further elaboration on how that judgment was reached was presented.

Purported Benefits of Hospitalist Programs

The literature search delineated many of the anticipated benefits of hospitalist programs proffered during the evolution of the specialty. Dynan et al. (2009) best captured the major historical arguments for initiating hospitalist programs, and these same benefits continue to be used in 2020 as justification for the programs. Specifically, hospitalists:

1. Reduce the ALOS and this is associated with a reduction in costs.
2. Increase ADC as primary care volume is enhanced.
3. Have advanced expertise to care for sicker patients.
4. Are more efficient diagnosticians.
5. Provide efficient, low-cost care without compromising quality.
6. Create care systems and processes that are implemented hospital-wide.
7. Participate in policy development and quality initiatives.
8. Have greater knowledge and understanding of the community resources available to discharged patients (particularly home health).
9. Provide high quality care. (Dynan et al., 2009)

This study examines the first two arguments above at critical hospitals specifically.

Theoretical Framework and Conceptual Constructs

Institutional Theory

Institutional theory suggests that organizations in an industry tend to make similar strategic decisions and investments. The theory centers on the concept of social construction and suggests that organizations in the same industry subjectively understand or perceive the internal and external environments of the industry they are in. As a result, managers perceive the world in a similar manner and then behave accordingly. Managers of an industry tend to think alike, make decisions in similar manners, and create a world in line with their perceptions (Raynard, 2015).

DiMaggio and Powell concluded that there were three types of pressures that drive homogeneity in organizations. They hypothesized that organizations will adapt similar structures because of these pressures. *Coercive* pressure comes from laws, legal mandates, and regulations. These pressures force organizations to look alike, as they are required behaviors. *Mimetic* pressure is the propensity to copy other successful organizations in periods of uncertainty (much like the early evolution of the hospitalist specialty). *Normative* pressure toward homogeneity arise from similar attitudes and approaches and the need to conform to what is expected in a particular industry (DiMaggio, 1983).

There are five basic principles of institutional theory that help to explain hospital leader decision making (Raynard, Johnson, and Greenwood, 2015). First, in hospitals, there exists a "social web" of norms and expectations that constrain and shape leader decisions. These social rules influence decision makers to act within the perceived set of norms and behave in similar fashions.

Second, some norms and expectations of healthcare facilities come from outside sources. Laws, regulations, accreditation agencies, and professional societies all contribute to the creation of social norms organizations must follow. The coercive rules and requirements brought forth by these groups tend to constrain decision making and force industry alignment.

Third, by conforming to these social rules, hospitals gain approval, support, and public endorsement. The hospital gains legitimacy in the marketplace. To not conform creates risk and the possibility of developing a negative reputation.

Fourth, social rules become expected and institutionalized over time. These accepted norms become harder and harder to change or resist. This issue may be particularly pertinent in the case of hospitalist programs. Once the social norm of having hospitalists is fulfilled, it becomes very difficult to change to a different model of care.

Lastly, because hospitals experience similar social expectations and pressures of conformity, they tend to make similar “copycat” or mimetic decisions. Hospitals tend to do similar initiatives within similar times and in line with what is viewed as essential and necessary (Raynard et al., 2015).

Interesting, the social norms that create legitimacy for a hospital can reduce efficiency and actually hinder the hospital’s competitive position in the marketplace (Meyer, 2006). Hospitalist programs at critical access hospitals may fit into this category, as they have high labor costs, but they may lack the ability to cover those costs. Alternatively, hospital leaders must justify the programs in non-financial terms and accept the expense associated with the program.

This review suggests that administrators at critical access hospitals followed the national trend and succumbed to social (and physician) pressures rather than utilizing appropriate financial and technical analyses to guide the decision-making process for the adoption of hospitalist programs. Hospital leaders often fall victim to institutional theory. Hospital leaders focus on structures and practices that are accepted and commonplace across the country. To vary from accepted medical practice and care delivery creates risk. Compliance is chosen because other alternatives begin to appear inconceivable. Especially in periods of uncertainty or evolution, decisions are made in a “taken-for-granted” mechanism so as not to vary significantly from other competitors or from established norms (Meyer, 2006). Institutional theory suggests that hospital decision makers are comfortable following the lead of other hospitals they perceive to be successful or the lead of other administrators whom they respect and find minimal risk in emulating. Miles describes this mentality as “normative isomorphism” (2012). In the hospital application, normative isomorphism can be described as conforming to established practices that have become accepted as best practice or standard services that virtually all hospitals have and the community has come to expect as essential. Meyer et al. (2006) noted that the effect of isomorphism makes organizations captive to their industry. They posited that organizations passively conform to broader forces to gain institutional conformity rather than making decisions based on financial or technical efficiency. In the case of hospitalist programs, it can be argued that smaller hospitals may have felt significant pressure to adopt hospitalists because larger hospitals were quickly converting to the model. Conversely, not having inpatient medicine specialists may potentially cause smaller hospitals to lose competitive advantage or reputation. Primary care physicians may have seized on the perceived need for conformity by convincing critical access hospital leaders that not having hospitalist programs would be detrimental to primary care physician retention and that not initiating hospitalist programs would be a huge misstep.

As referenced earlier, institutional theorists suggest that a more basic type of isomorphism exists that may explain why critical access hospitals initiated hospitalist programs with limited financial analysis and questionable economic and/or technical return. “Mimetic isomorphism” suggests that when an organization is unsure of a particular decision that they merely imitate the decisions of others (Miles, 2012). This suggests that decision-making is expedited as administrators find comfort and safety in the notion that others have done the same thing, have not been substantively harmed, and that the decision appears to be relatively straightforward and with limited risk. These types of decisions tend to be those that can easily be undone if trouble presents in the future. In the case of hospitalists, these programs are personnel-based and can be eliminated if necessary. Hospitalist programs do not require huge capital investments involving facility or equipment. This is not to say that dismantling a hospitalist program is simple or without significant pain. Alternatives to the provision of inpatient care would need to be mobilized and require considerable work and expense to accomplish.

In addition to coercive, normative, and mimetic isomorphism, the term "legitimacy" is pertinent to the understanding of institutional theory. For a hospital to be accepted in the community, it must have legitimacy. Hospital services must be viewed as high quality, technologically up-to-date, and practicing mainstream medicine. According to Kostova (2008), "Legitimacy refers to the extent to which an organization's actions are socially accepted and approved by various internal and external stakeholders." As critical access hospitals were feeling the pressure to adopt hospitalist programs, it is assumed that administrators found comfort in the legitimacy these programs were enjoying at larger hospitals. Internal stakeholders at larger hospitals were reporting satisfaction with hospitalist programs (primary care and financial stakeholders specifically). Thus, the programs had legitimacy for critical access hospital administrators, and the decision to initiate hospitalist programs was safe given that hospitalists were proven in the marketplace and explained by the tenants of institutional theory.

