

The Evaluation of Patient, Provider and Organizational Outcomes Following the Implementation of a Chest Pain Unit

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“On my honor as a student, I have neither given nor received unauthorized aid on this assignment”

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Abstract

In February 2013, a new Chest Pain Unit (CPU) opened in a 238 bed community hospital in the Mid-Atlantic region. The purpose of this Capstone project was to evaluate patient, provider and organizational outcomes associated with the implementation of this new unit as compared to routine care. Selected outcomes were compared for those patients treated in the CPU ($n=30$) and those patients ($n=30$) who were treated on the Routine Care Unit (RCU) during a 90 day timeframe. Statistically significant differences were found between the ages of each population. Troponin testing trended toward a reduction in the time interval between tests when performed in the CPU as compared to RCU. The overall length of stay also displayed a trend toward improvement for patients in the CPU. Insurance payments were found to be higher for CPU patients. There were no differences in clinical outcomes between the groups as measured by readmissions. Patient satisfaction with care in the CPU was also reviewed. Findings in this evaluation indicated trends toward improvement for all variables studied and further investigation of these initial findings is indicated to determine if statistically significant differences may exist when comparing the total population of low risk chest pain patients in each location over an extended timeframe.

Keywords: chest pain unit, patient outcomes, effectiveness, efficiency

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Section 1: Introduction

Many hospitals in the United States can no longer accommodate the growing number of patients seeking services. As a result of trends in national demographics, increasingly complex patient co-morbidities and reductions in reimbursement, many hospitals have either closed or dramatically reduced the number and types of services provided (Baugh, et al., 2012; Bayley et al., 2005; Daly, Campbell & Cameron, 2003; Hoot & Aronsky, 2008,). The recent passage of the Affordable Care Act will only exacerbate this problem as patients who have not previously been treated may turn to hospitals to address their care needs (Hoyt & Proehl, 2012).

Ironically, as American healthcare begins to shift from being “volume-based” to being “value-based”, aggressive improvements in the efficiency of hospital care will become mandatory (The Advisory Board, 2011). Nursing leadership is poised to assume a strategic role in creating the future of hospital-based care through the development and implementation of innovative evidence-based practices targeting high volume, low risk patients who are currently being treated in the inpatient context (Baugh & Bohan, 2008; Hess & Nestler, 2012; Ross, et al., 2012). One of the largest patient populations currently being treated in hospitals are patients with low risk chest pain (American College of Cardiology, 2007, Peacock & Cannon, 2009).

Over eight million people are seen annually for chest pain in the United States (Amsterdam et al., 2010). Coronary artery disease remains the leading cause of death with angina (chest pain) as a primary symptom (Roger, et al., 2007). Public health initiatives have targeted information on the importance of seeking medical care in the presence of chest pain (Cytryn, Yoskowitz, Cimino & Patel, 2009). Although the majority of the patients with chest

pain do not have a life threatening condition, chest pain continues to be the most frequently treated symptom in hospital emergency departments (Hess & Neslter, 2012; Holly & Hamilton, 2012; Hoot & Aronsky, 2008).

Emergency department (ED) providers are faced with the very complex task of quickly deciphering symptom information and making decisions about subsequent treatments for patients with chest pain (Amsterdam, et al., 2010; Greene, 2010; Jourdain, 2009; Schriger & Newman, 2012). There is significant liability associated with failure to diagnose an acute coronary syndrome. In the absence of alternatives, patients who enter the ED with low risk chest pain are often admitted for evaluation rather than discharged home (Peacock & Cannon, 2009). An alternative to inpatient admission for low risk chest pain patients however is the assessment, diagnosis and treatment of these patients in either an emergency department observation unit (EDOU) or a dedicated chest pain observation unit (Beck, Musial & Barrett, 2007; Goodacre, et al., 2004; Jagminas & Partridge, 2005; Ross, Naylor, Compton, Gibb & Wilson, 2001).

Overview of the Problem

Although dedicated chest pain observation units have consistently demonstrated improved patient, provider and organizational outcomes, only one third of all hospitals in the United States currently offer any type of dedicated observations services (Contos, 2011). Consequently, many organizations treat low risk chest pain patients in EDs and on inpatient units. It is estimated that individual hospitals are currently losing 4.6 million dollars each year as the result of these patient placements (Baugh, Venkatesh, et al., 2012). It has also been estimated that the cost savings for low risk chest pain patients admitted to the hospital could be over \$1500 (Shah et al., 2012). As insurance reimbursements continue to decline, it is imperative that

nursing leaders not only recognize opportunities to improve patient care through evidence-based practices, but also participate in the creation of alternative patient care processes which will maximize efficiency and reduce costs within their organizations (Siek, 2005, The Advisory Board, 2012).

In the winter of 2012, several patients requiring admission to the study hospital were stabilized and then transferred to other facilities in the region. Initially, it appeared that the study hospital did not have sufficient bed capacity to place all patients requiring admission on an inpatient unit. Further analysis revealed that both delays in the discharge process as well as the use of inpatient beds for patients receiving outpatient observation services often resulted in a census at maximum capacity. An in-depth review of primary diagnoses revealed that patients with the diagnosis of low risk chest pain represented the greatest percentage of these patients. It should also be noted that in 2012, physicians in the organization had no other choice but to place outpatients requiring observation services on an inpatient unit.

Chest pain patients with a low risk of acute coronary syndrome, commonly referred to as “low risk chest pain patients” are defined as hemodynamically stable patients with no dysrhythmias, a normal electrocardiogram and negative initial cardiac injury markers (Amsterdam, et al., 2010). Low risk, however, does not equal “no risk” and conservative evaluation has been shown to reduce post-discharge mortality (Purim-Shem-Tov, Silva & Rumoro, 2007).

Patients identified with a high risk of myocardial infarction have historically been treated very quickly (Byrne, Murdoch, Morrison & McMurray, 2002). Patients presenting with low risk chest pain however often experience delays in diagnosis and testing and long lengths of stay (Anderson, et al., 2007; Beck, et al., 2007). Recognizing the need for a change, the study hospital

established a Chest Pain Unit (CPU) for observation patients in February 2013 (Garvey, 2001). As the development activities of the CPU are described elsewhere, this evaluation examined changes in selected outcomes following implementation.

Purpose of this evaluation

This evaluation compared outcomes associated with patient care, provider effectiveness and operational efficiencies following the implementation of a chest pain unit. By highlighting not only patient outcomes but also targeting the provider and organizational outcomes associated with the use of a well-defined clinical process, the findings of this evaluation will provide support to those senior nursing leaders seeking to implement similar processes in their own organizations.

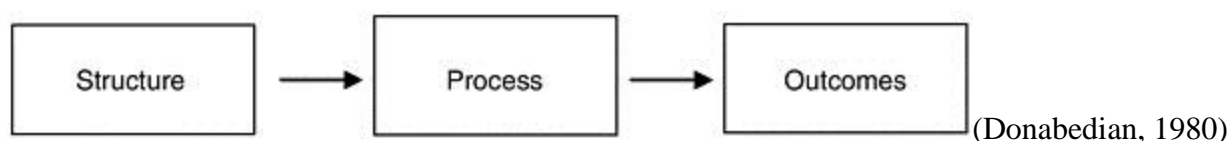
Nursing leaders must safeguard acute care margins by standardizing care processes, improving the patient experience, improving productivity and growing patient revenues. The findings from this evaluation are timely given the anticipated changes in patient care and reimbursements associated with the Affordable Care Act (The Advisory Board, 2011). This evaluation will provide a “springboard” for active discussions regarding the advantages of implementing evidence-based practices within modified hospital-based processes in order to provide enhanced care to observation patients.