Applying institutional theory to the decision-making process unilaterally, however, ignores several other very important factors. In the case of hospitalist programs at critical access hospitals, hospital size, hospital ownership, patient volume, proportion of Medicare and Medicaid patients admitted, and patient acuity may have been under-researched during the decision-making process. As other larger hospitals were reporting financial improvement and primary care physician satisfaction associated with their hospitalist programs, the programs were considered to be a legitimate strategy, and that alone may have created comfort for critical access hospitals to move forward with adoption.

Institutional theorists are very interested in this decision-making phenomenon. This study hypothesizes that critical access hospitals lack the requisite volume necessary to cover program costs. It is posited that due to the relatively low acuity and short length of stay of critical access hospital inpatients, the ability for hospitalists to significantly decrease the length of stay is diminished. Applying institutional theory, critical access hospital administrators may have approved a new inpatient care model that yields no measurable economic or technical purpose. This is because it appears that Hospitalist programs at critical access hospitals have become "institutionalized," and the reason for having them is predicated on the notion that most other hospitals have them rather than being based on sound financial analysis or legitimate technical need. Additionally, institutional theorists would argue that hospitalist programs have become so commonplace and taken for granted that administrators and other leaders no longer question why they were started, if they are financially viable, or if they should continue (Oliver, 1997). Oliver's final point of whether hospitalist programs should continue to exist at critical access hospitals warrants additional discussion.

Under the premise of institutional theory, once a critical access hospital has responded to the expectation to conform by initiating a hospitalist program, it becomes increasingly difficult to change direction and resist the institutional norm. Larger, stronger organizations may have the reputational strength to deviate from the norm and be innovative. These organizations can try new things and survive an occasional failure because they are viewed as cutting edge leaders willing to experiment and learn. The same mentality does not hold in critical access hospitals. The need for conformity and legitimacy in the healthcare marketplace is ever present if a critical access hospital hopes to survive. To vary from the norm exposes the critical access hospital to potential criticism and spark rumors that the services there are less than optimal and should be avoided. Small, rural, and financially vulnerable organizations like critical access hospitals cannot take the risk of being too far outside the boundaries of what is acceptable practice by lacking those attributes that have become "institutionalized."

Miles concluded that "some organizational structures and methods are so commonplace that nobody ever challenges them" (2012). The practices evolve to the point that both administrators and patients believe that this is the only possible way of doing business. Hospitals tend to imitate those structures and practices that have been made legitimate by other hospitals and conform to the same norms, habits, and practices as everyone else—both consciously and unconsciously (Miles, 2012). Hospitalist programs at critical access hospitals may be a prime example of this phenomenon. It is suggested that hospitalist programs were approved and instituted at critical access hospitals largely due to pressure from primary care physicians looking to improve lifestyle. Due to widespread acceptance throughout larger American hospitals, isomorphism likely fast-tracked the approval process. Today, due to institutional conformity, hospitalists are commonplace in critical access hospitals and are now seen as essential and legitimate. Once the model is in place, it becomes increasingly difficult to change—even if it is proven that the model produces limited financial and technical benefits.

This study examines the primary arguments made by proponents at critical access hospitals when lobbying administrators to adopt hospitalist programs. First, it examines the extent to which hospitalists reduce the ALOS of inpatients and thus the overall cost of care. In so doing, additional profit could be generated in those patients being reimbursed to the hospital on a flat-rate DRG basis. Second, primary care physicians predicted that if relieved of inpatient responsibilities, they would increase the number of patients seen in their out-patient offices, generate more revenue, and identify more patients in need of hospitalization. They convinced administrators that ADC levels would likely increase, thus improving financial performance and justifying the costs of the hospitalists. While institutional theory may explain how administrators reached a comfort level with the decision to add hospitalist programs, this research is designed to study whether relying on conformity alone provided an appropriate basis for decision-making.

Conceptual Construct

The ability of hospitalist programs to cover their own costs is influenced by multiple forces. Some forces provide a positive financial effect, and others serve to increase costs. This study examines the effect hospitalist programs have on two of these forces: ALOS and ADC levels. A reduction in ALOS serves to decrease costs, and an increase in the ADC serves to increase revenue.

Please see Figure 1. This model illustrates nine potential forces (four positive and five negative) that may be associated with hospitalist programs. The right side of the model illustrates those forces that may result in positive financial effects. The model suggests that a reduction in the ALOS and an increase the ADC both have a positive effect on the program's ability to cover its own costs. This study examines those two dependent variables to determine if the positive effect exists in critical access hospitals and, if so, to what extent. The model also suggests that because hospitalists are dedicated solely to the care of inpatients, that resource use is more efficient and results in lower costs.

The left side of the model illustrates negative forces. High hospitalist salary expenses, a potential decrease in cost-based Medicare and Medicaid revenue due to lower costs, low average inpatient volume, low patient acuity, and small rural populations served all result in negative forces inhibiting the ability for hospitalists to cover program costs.

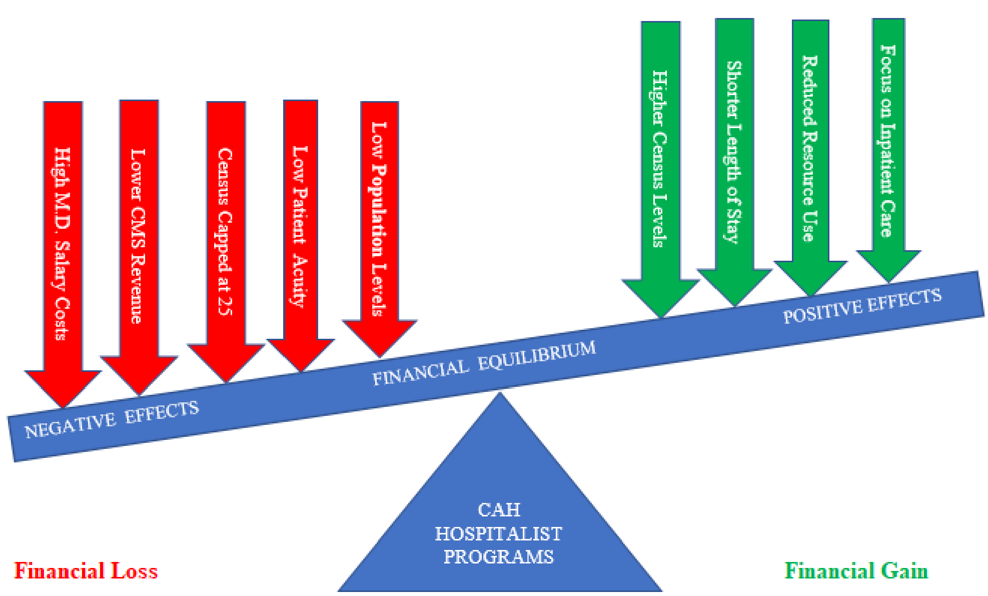

Figure 1. Conceptual Financial Model

As seen in Figure 1, this study hypothesizes that the reduction in ALOS and the increase in ADC proffered by proponents of hospitalist programs cannot be leveraged in sufficient magnitude to offset the negative forces. If proven to be true, this deficit tips the financial performance of hospitalists programs to the left signifying that hospitalist programs in critical access hospitals may not be financially viable.

Statement of Hypotheses

This study examines two major influences that affect the ability of hospitalist programs to cover their own costs: a reduction in the ALOS and an increase in ADC. This study hypothesizes that in critical access hospitals, these two essential metrics cannot be leveraged due to the low patient volume prevalent in the rural service areas critical access hospitals serve.

Hypothesis 1

ALOS at critical access hospitals that use hospitalists is *not* significantly lower than at critical access hospitals that do not use hospitalists.

The effect of hospitalist programs on the ALOS at critical access hospitals will be examined. As this one factor is the major source of cost reduction and is purported to have the greatest positive effect on program viability, it is appropriate to determine if there is a significant reduction in the ALOS at CAHs that use the hospitalist model. According to AHA data, most critical access hospitals have ADC levels below ten patients (AHA Survey Data 2017). It could be argued that due to the very low volume and low acuity of inpatients admitted at CAHs, all patients would be cared for efficiently and that the ALOS would not significantly vary regardless of the model of inpatient care used. Hypothesis 1 will be supported if the hospitals in the study that use hospitalists do not demonstrate a statistically significant decrease in ALOS at the 0.05 alpha level.

Hypothesis 2

ADC levels at critical access hospitals that use hospitalists are *not* significantly higher than at those critical access hospitals that do not use hospitalists.

The effect of hospitalist programs on ADC levels will be examined. When lobbying hospital administrators to initiate hospitalist programs, literature suggests that primary care physicians promised a subsequent increase in ADC levels due to their ability to see more outpatients in their office if relieved of inpatient responsibilities (Hoffman et al., 2016). Similarly, literature suggests that transitioning from a non-hospitalist model to a hospitalist model would allow hospitals to admit more complex patients and that this too would result in an increase in ADC (Casey et al., 2014). As CAHs are located in rural isolated areas, this study hypothesizes that the additional volume of patients necessary to realize these volume predictions does *not* exist and that census levels are not statistically different when comparing CAH's with and without hospitalist programs. Hypothesis 2 will be supported if those hospitals in the study do not demonstrate statistically significant differences in ADC levels at the 0.05 alpha level.

In summary, the effect of the Hypotheses 1 and 2 above must be determined in both direction and magnitude and then viewed cumulatively to predict the ability of hospitalist programs at critical access hospitals to cover program costs. The results of this study have long-range applicability to critical access hospital administrators that currently use the hospitalist model of inpatient care and to those CAHs contemplating starting hospitalist models in the future.

CHAPTER 3

METHODS

This chapter describes the methods of this study including its data source, sample determination, measures, study design, and approaches to statistical analyses.

IRB Project Number

A request for determination of *Not Human Subjects Research* was submitted to the University of Alabama at Birmingham (UAB) Institutional Review Board (IRB). A project number, IRB Project Number 300004426-001, was assigned and IRB determined that the research is *Not Human Subjects Research* and is therefore not subject to IRB oversight.

Data and Sample

Data Sources

This study used secondary data from the AHA Annual Survey data from the years 2013-2017. Table 1 has a complete listing of the variables used and the reference source and data codes that correspond to those variables.

Table 1

Variable Listing, Definition, Reference Location

Variable	Definition	Reference Source
Dependent Variables		
Average Length of Stay (ALOS)	The average number of days an inpatient is hospitalized at each hospital.	AHA Survey Data Calculation Code: 777 IPDTOT / 776 ADMTOT.
Average Daily Census (ADC)	The average number of inpatients in each hospital on a given day.	AHA Survey Data Calculation Code: (777 IPDTOT / 776 ADMTOT) x ADMTOT / 365.
Independent Variable		
Physician-based Hospitalist Program	A dichotomous variable of the presence or absence of a hospitalist program (1,0); 1 = hospitals that use hospitalists and 0 = hospitals that do not use hospitalists.	AHA Survey Data Code: 985 HSPTL
Control Variables		
Ownership	A dichotomous variable that delineates ownership (1,0): 1 = not-for-profit, 0 = governmental, non-federal.	AHA Survey Data Code: 7 CNTRL
Licensed Beds	A continuous variable that captures the number of licensed beds at each hospital in the study.	AHA Survey Data
Proportion of Medicare Inpatients.	Equals the number of Medicare discharges / the total number of overall admissions.	AHA Survey Data Calculation Code: 785 MCRDC / 776 ADMTOT
Proportion of Medicaid Inpatients.	Equals the number of Medicaid discharges / the total number of overall admissions.	AHA Survey Data Calculation Code: 787 MCDDC / 776 ADMTOT

Sample

All U.S. hospitals listed as critical access hospitals in the AHA Survey Data were initially included in the study (AHA Survey, Field Name Code MAPP18). As of July 2019, 1,350 U.S. hospitals were designated as critical access hospitals (Flex, 2019).

Two separate samples were developed for the study. Sample One represents the main study sample and examined hospitals that either used hospitalists for all five years of the study or did *not* use hospitalists at any time during the five years of the study. As this study is a five-year longitudinal study, Sample One provided the data necessary to study both *between* hospital variation and *within* hospital variation.

Sample One was then expanded to include hospitals that began the five-year study period without a hospitalist program but started a program during the study period. The resultant Sample Two was created to provide a sensitivity analysis and to further analyze the variances between hospital years that used hospitalists and those years that did not. Hospitals with mature hospitalist programs (all five years) may experience a different effect on the dependent variables of ALOS and ADC (due to enhancement in physician experience or the maturing of inpatient processes) than do hospitals who have just started programs and are still ramping up. Sensitivity analyses assured that these differences were captured and incorporated into the final analysis and conclusions. As with Sample One, Sample Two also examined both *between* and *within* hospital variation.

Exclusion Criteria

Exclusion Criteria for Both Data Sets (Sample One and Sample Two).

- As a verification of Code MAPP18 (designation as a critical access hospital), hospitals that reported licensed beds greater than 25 (AHA Code LBEDSA) *and* critical access status were excluded as greater than 25 beds exceeds the maximum licensed beds allowed for critical access designation.