Theoretical Framework

The assessment of structure and process as the antecedents of key patient care outcomes was introduced by Avedis Donabedian, MD, MPH. Donabedian’s “medical care process” model outlined client and provider behaviors which lead to the subsequent use of services resulting in health outcomes (Donabedian, 1968). Through the creation of this framework, Donabedian

proposed that standards for clinical performance could be created and measured and care subsequently improved through review of the quality of each of the components of the model (Donabedian, 1980).

Figure 1: Donabedian's Theoretical Framework

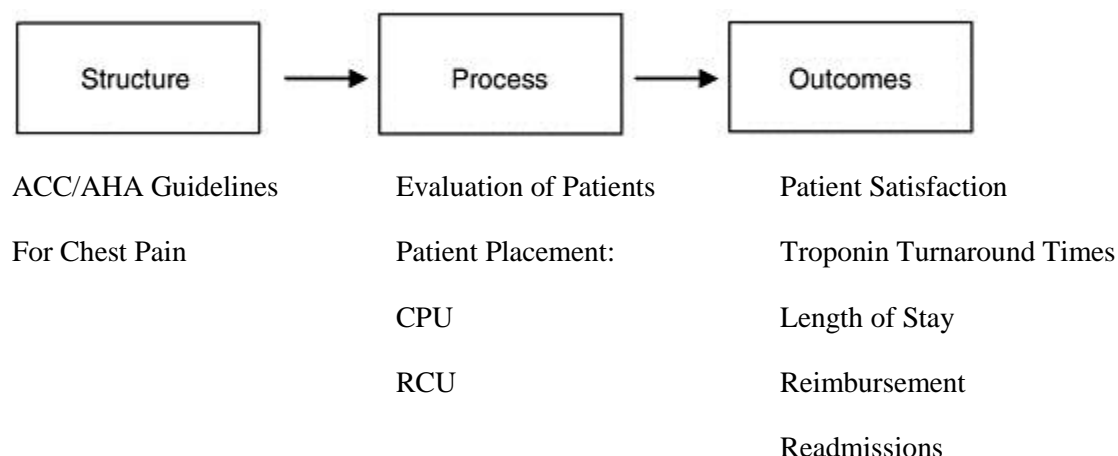


Since that time, various government agencies such as the Agency for Healthcare Research and Quality (AHRQ) have adopted and enhanced this framework when addressing quality measurement in healthcare (AHRQ, 2012). Structure or context has traditionally referred to the organizational resources found in health care settings. This can include both material resources such as the physical plant and supplies as well as human resources such as staffing or physician coverage (Committee on Redesigning Health Insurance Measures, 2006). Additionally, organizational structure can also apply to patient management, culture and design (Glickman, Baggett, Krubert, Peterson & Shulman., 2007). Process refers to what is actually done to and for the patient during the provision of care (McQuestion, 2006). Outcomes are seen as the result of the patient's contact with the health system and measure the impact of the care on a patient's health status.

The structural elements of this evaluation included the study hospital's management of patients with low risk chest pain using the pathways and protocols outlined by the American Association and the American College of Cardiologists (ACC/AHA, 2007; Amsterdam, et. al., 2010). The process elements of the evaluation included the use of a stratification system to determine patient risk and physician decision making about patient placement in either the CPU

or RCU. The outcomes of each patient group were diverse and included patient, provider and organizational outcomes.

Figure 2 :Theoretical Framework applied to this Evaluation



Choosing the appropriate outcomes indicators are critical to the evaluation of new any structure or process. Utilizing different categories of outcomes during an evaluation more accurately reflects the full scope of the patient care being evaluated. This diversity was intended to provide for a more holistic evaluation (Jennings, Staggers & Brosch, 1999).

Research Question

Are there differences in patient, provider and organizational outcomes following the creation and implementation of a Chest Pain Unit as compared to outcomes on a Routine Care Unit?

Section II: Review of the Literature

The initial search of the literature began using the electronic databases of CINAHL and Ovid MEDLINE. The initial search terms of “chest pain units” and “low risk chest pain” yielded 355 citations. The CINAHL search was further refined using the key words “chest pain units” and “outcomes”. This search yielded 99 citations. A final search adding the key words “randomized control trials” produced seventeen (17) citations which, upon review, did not target any of the variables of interest in this evaluation. These studies were found to primarily address medication selection and testing protocols for low risk chest pain patients and did not focus on any elements of structure or process.

The MEDLINE database was then searched using the key words “chest pain units” and “outcomes”. The search was further refined by selecting English language journals during the period of August 2002 to August 2012. It should be noted that the majority of the articles reviewed were descriptive studies of the impact of selected interventions on low risk chest pain patients. Confounding this literature search were research studies regarding rapid access chest pain clinics. Although these studies were reviewed, they were ultimately excluded given the purpose of these units and the context within which patient care was provided.

The final inclusion criteria for this literature review were (a) studies conducted between 2002 and 2012 that focused on freestanding chest pain units or those integrated into an observation unit (b) studies that compared the outcomes of low risk chest pain patients treated in CPUs to those treated in other types of units. Studies solely focusing exclusively on low risk chest pain patients or on protocol development, testing recommendations and patient risk stratification were excluded. A total of seven studies and one systematic review were found which met all of the inclusion criteria.

A further search of the Cochrane Library using the key words “chest pain unit” provided one additional relevant finding. An updated systematic review is currently in process and will include randomized controlled trials comparing chest pain observation units to routine emergency patient care. The findings of this systematic review have not yet been published. A final database survey of the Educational Resources Information Center (ERIC) database revealed two additional studies, one of which provided information on lay knowledge in response to the symptoms of acute myocardial infarction (Cytryn, Yoskowitz, Cimino and Patel, 2007). A focused search of selected professional journals was also conducted. This final search yielded three additional studies which met the inclusion criteria. A total of 10 studies and one systematic review which met all of inclusion criteria were identified (see Table 1).

Chest pain centers were developed in the late 1980s as a protocol driven methodology used to rapidly and accurately diagnose patients presenting with chest pain in order to reduce mortality and morbidity (Bahr, 2000; Lewis & Amsterdam, 2001; Storrow & Gibler, 2000). Similar to the trauma center concept, focused care for patients with chest pain, provided through designated pathways, was determined to be the most effective way to reach a definitive diagnosis (Amsterdam, Lewis, Kirk, Diercks & Turnipseed, 2002; Joseph, 2004; Peacock & Cannon, 2009). These pathways also allowed for the provision of rapid treatment in order to maximize outcomes. The initial target patient population triaged using these protocols were patients *with* myocardial infarction (Bahr, 2000).

Following the implementation of these pathways, it was determined that only a minority of the patients presenting with chest pain have life-threatening conditions (Joseph, 2004). As a result, separate processes evolved for those patients with the lowest risk for coronary artery disease. These patients only required periods of observation and selected testing, not aggressive

therapies in order to reduce the likelihood of discharge in the presence of ischemia (Gesensway, 2010; Peacock & Cannon, 2009).

Studies conducted in the 1990s on low risk chest pain protocols, processes and outcomes revealed that care provided within the context of a chest pain “unit” was both safe and effective when compared to usual care. Specific outcomes such as 30 day mortality and morbidity, cost effectiveness, patient satisfaction and overall length of stay were researched in a series of landmark studies and shown to be improved through the focused care provided to low risk chest pain patients using evidence-based protocols (Farkouh, et.al., 1998; Roberts, et.al., 1997 Rydman, et.al., 1997).

Based upon this earlier research, chest pain units were then developed and implemented in the United Kingdom (UK) in 2001 (Goodacre, et al., 2004). Unlike chest pain care in the United States, which evolved from a focus on ischemia to a focus on patients at low risk, these units were developed exclusively for the care of low risk patients. Adoption of the chest pain unit process has been inconsistent across the UK. Chest Pain Units were, however, established in several hospitals and many of these hospitals have participated in subsequent recent research trials (Cross, How & Goodacre, 2007).

The findings reported in this literature review come primarily from these contemporary European studies. Although the healthcare systems vary between the United States and the UK, many of the outcomes studied in the European studies were measures of structure and process. These variables were relevant to this evaluation. Contemporary studies related to chest pain units in the United States were found to primarily focus on testing protocols and stratification tools.

In 2000, Goodacre conducted a literature review of the chest pain unit studies conducted by researchers in the United States during the 1980s and 1990s. His review targeted all studies

conducted on chest pain observation, chest pain evaluation and chest pain assessment. As his review contained no stated timeframes, it is assumed that all relevant studies were included.

A total of six studies from the United States initially met Goodacre's (2000) initial inclusion criteria and findings from each were presented in the review. These findings focused on a variety of outcomes such as 30 day event rates, re-hospitalizations and complications for patients treated in chest pain units as compared to patients treated in a routine setting which was typically a monitored cardiology inpatient unit. Goodacre reported that there were no statistically significant differences in mortality, events, re-hospitalizations and complications across these studies. His conclusion was that chest pain units provided safe care when compared to "routine" care.

Goodacre (2000) also reviewed six descriptive studies which presented findings for a variety of outcomes for chest pain unit patients but contained no comparison group. He also included five studies in his review which were just cost comparisons. Findings from these descriptive studies included non-significant increases in re-attendance (readmission) rates in two of the studies, improved patient satisfaction in one study and reductions in cost of care in two studies. In one of these studies, the only significant difference in outcomes was an increase in diagnostic certainty following chest pain observation unit evaluation.

For the studies including cost as a variable, Goodacre (2000) noted limited findings given the absence of a comparison group. Goodacre concluded that the research on chest pain units in the United States conducted prior to 2000 demonstrated evidence that chest pain unit care was just as safe as routine care and other that other benefits of these types of units, such as improved patient satisfaction and increased cost savings might also exist (Goodacre, 2000)

Based upon his review of the literature, Goodacre then conducted a study between 2000 and 2001 in the emergency department of the Northern General Hospital in Sheffield, UK (Goodacre, et al., 2004). The objective of the study was to measure the clinical and cost effectiveness of a chest pain observation unit compared to “routine” care provided in either the Emergency Department or on the inpatient units in the hospital. The clinical outcomes studied were: the proportion of admissions, the number of patients sent home inappropriately with acute coronary syndrome, major events over six months, health utility, hospital re-attendance (visits) and re-admission. The costs per patient to the health service were also studied (Goodacre, et al., 2004).

In this study that was conducted over a six month period, patients (N=972) were randomly assigned to either the Chest Pain Observation Unit (CPOU) ($n=479$) or initially treated in the Emergency Department and then placed on an inpatient unit for observation ($n=493$). Goodacre (2004) concluded that there was a statistically significant difference in the number of patients admitted from the routine care group ($p<0.001$) as compared to the patients treated in the CPOU. There were no statistically significant differences in inappropriate discharges, major events at 6 months or differences in the cost associated with the initial episode of care between the groups. Patients treated in the CPOU rated higher health utility (higher health quality) at 48 hours post discharge and at one month post discharge than the routine care patients ($p=0.008$). Decreased services (visits) utilization for the CPOU patients over a six month period also appeared to result in an overall cost savings per patient to the health system (Goodacre, et al., 2004).

When the National Health Service Institute for Innovation and Improvement in the UK targeted chest pain as a primary focus of effort to decrease inappropriate utilization of inpatient

admissions, Goodacre et al. (2007) was awarded a grant to study the use of chest pain units to specifically reduce the number of emergency department admissions without decreasing the quality of care provided to patients as measured by re-attendance (visits) and admission within 30 days. The Effectiveness and Safety of Chest Pain Assessment to Prevent Emergency Admissions (ESCAPE) trial was conducted in 2004 and 2005 and resulted in a number of published studies all of which utilized the data collected by the participating organizations (Goodacre, Cross, Lewis, Nicholl & Capewell, 2007).

Between November 2004 and June 2005, personnel in fourteen hospitals in the UK agreed to participate in a cluster randomized trial to establish chest pain units within their facilities. Seven hospitals were randomly selected to establish chest pain units using pre-defined protocols and seven hospitals were asked not to set up units and to continue to provide “routine” care. The routine care facilities tended to be slightly larger than the hospitals which established chest pain units and were more frequently located in urban settings.

Data on a number of variables were collected over a one year timeframe. The primary outcomes studied for the initial study were: proportion of admissions, re-attendance (visits) and admission within 30 days. Data for each participating facility were compared pre and post intervention (establishing the chest pain units) and also compared between the intervention (those with chest pain units) hospitals and the control (those providing routine care) hospitals.

The overall number of “attendances” (visits) for chest pain increased for both the control hospitals (3.5%) and the intervention hospitals (16%) during the study timeframe. Although not statistically significant ($p=.08$), findings were that this increase was more significant for the intervention hospitals. This finding however was not consistent across those hospitals.

Additional findings were that although there were no differences in 30 day re-admission rates or re-attendance (visit) rates ($p=.044$). In this study, admission rates ($p < 0.001$) were actually found to be higher in the hospitals *with* the chest pain units. This contradicted Goodacre's earlier study findings (Goodacre, et al., 2004). The authors concluded that additional research was required to determine if any of the individual chest pain units had beneficial outcomes for selected patients. Following the ESCAPE trial findings, the structure, process and outcomes of the seven intervention hospitals were studied using a descriptive study design (Arnold, Goodacre & Morris, 2007).

In this study, differences across the facilities in total percentage of patients discharged from the chest pain unit as well as the percentage of patients discharged who experienced an adverse event as defined by a readmission in less than 48 hours, death or non-fatal myocardial infarction were studied. Anecdotal information was also provided in this case study regarding some of the characteristics of each of the units such as their location, staffing, operational hours and access to testing. The information in this study was not comprehensive nor was it statistically analyzed (Arnold, et al., 2007).

A review of the findings from the study revealed that there were no significant differences in the percentages of patients discharged (79% to 89%) across the units. The proportion of adverse events following discharge was from zero to three percent (3%) across the hospitals. A subsequent comparisons of patient demographics across the hospitals revealed that two of the hospitals managed fewer and younger patients, while two of the hospitals managed a greater number of older patients with more comorbidities. The authors concluded that this study may have actually underestimated the numbers of patients treated and that the process changes

associated with the implementation of a chest pain unit may have impacted other types of care provided in the organization (Arnold, et al., 2007).

To further investigate the impact of the chest pain units on both patients and staff, two additional studies coincided with the ESCAPE trial. In one study, patients were interviewed subsequent to their care at both the intervention hospitals and the control hospitals to determine their opinions (Johnson, Goodacre, Tod & Read, 2008). In the other study, clinicians were interviewed to determine key themes associated with the successful development and implementation of chest pain units within their hospitals (Macintosh, Goodacre & Carter, 2010).