- Hospitals that reported the use of hospitalists (AHA Code HSPTL), but did *not* report having any privileged *hospitalist physicians* (AHA Code TPHSP), were excluded. This eliminated hospitals that consider mid-level providers as hospitalists as that model of inpatient care requires a physician supervisor and is a structurally different model of care than that being studied in this dissertation.
- Hospitals reporting long-term care beds (Code OTHLTHOS or Code SUNITS) were excluded as acute care ALOS and ADC levels are skewed by the presence of long-term care patients with extended stays.
- Hospitals that reported the organization status “investor-owned, for-profit” (AHA Code CNTRL) *and* critical access status were excluded as investor-driven decision-making may adversely skew both ALOS and ADC metrics.

Additional Exclusion Criteria for Sample One Only.

- Hospitals that reported the use of hospitalists in 2013 but *not* in 2017 (AHA Code HSPTL) were excluded. This exclusion assured that data collected during a phase out of hospitalist services and during a ramp up of a new model did not skew the study results.
- Hospitals that did *not* report the use of hospitalists in 2013 but did report the use of hospitalists in 2017 (AHA Code HSPTL) were excluded. This exclusion assured that the data on each hospital in the study represented a steady state throughout the study period with no ramp-up data to skew results.
- Hospital years with missing data were excluded from the study.

Additional Exclusion and Inclusion Criteria for Sample Two Only.

- Hospitals that reported the use of hospitalists in 2013 but *not* in 2017 (AHA Code HSPTL) were excluded. This exclusion assured that data collected during a phase out of hospitalist services and during a ramp up of a new model did not skew the study results.
- Hospitals that did *not* report the use of hospitalists in the early years of the study period but added hospitalist program during the study period *and* reported the use of hospitalists in at least 2016 and 2017 (AHA Code HSPTL) were *included* in Sample Two.
- Hospital years with missing data were excluded from the study.

Sample Size

Following the exclusion process outlined above, Sample One included 1,620 hospital observation years (547 years using hospitalists; 1,073 years not using hospitalists).

Following the additional exclusion and inclusion procedures outlined above, Sample Two included 206 additional hospital years for a total of 1,826 hospital observation years (670 years using hospitalists; 1,156 years not using hospitalists).

Measures

This study examined the relationship between the independent predictor variable (the presence or absence of a physician-based hospitalist program) and the dependent outcome variables of ALOS and ADC. This study was designed to determine the effect hospitalists have on *decreasing* the ALOS and *increasing* the ADC in critical access hospitals—the two most prominent arguments for starting a hospitalist program.

Control Variable Justification

The following control variables were used to better understand and account for the variation in ALOS and ADC between critical access hospitals that use hospitalists and those that do not:

- Ownership (not for profit or governmental),
- Licensed beds,
- Proportion of Medicare inpatient admissions, and
- Proportion of Medicaid inpatient admissions.

The control variables are described below and represent other factors that may influence ALOS and ADC.

The *ownership* of a critical access hospital may influence both ALOS and ADC. Governmental (non-federal) critical access hospitals may have less incentive to reduce ALOS but may run higher ADC levels based on the population of patients they serve. These include state-owned, county-owned, and city-owned hospitals, as well as hospitals owned by a hospital district or authority and church-operated hospitals. Non-profit critical access hospitals serve a different population of patients and arguably have greater financial pressures than governmental hospitals. Differences in ownership may result in variation in both ALOS and ADC that is not associated with hospitalist performance and were controlled for.

The *number of licensed beds* of a critical access hospital may influence both ALOS and ADC. A CAH may have up to 25 licensed beds but may choose to license fewer than 25. A lesser number of licensed beds may have an effect on the ADC, as less beds are available (and staffed) for inpatient admissions. Similarly, if less patients can legally be admitted, it may lessen the daily number of patients a hospitalist must care for and may favorably enhance their ability to decrease the ALOS.

As Medicare and Medicaid patients have unique healthcare needs based on age and other social determinants of health, an increased *proportion of Medicare or Medicaid inpatients* may affect ALOS and ADC. For example, as Medicare patients are older and tend to have multiple co-morbidities, their ALOS may be longer than commercially insured patients who tend to be younger and healthier overall. Medicaid patients may be disabled or otherwise affected by social determinants, and they too may be predisposed to longer lengths of stay. The variation in ALOS and ADC due to the proportion of Medicare and Medicaid populations served is not directly associated with hospitalist performance and were controlled for.

Analytical Strategy

First, univariate analyses were performed on each variable. Descriptive statistics for the categorical and continuous variables are reported. Frequencies and percentages are presented for the categorical variables. Means and standard deviations are presented for the continuous variables.

Second, bivariate analyses (t-tests) were performed on each dependent variable (ALOS, ADC) with the independent variable (presence or absence of hospitalist program) and with the categorical control variable of hospital ownership to determine the relationship between hospitalists, ownership, and the dependent variables of ALOS and ADC. The bivariate analyses were performed on the pooled data for all five years of the study and on each individual year of the study to detect trends or outliers.

Third, correlation analyses (Pearson's correlation coefficients) were performed to study the strength of the relationships between the continuous variables (ALOS, ADC, licensed beds, proportion of Medicare inpatients, and proportion of Medicaid inpatients). The correlation analyses were performed on the pooled data for all five years of the study and on each individual year of the study to detect trends or outliers.

Fourth, a multivariate, random-effects panel analysis was performed examining the effect hospitalist programs have on ALOS and ADC. The multivariate analyses were performed on the pooled data for all five years.

An example of the panel data developed for the study is illustrated on Table 2.

Table 2

Panel Data Example

Hospital	**Year**	**Hospitalist**	**Y_1**	**Y_2**	**X_1**	**X_2**	**X_3**	**X_4**
1	2013	1	3.2	7.7	1	25	0.65	0.14
1	2014	1	3.4	7.3	1	25	0.59	0.12
1	2015	1	3.2	7.4	1	25	0.61	0.15
1	2016	1	3.1	8	1	25	0.68	0.11
1	2017	1	3	8.3	1	25	0.66	0.12
2	2013	0	3.6	7	0	10	0.54	0.16
2	2014	0	3.7	7.2	0	10	0.53	0.18
2	2015	0	3.7	7	0	10	0.6	0.17
2	2016	0	3.9	6.9	0	10	0.55	0.15
2	2017	0	3.6	7.3	0	10	0.59	0.16

Where:

Hospital = individual hospital identifier,

Year = each individual year in the study,

Hospitalist (**Independent Variable**), = dummy variable (1,0), where 1 = hospital years with physician hospitalists, 0 = hospital years with no physician hospitalists,

Y_1 (**Dependent Variable 1**) = ALOS (in days),

Y_2 (**Dependent Variable 2**) = ADC (in patients),

and **Control Variables**:

X_1 = Ownership, = dummy variable (1,0), where 1 = not-for-profit and 0 = governmental),

X_2 = Licensed Beds

X_3= Proportion of Medicare admissions, and

X_4= Proportion of Medicaid admissions.