In the first study patients (N=26) were interviewed between September 2005 and June 2006 to determine patient opinions of care provided in the chest pain unit ($n=14$) or in the emergency department followed by placement on an inpatient unit ($n=12$). Patients in both groups expressed high levels of satisfaction with nursing care. Access to a specialist nurse in the chest pain unit significantly improved satisfaction. Triage, diagnosis, treatment, observation/monitoring, discharge and follow-up have been noted to be the most significant components of nursing care provided to patients in a chest pain unit (Siebens et al., 2007).

Some of the patients in this study stated that they were not satisfied with the levels of information provided, particularly those patients who continued to be unsure of their final diagnosis ($n=5$) expressing the highest levels of dissatisfaction. The authors concluded that variations in patient satisfaction appeared to be closely related to the hospital in which the care was provided rather than the setting of the chest pain unit or routine care (Johnson, et al., 2008).

In the second study interviews with caregivers affiliated with the ESCAPE trial revealed key themes in the implementation of the chest pain units in six of the seven participating studies. Cardiologists ($n=4$), Emergency Room physicians ($n=6$) and nurses who worked in the units

(n=16) identified themes around inputs, process and outputs. This study does not specify when these interviews occurred. The authors state that it was “intended to identify the possible reasons for variations in implementation of the chest pain units across the original study hospitals” (MacIntosh, et al., 2010, p.676). These variations were thought to have contributed to the differences across hospitals in the original ESCAPE trial (Macintosh, et al., 2010).

All of the caregivers interviewed in this study agreed that the services provided by chest pain unit personnel were needed in their respective organizations. The themes which emerged related to implementation were: organizational readiness, team characteristics, role boundaries, leadership, staffing, operational delivery, the impact of the unit on team members and the expansion of roles in the context of a new service. It was noted that those organizations primed for this innovation through success with previous innovations, appeared to have higher volumes of patients. Additionally those hospitals which allowed staff to “expand” their roles and “cross” departmental boundaries appeared to implement the chest pain units with less internal tension and a greater sense of shared ownership. Finally, the presence of one person who very actively maintained the trial appeared to be influential in the success of implementation (Macintosh, et al., 2010).

The final article associated with the ESCAPE trial focused on the development of a nomogram for use by organizations in determining the cost effectiveness of implementing a chest pain unit. Using a sensitivity analysis, the authors state that those hospitals which currently admit less than 35% of patients presenting with chest pain will not see reduced costs following the implementation of a chest pain unit. Concurrently hospitals which incur significant additional costs in order to implement a chest pain unit, such as new physical space, additional staffing and equipment, will experience negligible initial cost savings. Longer term savings may be

associated with reduced admissions and reduced re-attendances (Goodacre & Dixon, 2005). Several additional studies were included in this literature review which targeted additional strategies to reduce costs through improved patient placement and reductions in overall length of patient stay.

Another study, conducted in a large university hospital, compared admission information (total number of admissions, percentage of admissions and the rate of conversion to inpatient status for each) and the mean costs of care for patients treated in an inpatient hospital observation unit (IHOU) to patients treated in an ED observation unit. Findings from the study revealed a statistically significant increase in the percentage of low risk chest pain patients sent to the IHOU ($p=0.001$) and a statistically significant increase in the rate of conversion to inpatient status for patients in the IHOU ($p<.0001$). Corresponding to these findings were higher mean costs for IHOU patients (\$1040) as compared to the ED observation unit patients (Jamingas & Partridge, 2005).

A study which complements these findings was conducted in Baltimore (Jibrin, et al., 2008). The authors of this study sought to validate the use of outpatient protocols on patients placed on a short-stay inpatient unit in order to determine if the outcomes were comparable to chest pain units. The researchers compared outcomes for low risk chest pain patients placed on a Chest Pain Short Stay Unit (CPSSU) which was located on an inpatient unit adjacent to the Critical Care Unit to those patients treated in the Emergency Department (ED) using same protocols for low risk chest pain.

A review of the findings revealed that the overall lengths of stay was higher on the CPSSU than in the ED with the incidental finding that ED length of stay was directly related to the availability of stress testing. The costs per episode of care on the CPSSU were also higher

than the ED (\$978 compared to \$1543). These differences between inpatient and outpatient care were supported by earlier studies. Ironically, as the result of payment disincentives in Maryland, reimbursement for care on this unit was also higher resulting in increased organizational revenue (Jibrin, et al., 2008)

Findings from another study, conducted through a retrospective chart review from a large hospital system in metropolitan Detroit, demonstrated both a reduction in the length of time to patient placement *and* the overall length of stay following the implementation of an Emergency Department Observation Unit for low risk chest pain patients.

In this retrospective study, patients with a diagnosis of low risk chest pain (N=120) were randomly selected. A total of 92 patients met the inclusion criteria. An equal number of patients ($n=46$) admitted prior to the implementation of an Emergency Department Observation Unit (EDOBS) were compared to those patients treated after the unit was created ($n=46$) for two outcomes: ED registration time to unit and total length of stay. The researchers found a statistically significant reduction in total length of stay ($p<0.001$) following the implementation of the EDOBS unit for low risk chest pain patients. It should be noted that an Emergency Nurse Practitioner managed the patients seen in the EDOBS (Beck, et al., 2007). The final two studies included in this literature review, both published in 2012, focused on admission rates, length of stay and estimated cost savings.

Rates of admission for a newly opened Chest Pain Evaluation Center (CPEC) were compared to rates of admission for low risk chest pain patients during the same six week period in 2009 and 2010 (Winchester, Stomp, Shifrin & Jois, 2012). Researchers found a statistically significant ($p<0.001$) reduction in the proportion of patients admitted in 2011 following the creation of the unit. One hundred and eighty one patients were studied and although volumes for

low risk chest pain patients continued to increase each year (including 2011), the proportion of patients admitted in 2011 following the implementation of the unit were significantly lower than previous years. One critique of this study is the lack of a comparison of the patient demographics for each year with the risk stratification of each patient cohort. One is left to question whether the patient groups in each of these years were similar in demographics and risk stratification.

In the final study, researchers compared lengths of stay and costs for a hypothetical chest pain observation unit as compared to usual care (Shah, et.al., 2012). A retrospective chart review was conducted in an academic medical center in New Jersey for patients treated with low risk chest pain between July 2010 and June 2011. The Thrombolysis in Myocardial Infarction Score (TIMI) was used to risk stratify all of the 777 charts reviewed. Patients were then placed into a hypothetical chest pain observation unit which delineated length of stay and cost of care for each patient based upon their stratification score. These scenarios were then compared to the actual patient lengths of stay and costs. The average length of stay for patients in the hypothetical CPOU was significantly lower than the actual length of stay for these patients ($p=0.001$). The costs of care were also lower with an average savings of \$1592.00 per patient. A limitation of this study was the lack of “real” data and the definitions of costs.

Summary of Findings

In the past 30 years, the treatment of patients with chest pain has transitioned from a focus on acute myocardial infarction in the larger context of a chest pain “center” to the treatment of low risk chest pain patients in the context of a chest pain observation unit (Bahr, 2000, Amsterdam et al., 2010, Peacock & Cannon, 2009). The development of chest pain units internationally has resulted in demonstrated improvements to selected outcomes. Chest pain unit care is really more about a “process” of care, rather than a discreet physical location (Goodacre,

2000). Chest pain observation units have been shown to be equally safe when compared to routine inpatient care (Arnold, et al., 2007, Goodacre, 2000, Goodacre, et. al., 2004).