Analyzing the Data

Upon final determination of Sample One and Sample Two, a Shapiro-Wilk Test was performed on each dependent continuous variable (ALOS, ADC) to establish statistical normality. The Shapiro-Wilk Test results were then analyzed and confirmed with histograms.

Fixed-effects and random-effects models were considered for this study. It was assumed that true variation between the hospitals in the study existed and were not well correlated. To confirm which model would best analyze the study's data, a fixed-effects estimator was performed in Stata. The estimator failed to produce a beta coefficient for the independent predictor variable. The fixed-effects model was rejected. A random-effects panel regression was then performed that better fit the panel data and was chosen for this study.

Five separate measurements were made for each variable corresponding to the years of the study (2013-2017). The repeated measurements had the same meaning and metric throughout the study.

Beta coefficients were derived from the multivariate analyses to quantify the association between the independent variable (hospitalists) and the dependent variables (average length of stay and average daily census) in critical access hospitals.

Regression Equations

Regression Equation 1:

$$Y_{(ALOS)it} = \beta_0 + \beta_1(_{Hospitalists})X_{1,it} + \beta_2 X_{2it} \ldots \beta_5 X_{5it} + \alpha_i + \mu_{it}$$

Regression Equation 2:

$$Y_{(ADC)it} = \beta_0 + \beta_1(_{Hospitalists})X_{1,it} + \beta_2 X_{2it} \ldots \beta_5 X_{5it} + \alpha_i + \mu_{it}$$

Where:

Y_{it} is the dependent variable (ALOS or ADC) where i = individual hospital and t = year,

β_0 is the y-intercept for ALOS or ADC,

β_1 is the coefficient of the independent variable (hospitalists),

X_{it} represents the independent variable (hospitalists) where i = individual hospital and t = year,

$\beta_2 - \beta_5$ represent the coefficients of the four control variables (ownership, licensed beds, proportion of Medicare patients, and proportion of Medicaid patients),

$X_2 - X_5$ represent the control variables above where i = individual hospital and t = year,

α_i (i = 1…. n) is the unknown intercept for each hospital (n hospital-specific intercepts), and

μ_{it} is the error term where i = individual hospital and t = year.

As stated, the regressions were performed in STATA IC 15.1 software, and statistical significance was set at the 0.05 alpha level.

CHAPTER 4

RESULTS

The purpose of this chapter is to provide a description of the information used to assess the study hypotheses and to present the findings from the research. The descriptive statistics for the study population are presented first. Results and findings specific to each hypothesis are then presented. A summary of the findings completes the chapter.

Establishing Normality

Shapiro-Wilk Test

The Shapiro-Wilk Test tests for normality in continuous variables and identifies the presence of skewness and kurtosis. The null hypothesis for the Shapiro-Wilk test is that the data are normally distributed. If the p-value is greater than 0.05, then the null hypothesis is not rejected and the data are normally distributed. If the p-value is less than 0.05, the null hypothesis is rejected, and the data significantly deviate from a normal distribution.

Shapiro-Wilk Test ALOS

For the dependent variable of average length of stay (ALOS) in Sample One, the p-value was <0.001, indicating that the data are *not* normally distributed. A histogram was created to better understand the distribution of the data. Sample Two produced similar results. Please see Figure 2.

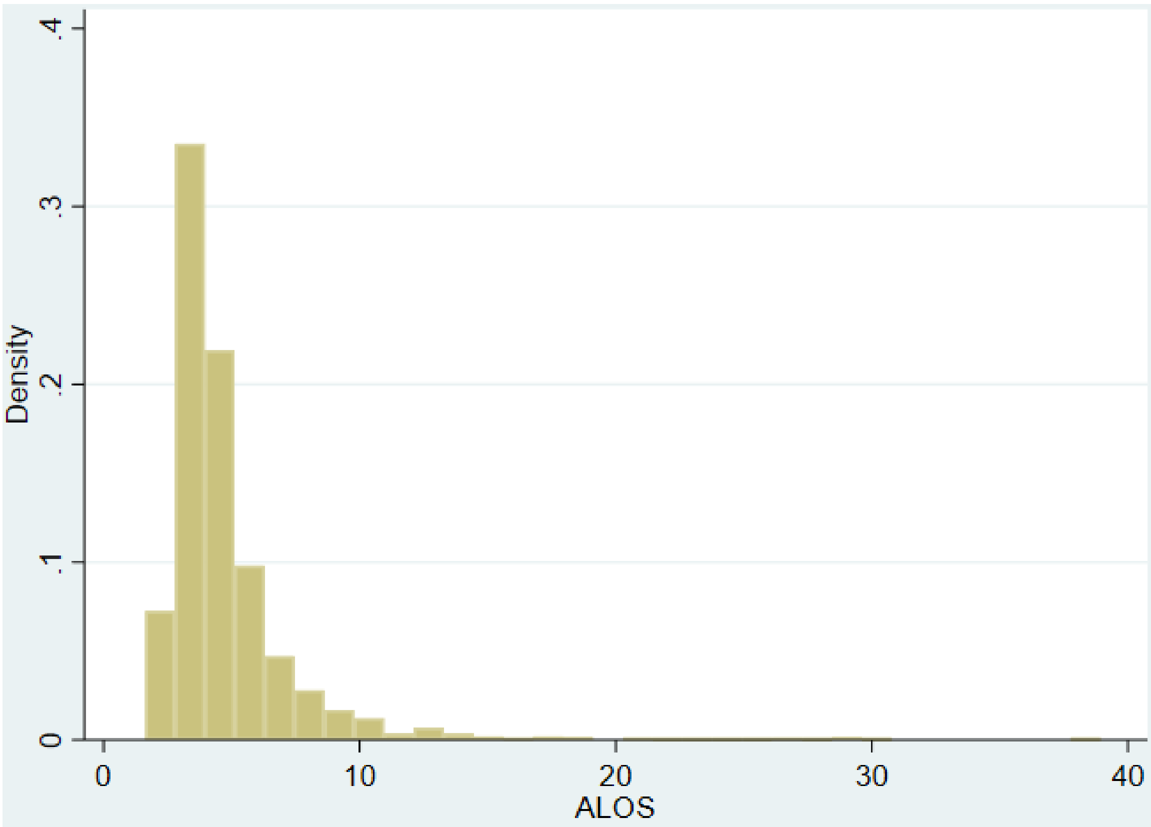

Figure 2. Distribution of ALOS Data—Sample One

ALOS data are skewed to the right with the bulk of the data represented by shorter stays and a single tail confirming the Shapiro-Wilk test conclusion of non-normality.