Observation services can be provided on inpatient units (Contos, 2011). As many organizations are beginning to utilize observation services in order to optimize efficiencies and maximize reimbursements, low risk chest pain patients are now being placed on these types of units (Hess & Nestle, 2012). There is considerable variation in the use of observation services across the country (Ross, Hockenberry, et al., 2012). In the most current survey of practice patterns associated with the care of low risk chest pain patients, leadership in the 64% of the hospitals which responded indicated that they had an evaluation protocol in place and 38% reported a designated area for the evaluation of patients which illustrates that these findings are relevant to clinical practice (Diercks & Panacek, 2010).

Based upon the review of the literature there is sufficient evidence to support the conclusion that chest pain units provide safe care to low risk chest pain patients while improving selected outcomes. These include: reductions in inappropriate admissions, reductions in overall length of stay, increases in patient satisfaction and reductions in costs (Beck, et al., 2007, Goodacre, et al., 2007, Jamingas & Partridge, 2005, Jibrin, et al., 2008, Johnson, et al., 2008, Macintosh, et al., 2010, Shah et. al., 2012, Winchester, et al., 2012).

Implications for the present project

The analysis of research reveals that patient, provider and organizational outcomes associated with the care of low risk chest pain patients improve following the development and implementation of chest pain units when compared with routine care either provided in the emergency department or on inpatient units.

Section III: Methods

Research Design

Using a quasi-experimental design, this evaluation was structured to determine if there were any statistically significant differences ($p < .05$) in outcomes between the chest pain unit patients and the routine care patients on five variables. SPSS ® Version 22 was used for all statistical analyses. Effect size was also calculated for each of the variables of interest.

Purpose

The purpose of this evaluation is to determine the impact of a designated chest pain unit on patient, provider and organizational outcomes.

Questions:

Patient: Is there a difference in patient satisfaction between those patients treated in a chest pain unit and those patients receiving routine care?

Provider: Is there a difference in the technical proficiency of the providers in a chest pain unit as measured by troponin testing intervals when compared to providers conducting troponin testing on an inpatient unit?

Organizational: Is there a difference in the overall length of stay for patients treated in a chest pain unit as compared to patients receiving routine care?

Is there a difference in the total amount of payment received from an insurance company by the organization for an episode of low risk chest

pain for patients treated in a chest pain unit as compared to the inpatient context?

Is there a difference in the 30 day readmission rates for patients treated in a chest pain unit as compared to patients treated on an inpatient unit?

Definition of Terms

Patient-focused Outcomes: Diagnosis focused measures related to physical condition and holistically-focused measures related to a person's response

Patient Satisfaction: An overall patient satisfaction score is currently being collected on an aggregate level for each nursing unit. Data is collected by an independent contractor and a score indicating the overall levels of satisfaction on a five point Likert scale on a variety of indicators is collated and reported to the organization. Patient Satisfaction variables are outlined in Appendix A.

Provider-Focused Outcomes: Measures of Provider Proficiency and use of services

Technical Proficiency: Measures of technical proficiency as evidenced by troponin testing interval times. The interval between the first troponin collection time and the second troponin collection time will be measured and is expected to be 360 minutes (6 hours).

Organizational Outcomes: Measures which provide evidence of an organization's effectiveness

Length of Stay: Overall patient length of stay is defined as the time of arrival to the Emergency Department to the time of discharge (Society of Cardiovascular Patient Care Accreditation Manual Definition 5.2.2.0)

Reimbursement: Patient reimbursement will be defined as the total amount of payment received from an insurance company by the organization for an episode of low risk chest pain. This will include the insurance payment only.

Readmissions: Readmissions will be defined as any admission for a chest pain related diagnosis with 30 days of the initial low risk chest pain observation visit. Patients admitted during the evaluation process will not be considered readmissions. Rates are expected to be less than .2% (Peacock & Cannon, 2009).

Setting

The setting for this evaluation was a 238 bed rural community hospital in the Mid-Atlantic region. In this evaluation, patient, provider and organizational outcomes for those patients receiving care for low risk chest pain in a newly established five bed CPU were compared to the same outcomes for patients receiving in the RCU.

Sample

The patients in this evaluation were a convenience sample of low risk chest pain patients treated either in the RCU or in the new CPU. Inclusion criteria were: low risk chest pain, defined as a Thrombolysis in Myocardial (TIMI) score of zero or one, two troponin tests and stable vital signs. Patients included in the evaluation also had to have public, private, employer-sponsored medical insurance, or self-insurance. Patient determined to have TIMI scores of greater than one or who did not have insurance were excluded.

All low risk chest pain patients treated in each area who met the inclusion criteria had an equal chance of being selected. Patient selection was accomplished through the use of a random numbers table to reduce sampling error (Burns & Grove, 2005, Burns & Grove, 2007).

Measures

A power analysis revealed that a sample of not less than 30 patients treated in the CPU and 30 patients in the RCU would yield the recommended power (80%) for measuring the differences between these groups using independent *t*-testing (VanVoorhis & Morgan, 2007, Norman & Streiner, 2003).

Procedures

Patients presenting to the organization's Emergency Department were triaged following organizational policy. Patients determined to have low risk chest pain (0 or 1) and stable vital signs were eligible for care in the CPU. Patients who were determined to have low risk chest pain as defined above were also eligible for placement on the RCU.

A calculation was done to determine the inpatient unit with the highest number of low risk chest pain patients during the evaluation timeframe. An 18 bed medical surgical unit providing telemetry services, was determined to have the highest volume of low risk chest pain patients and was therefore designated the RCU. Patients were selected from this unit for the comparison group. It should be noted that the cohort of nurses working on the RCU were also the nurses who worked in the CPU. This shared workforce was thought optimal, as it reduced the possibility of nursing practice variations between the two locations.

It was determined that between March 12 and June 12, 2013 a total of 102 patients were discharged from the CPU with a diagnosis of low risk chest pain. Patients had a discharge diagnosis of low risk chest pain: ICD 9 Code 786.5 which includes 786.50, NOS (Chest Pain, Not Otherwise Specified) and 786.59, NEC (Chest Pain Not Elsewhere Classified). Using these same codes, it was also determined that a total of 149 patients were discharged from the RCU

during this time frame. All of the patients in each group were also classified by the study hospital upon discharge as outpatients receiving observation services.

Records for patients who received care in the CPU were selected by the study hospital's data analyst using the random numbers table. Thirty records were selected. All 30 patient records were manually reviewed for inclusion and exclusion criteria. All patients had a TIMI score of either zero or one, no less than two troponin tests, their total length of stay documented, with documented insurance coverage and payments. Following review, three patients in the initial sample were excluded. Three additional patients were then selected and reviewed and met all of the inclusion and exclusion criteria.

Records for patients who received care in the RCU and discharged during the study timeframe were initially screened to determine the TIMI for each patient. Unlike the patients in the CPU, a TIMI score of zero to one was not a criterion for admission to the RCU so TIMI scores were calculated retrospectively using admission documentation. Following this review, a total of 54 patients were found to have a TIMI score of zero or one. From this group of 54 patients, 30 patients were randomly selected. All the records selected were then also manually reviewed for all inclusion and exclusion criteria. All patients had a TIMI score of zero or one, no less than two troponin tests, documented total length of stay and with documented insurance coverage and payments.