Shapiro-Wilk Test ADC

For the dependent variable of average daily census (ADC) in Sample One, the p-value was also <0.001, indicating that these data are also not normally distributed. A histogram was created to better understand the distributiuon of the data. Sample Two produced similar results. Please see Figure 3.

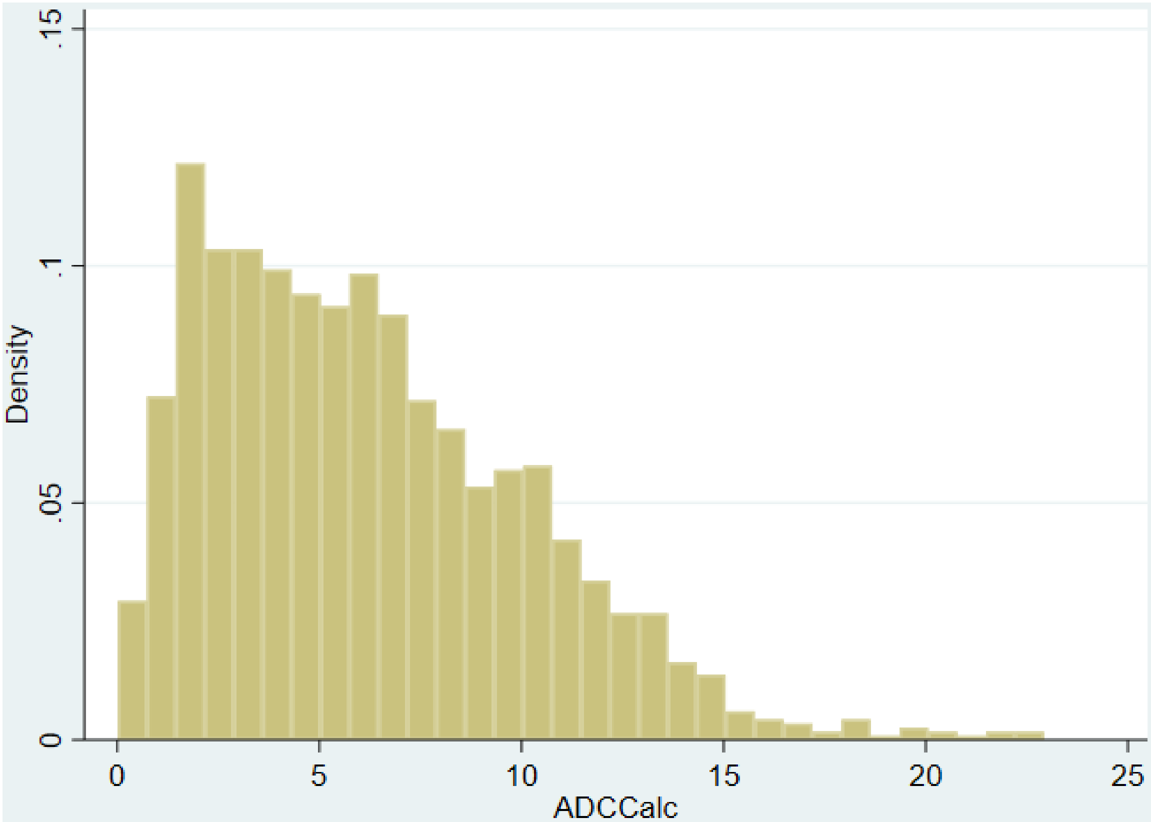

Figure 3. Distribution of ADC Data—Sample One

ADC data are skewed to the right with the bulk of the data represented by lower ADC levels and a single tail, confirming the Shapiro-Wilk test conclusion of non-normality.

Non-normality was expected in ALOS and ADC, as critical access hospitals tend to have lower acuity (shorter lengths of stay) and fewer inpatients per day, as previously stated.

Univariate Analyses

Table 3 summarizes the results of the univariate analyses. The first column summarizes the results from the first year of the study (2013), and the second captures the last year of the study (2017). Table 3 illustrates virtually no variation in the variables between the first and last year of the study. Each year of the study was checked individually and confirmed this observation. In the dependent variables, ALOS was tightly ranged from a low of 4.72 days to a high of 5.01. ADC ranged from a low of 5.95 to a high of 6.51. The independent variable analysis illustrated that the percentage use of hospitalists in each year of the study was unchanged. The continuous control variables (proportion of Medicare and Medicaid patients and licensed beds) were essentially constant throughout the five years of the study with no fluctuation year-to-year. Likewise, the categorical variable of hospital ownership was virtually unchanged throughout the study.

Table 3

Descriptive Statistics of Variables (N = hospital year observation)

	Baseline (2013) n = 338	**End line (2017) n = 340**
Variables	**Mean (SD) or Frequency (%)**	
Dependent Variables		
Average Length of Stay (ALOS)	4.74 (3.25)	5.01 (2.96)
Average Daily Census (ADC)	6.51 (3.94)	5.95 (3.91)
Independent Variable		
Physician-Based Hospitalist Program		
Yes	223 (66.0%)	225 (66.2%)
No	115 (34.0%)	115 (33.8%)
Control Variables		
Ownership		
Not-for-profit	200 (59.2%)	203 (59.7%)
Government non-federal	138 (40.8%)	137 (40.3%)
Organizational Factors		
Hospital Size (licensed bed)	22.95 (4.10)	22.64 (4.33)
Payer mix		
Proportion of Medicare Inpatients	0.65 (0.17)	0.66 (0.17)
Proportion of Medicaid Inpatients	0.10 (0.09)	0.10 (0.09)

Summary of Hypothesis Testing

Bivariate Analyses

Bivariate analysis (ttests) demonstrated a reduction in ALOS of 1.04 days per admission (4.17 days per admission vs. 5.21 days per admission) and an increase in ADC of 3.25 patients per day (8.36 patients per day vs. 5.11 patients per day) in CAHs that used hospitalists to provide inpatient care when compared to CAHs that used altarnative models of care (p-value < 0.001). The analysis also demonstrated that non-federal government hospitals averaged a longer ALOS (5.33 days vs. 4.54 days) and lower ADC levels (5.75 patients per day vs. 6.52 patients) when compared to not-for-profit CAHs (p-value < 0.001). The analysis was repeated for each individual year in the study, and the results correlated well with the pooled sample. The results from the pooled data are outlined on Table 4.