Demographic information was obtained and included the patient's age in years, identified gender (male or female), the patient's race and the type of medical insurance as described in the hospital's electronic medical record. Collection and reporting times associated with blood samples used for troponin testing for each patient were documented in the electronic medical

record. The time stamp data associated with the initial troponin collection time was collected and the timestamp of the second troponin collection was also obtained. The interval between the two collection times was defined by the total number of minutes between each lab draw. If the patient's record did not contain two testing times the patient was excluded from the analysis.

The patients' length of stay was calculated using the recorded time of arrival to the Emergency Department and the recorded time of patient discharge and was captured as the total number of hours. If the patient's arrival time in the Emergency Department was not accurately documented, the patient was excluded from the analysis. Additionally, if patients were determined to meet inpatient criteria during the episode of low chest pain they were excluded from the analysis.

Reimbursement was documented in patient's financial record following adjudication from the insurance company. Data on amounts billed, co-payments from the patients and adjustments to payments were available for review although not included in this evaluation. Denials of payment were recorded as a zero payment. Patients who did not have insurance were excluded.

Readmission data were also collected from the each patient's medical record. The patient's subsequent medical record, following the initial visit for low risk chest pain, was reviewed to determine if there were any admissions within 30 days for either inpatient services or observation services.

Patient satisfaction data were collected using Avatar®, the organization's current patient satisfaction assessment agency. The survey questions target different aspects of the patient care experience and the scores of satisfaction help leadership develop action plans for improvement. A sample of the patient survey questions is found in Appendix B. Surveys were sent to all

patients discharged from both the CPU and the RCU. Unfortunately, patient satisfaction data collected from the patients on the RCU were not exclusive to low risk chest pain patients. Thus, although the patient satisfaction data from the CPU were evaluated, the patient satisfaction data from the two units could not be compared.

Data were collected from the electronic medical record system and the Avatar® database. Financial data were derived from the organization's Heart and Vascular Database. All data elements were manually reviewed for accuracy, completeness and compliance with the inclusion and exclusion criteria. Incomplete or inaccurate records were excluded.

Protection of Human Subjects

Low risk chest pain patients had historically been treated safely in the study hospital. Organizational performance with regard to patient care outcomes for acute coronary syndrome (which include the evaluation of all patients with chest pain) met or exceeded national benchmarks before and during the evaluation timeframe. As noted in the review of the literature, prior studies have demonstrated that patients who receive care in chest pain units do not appear to be at any higher risk for worse clinical outcomes than those patients receiving routine care. There were no other known ethical issues associated with patient participation in this evaluation (Lynn, et al., 2007).

All of the organization's Emergency Department patients presenting with chest pain during the study timeframe were triaged using the same national criteria for chest pain evaluation and treatment and all chest pain patients continued to receive care based upon clinical criteria, not random selection or assignment to a treatment group (ACC/AHA, 2007).

The data collected for this evaluation were intended to illustrate performance improvement following the implementation of the CPU and to complement the data collection process required for national accreditation by the Society of Cardiovascular Patient Care (Society of Cardiovascular Patient Care, 2012). All patient information was collected by employees of the organization and protected under the Health Care Insurance Portability and Affordability Act (HIPPA). Patient confidentiality was preserved throughout the evaluation process.

This evaluation was approved by the study hospital's Investigational Review Board in March 2013. It was concurrently approved by the University of Virginia's Institutional Review Board for Health Sciences Research in March 2013 (see Appendix B).

Data Analysis

Patient demographics were obtained for each patient in the respective samples and compared within each group to determine homogeneity. Comparisons of homogeneity were also conducted between the groups using an independent *t*-test for the age variable and Chi-square for the nominal variables of gender, race and type of insurance.

Patient satisfaction scores were provided by an independent contractor, Avatar® and reviewed at the aggregate level. In the absence of a comparison group, only the CPU patient satisfaction data was reviewed. The troponin testing intervals were collected for each patient and confidence intervals created for each group. Normality testing was assessed by the Shapiro-Wilk test. A comparison of the groups was done using the Mann-Whitney U non-parametric test.

The total number of hours for each patient's length of stay was collected and confidence intervals created for each group. Normality testing was assessed by the Shapiro-Wilk test. A comparison of the groups was done using the Mann-Whitney U non-parametric test. The financial

reimbursement data were collected for all patients in each group and found to be normally distributed. An independent t test was done to compare the groups for statistical significance.

Readmission data were reviewed using the total number of readmissions for each group and compared between groups.

Given the small size of the samples compared, effect size (ESs) was also calculated for each of the variables to determine the suggested strength of the relationship of each of the variables to treatment location (Durlak, 2009).

Strengths and Weaknesses of the Design

Although larger randomized controlled trials have established statistically significant differences in outcomes following the implementation of chest pain units, the goal of this evaluation was to determine if there were *any* changes in outcomes. The findings from this evaluation speak to both documented performance improvement and differences between the two groups (Norman & Steiner, 2003).

Nursing Practice Implications

The development, implementation and evaluation of the CPU presented a unique opportunity to integrate the *Essentials of the Doctorate of Nursing Practice Degree* into both a practicum experience and the development of this Capstone (AACN, 2006).

During the practicum experience, knowledge of the *scientific underpinnings for clinical practice* was utilized to determine the most appropriate risk stratification system, treatment algorithm and nursing interventions required for patients with low risk chest pain. In 2012, preliminary *analysis of organizational data* revealed that current evidence-based guidelines had not been implemented for patients with low risk pain and a review of the literature revealed that

an alternative care process could be established within the organization that would *improve health outcomes, ensure patient safety and enhance organizational efficiencies.*

A taskforce was created and facilitated by nursing leadership which included key leaders across several disciplines. *Interprofessional collaboration* was essential to the development and implementation of the CPU and the team included physicians, nurses, registration staff, billing staff, members of the information technology team and the Emergency Medical System (EMS) leadership. A review of the *health care policy* changes associated with the Affordable Care Act was required throughout the implementation of the CPU in order to maximize appropriate patient placement and reimbursement. Referrals of CPU patients to the HeartCheck® program were consistent with *clinical prevention and population health activities*. A health “coach” provided education on lifestyle modifications intended to reduce smoking, obesity and other cardiac risk factors intended to improve patient and population health. *Information technology* was utilized to collect data for the initial evaluation of the CPU, with ongoing evaluations planned by nursing leadership as a part of the quality improvement activities of the organization. (AACN, 2006).

Products of the Capstone

The findings of this initial evaluation were presented to the staff of the CPU, the organization’s Senior Leadership Team and the Heart and Vascular (physician leadership) Council in October 2013 in the context of ongoing performance improvement.

Section IV: Results

Demographics

Patient demographics were obtained for each patient from the respective groups. The aggregated patient population (N=60) had an average age of 56.6 years, was predominately white (93.3%) and female (56.7%) with Blue Cross insurance (40%). The two locations (CPU and RCU) were compared for homogeneity using an independent *t* test for patient age and Chi-square for the nominal variables: gender, race and insurance. The two groups were comparable for gender ($p=.50$), race ($p=.50$) and insurance type ($p=.335$). However, the assumption of homogeneity was violated for patient age as assessed by Levene's Test ($p=.055$) with a statistically significant difference noted ($p=.018$). The patients in the CPU had a mean age of 52.3 (± 11) years of age as compared with the patients in the RCU whose mean age was 60.9 (± 16) years of age (see Table 2).