Table 4

Bivariate Analysis of Variables (ttest)

Variables	**Dependent Variables Mean (SD) or Frequency (%)**		
	ALOS	**ADC**	***p-value***
Physician-Based Hospitalist Program			
Yes	4.17 (0.10)	8.36 (0.17)	*<0.001*
No	5.21 (0.10)	5.11 (0.10)	
Ownership			
Not-for-profit	4.54 (0.09)	6.52 (0.13)	*<0.001*
Government non-federal	5.33(0.14)	5.75 (0.14)	

The bivariate analysis suggests that hospitalists at CAHs reduce the ALOS by approximately one full day when compared to CAHs that use alternative models of inpatient care.

Bivariate Analysis—Correlation

Only two of the continuous variables demonstrated a meaningful relationship with one another. First, the proportion of Medicare and Medicaid inpatients demonstrated a moderate relationship (Pearson's coefficient of

-0.5107). This is an expected correlation due to “dual eligibility” patients. Dual eligible patients are typically in poorer health, require more care than other beneficiaries, and qualify for *both* Medicare and Medicaid coverage. Second, the number of licensed beds demonstrated a moderate relationship with ADC as expected; the more licensed beds a hospital has, the more likely it will have a higher ADC, and conversely, fewer licensed beds would cap the ADC (Pearson coefficient of 0.4133). The other continuous variables demonstrate virtually no correlation with one another and are essentially independent (Pearson correlation coefficients are all less than 0.2). As one variable increases or decreases, the others are not affected. Correlation analyses were also performed on each individual year of the study and correlated well with the pooled data. Please see Table 5 for the Pearson coefficients of the continuous variables on the pooled data.

Table 5

Bivariate Analysis of Variables (Correlation)

	Average Length of Stay (ALOS)	**Average Daily Census (ADC)**	**Licensed Beds**	**Proportion Medicare Inpatients**	**Proportion Medicaid Inpatients**
ALOS	1.0000				
ADC	0.1604	1.0000			
Beds	-0.0455	**0.4133**	1.0000		
Medicare	0.1524	-0.1367	-0.1018	1.0000	
Medicaid	-0.1155	0.2154	0.1966	**-0.5107**	1.0000

Multivariate Analysis

Multivariate analyses were performed with each dependent variable (ALOS, ADC), the independent variable (hospitalist usage), and all control variables (ownership, licensed beds, proportion of Medicare inpatients, and proportion of Medicaid inpatients). Identical analyses were performed on Sample Two for sensitivity analysis, correlation, and confirmation. The results are outlined on Table 6.

Table 6

Multivariable Regression with Random Effects

	(N=1620) ‡	
Variables	**ALOS**	**ADC**
	β(S.E)	**β(S.E)**
Physician-Based Hospitalist Program		
Yes	**-1.21** (0.34)***	**2.82** (0.39)***
No	*Reference*	
Ownership		
Not-for-profit	-0.55 (0.27)*	-0.16 (0.29)+
Government non-federal	*Reference*	
Hospital Size (licensed bed)	0.03 (0.03) +	0.17 (0.03)***
Payer mix		
Proportion of Medicare Inpatients	1.63 (0.38)***	0.37 (0.35)+
Proportion of Medicaid Inpatients	5.41 (0.73)***	-0.64 (0.68)+

**p* ≤0.05; ***p* ≤ 0.01; ****p* ≤ 0.001, += >0.05. ‡ Hospital year observations (2013-2017).

The multivariate analysis correlated with the bivariate analysis. CAHs that use hospitalists have ALOS levels that are approximately one full day less per admission than CAHs that use alternative models of inpatient care (p-value < 0.001). CAHs that use hospitalists have ADC levels that are approximately three patients per day more than CAHs that use alternative models of inpatient care (p-value < 0.001). Governmental

CAHs have slightly longer ALOS levels than not-for-profit CAHs. The number of licensed beds has virtually no effect on ALOS or ADC in CAHs. The proportion of Medicare inpatients increases the ALOS by an average of 1.63 days per patient, and the proportion of Medicaid patients increases the ALOS by an average of 5.41 days (both p-values < 0.001).

The bivariate and multivariate analyses failed to support Hypothesis One. These analyses suggest that hospitalists at CAHs reduce the ALOS by approximately one full day when compared to CAHs that use alternative models of inpatient care.

The bivariate and multivariate analyses failed to support Hypothesis Two. These analyses suggest that hospitalists at CAHs increase the ADC by approximately three patients per day when compared to CAHs that use alternative models of inpatient care.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

This study posited that due to low inpatient volume, low patient acuity, and low population density served, hospitalists in CAHs do not have the ability to appreciably reduce the average inpatient length of stay, nor are hospitalist programs in CAHs associated with an increase in average daily census levels above those levels achieved when primary care physicians provide inpatient care.

Reducing ALOS and increasing ADC are among the most prominent arguments for initiating hospitalist programs. Fully staffed, physician-based hospitalist programs in CAHs cost approximately $1M annually. It is desirable for much of this cost to be offset by decreasing the cost of inpatient care by reducing the ALOS and/or increasing revenue by increasing the ADC. If this cannot be accomplished at appreciable levels, the cost of hospitalist programs become prohibitive and could contribute to the demise of small, rural, and financially vulnerable hospitals.

The literature review noted that CAH administrators were historically pressured by primary care physicians to initiate hospitalist programs. According to Casey et al. (2014), “Primary care physicians either *requested* that the hospital set up a hospitalist program or *required* that the hospital do it by refusing to provide inpatient coverage.” Due to the threat of non-coverage of inpatients and the concern of primary care physician retention, this study suggested that CAH administrators may not have been able to complete a comprehensive clinical and financial analysis of hospitalist programs and may have initiated these programs hastily. This study was designed to provide an analysis of hospitalist performance at CAH's and determine if the predicted association between hospitalists and reduced ALOS and increased ADC were being realized.

Limitations of the Research

This study used secondary data from the AHA Annual Survey. Variation hospital-to-hospital is suspected based on the individual responding to the survey and their knowledge of hospital operations. Likewise, individual variation within hospitals is possible if different individuals were responsible for survey completion during the five-year study period.

While the study proved a relationship between hospitalists and the reduction of ALOS and increase in ADC in CAHs, it does not quantify the average financial effect of those findings. The study does not determine if hospitalist programs in CAHs are financially self-sustaining, only that they have a positive effect on key metrics that at least partially justify the programs.

The bivariate, multivariate, and correlation analyses demonstrate statistical significance, but they do not establish causality between hospitalists and ALOS and ADC. Many other variables may be contributing to the variation in ALOS and ADC but were not analyzed. These variables include: average patient age, case mix index, tests and exams ordered, nursing labor resources and patient assignment criteria, and variation between individual hospitalists such as years of experience or board certification.