Patient Satisfaction

An aggregated score was created by Avatar ® for overall patient satisfaction with care based upon the location of discharge. A total of 13 patient satisfaction surveys were collected from patients discharged from the CPU and contained no identifying patient information.

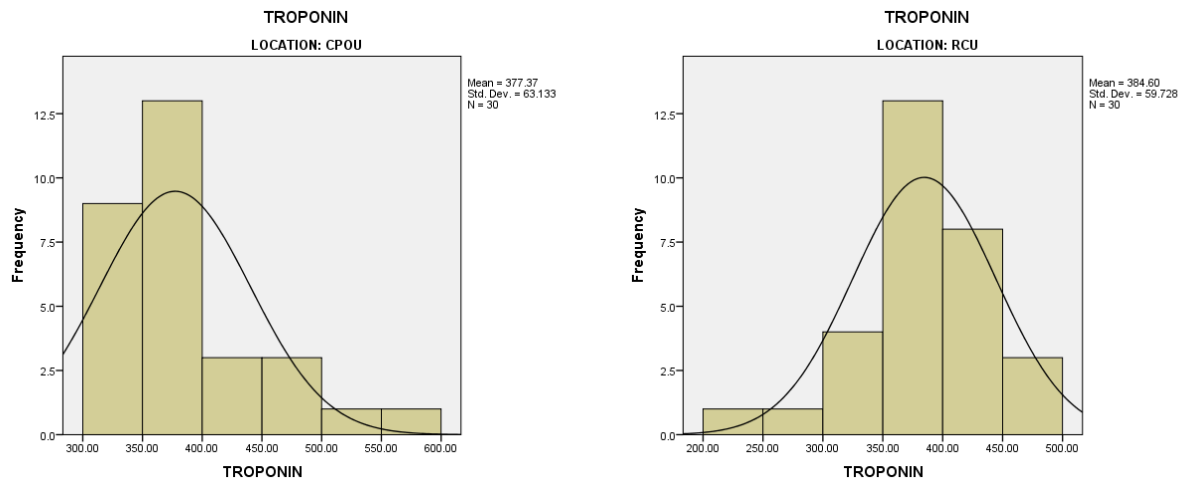
Although aggregated data was provided for the RCU, it could not be compared directly to the CPU patient satisfaction data. The RCU surveys were sent to all patients discharged from the RCU which included patients not seen for low risk chest pain, making a direct comparison invalid. CPU patient satisfaction scores were evaluated in the context of the CPU exclusively.

Second Troponin Time

Data on the second troponin time were collected and compared to the initial collection time for troponin testing within and across units. The mean time for the CPU was 377 minutes

while the mean time for the RCU was 384 minutes. These comparisons serve as the proxy for determining differences in provider technical proficiency between the chest pain unit and routine care. The troponin testing time intervals were normally distributed for patients in the RCU but were found to be positively skewed for patients in the CPU as assessed by the Shapiro-Wilk test.

Figure 3: Troponin Testing Intervals in the CPU and the RCU

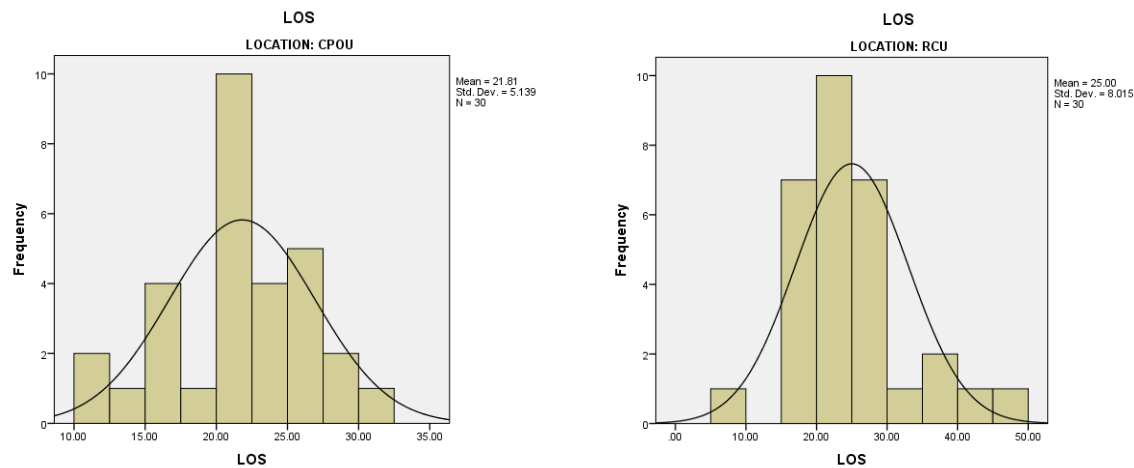


A comparison of the groups using the Mann-Whitney U non-parametric test revealed a trend toward significance ($p=.06$) in troponin testing time intervals between the groups but was not statistically significant with a small effect size of 0.195 (see Table 3).

Length of Stay

The length of stay was measured in hours between the time of arrival at the Emergency Department and the time of patient discharge. These mean times were compared within groups and across the groups. This comparison serves as a proxy for determining differences in organizational efficiency between care processes in the CPU (21 hours) and RCU(25 hours). The length of stay data were found to be normally distributed in the CPU but negatively skewed in the RCU as assessed by the Shapiro-Wilk test.

Figure 4: Length of Stay measured in hours in the CPU and the RCU



As noted above, there was a reduction in the length of stay by an average of four hours for patients in the CPU. A comparison of the groups was then conducted using the Mann-Whitney U non-parametric test which found no statistically significant differences between the groups for length of stay ($p=.09$) with a small effect size of 0.172 (Table 3).

Financial Reimbursement

Financial reimbursement was measured by the amount of payment received for each episode of low risk chest pain from an insurance company. Patient co-payments were not included. Confidence intervals for each group were created and payments compared across the groups to determine if there was any statistically significant difference between the groups using an independent t test. This comparison serves as a proxy for organizational effectiveness in the proper patient placement as evidenced by approval and reimbursement by third party payers.

There was homogeneity of variances for payments for the CPU and the RCU using the Levene's Test ($p=.191$). The average payment for the patients in the CPU was \$3787.33 and

\$3403.92 for the patients on the RCU. There was no statistically significant difference ($p=.455$) between the groups for payment amounts with only a small effect size of 0.194 (see Table 3).

Readmissions

Readmissions were measured using the total number of admissions within 30 days of the identified discharge date from the either CPU or the RCU. Although patients in this evaluation were seen for subsequent outpatient services and testing, no patients from either group were admitted to the hospital as either an inpatient or an observation patient within the thirty days following their initial evaluation for low risk chest pain (see Table 3).

Section V: Discussion

The purpose of this evaluation is to determine the impact of a designated chest pain unit on patient, provider and organizational outcomes .Given that practitioners were not mandated to use the same evaluation criteria or the same order sets for patients with low risk chest pain, it was anticipated that practitioner differences in the provision of care would increase variability and therefore reduce the measurable effects of patient placement in the CPU (Stomel, Grant & Eagle, 1999). Concurrently the relatively small sample size increased the likelihood of finding no statistically significant difference in the groups (Burns & Grove, 2007).