Lastly, the study did not delineate between employed hospitalists, contracted hospitalists, or locum tenens hospitalists—only the presence or absence of physician-based hospitalist programs. These employment differences may also account for additional variation but were not part of this study.

Management Implications

This study has concluded that hospitalists at CAHs reduce the ALOS of inpatients, which theoretically decreases the overall cost of providing inpatient care. The study also concludes that on average, CAHs that use hospitalists have higher inpatient volume than those hospitals that use other models of inpatient care. Due to the higher volume of patients served, this should result in increased revenue and profitability.

The results suggest that hospitalist programs in CAHs have the potential to produce a positive financial return. Administrators at CAHs must carefully examine their own revenues and variable costs per patient day to complete the analysis. As noted in the literature review, the ultimate financial effect of a reduction in ALOS is complicated and hospital-specific. Some hospitals in the literature were shown to *decrease* the ALOS but *increase* overall costs due to the high labor expense of the programs. CAH administrators are encouraged to apply the study findings to their own hospital and determine the local effect of a reduction in ALOS of one full day and an increase in ADC of three patients per day.

Based on the study findings, administrators at CAHs are encouraged to support hospitalist programs and preserve them as they have been shown to improve efficiency, augment the level of care provided, and improve hospital policies and processes related to inpatient care without a degradation in patient satisfaction or outcomes.

CAH administrators who do *not* currently have hospitalist programs will undoubtedly have to consider them in the future as primary care physicians age and leave the workforce. Increasingly, replacement primary care physicians are opting out of inpatient care. For those CAHs considering the addition of hospitalist programs, the findings suggest that financial risk is mitigated by a statistically significant reduction in ALOS and a statistically significant increase in ADC and that the initiation of hospitalist programs should be considered as a viable strategy.

The study's findings, however, do *not* relieve administrators of the responsibility to thoroughly evaluate hospitalist programs *before* initiating them and assure that they will be financially viable and cover costs. This study should instill caution in CAH administrators facing pressure to start hospitalist programs. At a cost of $1M per year, the decision to start a hospitalist program should not be a decision based on institutional theory. Without hard data and local financial justification, this can be an expensive mistake in a CAH that may already be financially vulnerable. A misguided decision may very well lead to the demise of the hospital.

Opportunities for Future Research

Decreasing the ALOS may result in an increase in re-admissions. The Palacio et al. study suggested a *reduced* probability of re-admission was significantly associated with an *increasing* length of stay, prior admission to the hospitalist service, and discharges to home with home health services. The odds ratio for each added day of stay was 0.931 ($P < 0.0001$). The odds ratio for prior admission to the hospitalist service was 0.784 ($P < 0.037$). The odds ratio for home health services was 0.681 but did not reach statistical significance ($P < 0.059$) (Palacio, 2009). As ALOS is a common metric for hospitalist performance, additional research on the effect of shortening the length of stay on other key metrics such as the re-admission rate would be valuable.

An in-depth financial analysis of what a reduction in ALOS of one day per patient and an increase in ADC of three patients per days equates to in net revenue in CAHs would be extremely valuable. This analysis would help administrators better understand the financial contribution of hospitalist programs and determine if the programs cover their own costs.

As an example, using a sample of one, the author's hospital currently has an ADC of approximately 7.5 patients per day. Net annual inpatient revenue is approximately $3.96 M. If this hospital were a non-hospitalist hospital and were to convert to a hospitalist model, what would be the expected increase in net revenue? Based on the current study, ADC would be expected to increase from 7.5 to 10.5 (7.5 + 3). Direct proportions would suggest an expected increase in net inpatient revenue from $3.96 M to $5.54M ($3.96M x 10.5 patients / 7.5 patients = $5.54M). The incremental increase in net revenue calculates as $5.54M – $3.96M = **$1.58M**. In this single hospital hypothetical, the addition of a hospitalist program would be expected to net an additional $1.58 M in net revenue. This rough calculation would justify the addition of the hospitalist specialty, as it would be projected to adequately cover its own costs. An in-depth scientific study is necessary to verify that this assumption in generalizable to all CAHs.

A study of patient acuity *and* hospitalist performance would be extremely valuable to better understand the variability of ALOS and ADC and the effect hospitalists have on these variables depending on the case mix index of the hospital. The current study produced models whereby only 2.2% of the total variation in ALOS, and 23% of the total variation in ADC was explained by the presence (or absence) of hospitalists. Thus, much of the variation in these two metrics is left unexplained. It is suggested that patient acuity (as measured by the case mix index) may be a much better predictor of ALOS and ADC than hospitalist programs. Further, does a higher case mix index enhance or decrease the ability of hospitalists to have an appreciable effect on ALOS and ADC?

Lastly, this study focused on the metrics of ALOS and ADC. These are only two of many possible opportunities for research. As stated, the analyses revealed that only 2.2% of the variation in ALOS and 23% of the variation in ADC was associated with hospitalists. Thus, other stronger predictors of ALOS and ADC must be sought. Likewise, other quality indicators that may be potentially affected by hospitalists should also be considered for further study at CAHs. Examples include the metrics already discussed above (re-admission rate, net revenue, patient acuity) but should also include other metrics such as mortality rate, medical errors, and medication errors.

Conclusion

The analysis concluded that neither hypothesis was supported. Hospitalists at CAHs reduce the ALOS by approximately one full day ($p\text{-value} < 0.001$) and are associated with an increase in ADC of approximately three patients per day ($p\text{-value} < 0.001$) when compared to hospitals that do not use hospitalists.

The study analyzed the association between hospitalists and ALOS and ADC in two related samples. The main sample (Sample One) studied hospitals that either used hospitalists for the entire five-year study or did not use them at all for the entire study period. Sample Two expanded on Sample One by adding hospitals that started the study without hospitalist programs but added them during the study period. Identical analyses were performed on each sample. Each analysis was then repeated for each individual year of the study to establish correlation and possible outliers. The results correlated very well in all regards and reached the same conclusion: ALOS was reduced and ADC was increased when hospitalists were responsible for inpatient care.

The analysis confirmed that despite low inpatient volume, low patient acuity, and small rural catchment areas, hospitalist programs in CAHs are associated with a statistically significant *reduction* in ALOS and with a statistically significant *increas*e in ADC.

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APPENDIX

IRB APPROVAL

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM

Office of the Institutional Review Board for Human Use

NHSR DETERMINATION

TO: Peterson, Robert Thomas

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

DATE: 03-Dec-2019

RE: IRB-300004426
An Analysis of Hospitalist Programs in Critical Access Hospital

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

The reviewer has determined this project is not subject to FDA regulatio Research. Note that any changes to the project should be resubmitted to determination.

If you have questions or concerns, please contact the Office of the IRB at :