The demographic information collected for this evaluation is reflective of the community served and of the patients treated in the facility for the past year. In the past year, the average age of all patients was 52.4, 60% of the patients treated were female, 88% per white and 27.3% had Blue Cross insurance (C. Fox, personal communication, October 4, 2013). These characteristics are similar to the characteristics of the entire group of patients analyzed in this evaluation (see Table 2). As noted above, the average age for patients in the CPU was younger (52.3) than both the average age of the total group (56.6) and the RCU (60.9). This difference in patient age across the locations may have been a function of either the evaluation tool used to determine patient risk for myocardial infarction (TIMI) or as the result of provider concerns about increasing patient comorbidities with advancing age.

The TIMI scoring system has patient age as an element used to risk stratify patients (Shah et al., 2012). Patients automatically receive one point on the scale when they are greater than 65 years of age. As patients with a TIMI score greater than 1 were not eligible for placement in the CPU, physicians may have had no other choice than to place older patients in the RCU. Further

analysis correlating the TIMI score with patient age ranges would have been helpful.

Additionally, had the admission criteria for the CPU included a TIMI score of zero to two (0-2), a greater number of older patients (>65 years of age) may have been admitted this unit (Shah, et al., 2012).

Perceived risk of adverse events related to age may have also played a role in the provider's decision to place patients on the "new" CPU unit versus the RCU unit (Purim-Shem-Tov, et al., 2007). Although the same cohort of nurses practiced in both the CPU and the RCU, the CPU represented a new physical location for patient placement which was apart from the inpatient units. Providers may have perceived that younger patients were at lower risk for adverse outcomes. This may have made the providers more willing to place the younger patients in the new CPU (Schriger & Newman, 2012).

Provider interviews related to their decisions for placement (CPU versus RCU) would provide insight into this issue. Given the smaller variance in patient ages (± 11 years in the CPU versus ± 16 years in the RCU), a certain age range or age demographic may have influenced patient placement. This same pattern of placement for younger patients with lower risks in the CPU was also found in the literature (Arnold, et al., 2007).

Troponin testing times are currently one of the key elements measured by the Society of Cardiovascular Patient Care (SCPC) accreditation process (SCPC, 2012). Testing times are expected to comply with the quality metrics for troponin testing as outlined by The National Academy of Clinical Biochemistry, Laboratory Medicine Practice Guidelines (SCPC, 2012). The study organization currently utilizes a troponin blood test which is drawn every 6 hours (360 minutes) and is analyzed in the main laboratory.

It was anticipated that patient placement in the CPU would result in a significant improvement in provider proficiency with regard to the time interval between the first and second troponin test. Given the prevalence of chest pain patients historically on the RCU, this issue had previously been researched and the RCU nurses engaged in the development of process improvements. Prior discussions with nursing staff revealed that the “distractions” associated with inpatient care often resulted in delays in phlebotomy. Nursing staff recommended the assignment of a single patient cohort (low risk chest pain) in order to allow them to “focus” and therefore improve the testing interval. This recommendation was made prior to the creation of the CPU.

It should be noted that modest improvements did occur, with the average interval between tests decreasing on average by seven minutes in the CPU (377 minutes) versus the RCU (384 minutes). Additionally, a visual inspection of the time intervals in the CPU also revealed a positively skewed distribution, indicating a tendency toward a reduced time interval. However, the differences in collection times in this evaluation were not statistically significant ($p=.06$). Analysis on a larger sample from both locations should be conducted and might reveal a significant difference. Nurses in the CPU could also be interviewed to determine the barriers to compliance with the six hour recommended interval (Macintosh, et al., 2010).

Although it was expected that the interval would improve for patients in the CPU, nurses have previously reported that the volume of care responsibilities associated with a single provider (RN) in the CPU sometimes felt “overwhelming” (C. Bowman, personal communication, April 16, 2013). Unlike the RCU, patient care technicians were not routinely available to assist with phlebotomy in the CPU which may further explain the lack of significant improvement.

An overall decrease in the length of stay for patients treated in chest pain units has been noted in several larger studies (Beck, et al., 2007, Jibrin et al., 2008, Shah et al., 2012). These decreases can result in significant costs savings for an organization, provided that clinical outcomes are comparable (Shah et al., 2012). Patients in this evaluation did experience, on average, a reduction in length of stay of approximately four hours (see Table 3). The length of stay was also found to be negatively skewed in the RCU, indicating, on visual inspection, that a majority of the RCU patients were on the unit for greater than 20 hours. The differences in length of stay between the two groups ($p=.09$) was not statistically significant.

Although the CPU is in closer proximity to the Emergency Department and to the non-invasive stress testing department, it is located “away” from the inpatient units. It was noted during the evaluation that a majority of the patients placed in both the CPU and the RCU were attended to by hospital employed providers. Based upon observations made by the nurses in the CPU, these practitioners spent the majority of their time on the inpatient units. It was reported to nursing leadership that several of the physicians expressed concerns about the location of the CPU, citing its distance from the inpatient units as a “burden” and “a long way away” from where they provided care. Nurses in the CPU perceived that their patients were often “seen last” (M. Daisy, personal communication, April 16, 2013). These observations may explain the minimal reduction in overall length of stay for CPU patients.

Many of the chest pain units that have seen significant reductions in length of stay have noted that dedicated resources allowed for improved efficiencies (Beck, Musial & Barrett, 2007). The study organization may need to further investigate the employment of a licensed independent practitioner in the CPU to maximize organizational efficiencies. Additional evaluation must also be conducted to determine if the time of day or day of the week resulted in

delays in discharge. Concurrently, the availability of testing may have led to unanticipated increases in length of stay (Jibrin et al., 2008).

Insurance reimbursements were evaluated to determine if there were improvements in payments for patients seen in the CPU versus RCU. Increased payments were anticipated as the result of proper patient placement (observation status) and changes to the billing processes associated with the CPU. Although insurance coverage was not a requirement for placement in either the CPU or the RCU, the uninsured patients were excluded from this evaluation because of the variability associated with payments by patients. Many patients who do not have insurance often elect not to pay for the services provided or to negotiate a discounted rate for their services. The anticipated variations in patient payment in the absence of insurance may have also confounded the findings of this evaluation as insurance payments were being used to assess organizational effectiveness.

The average reimbursement for patients in the CPU was \$383.00 more than the RCU, but this difference may merely be a reflection of the distribution of payers in the two locations and the allowed amounts reimbursed for each insurance plan. Although the total number and types of payers were normally distributed across both units, a higher percentage of patients in the CPU had Blue Cross and Tri-Care insurance (46.7%) as compared to the RCU (40.0%). It was not surprising that Medicare insurance was the primary payer for the greatest percentage (36.7%) of patients in the RCU, given the differences in age distribution between the locations.

Subsequent analysis should compare the percentage of charges paid for each patient in the two groups. Anticipated changes in reimbursement in association with the Affordable Care Act may more substantially influence the payments received for all observation patients placed

on inpatient units in the future (M. Burris, personal communication, August 29, 2013). Future evaluation of reimbursement in the CPU versus the RCU should be considered as differences between the two may become significant in the future (Contos, 2011).

One of the outcomes historically used to evaluate the clinical effectiveness of new programs as compared to “routine care” is the number of readmissions with 30 days following the initial episode of care being studied (Goodacre, 2000; Goodacre, et al., 2004; Goodacre, et al., 2007; Jibrin et al., 2008; Winchester, et al., 2012)). Medical records for patients in the CPU and the RCU were reviewed to determine if any of the patients in either group were readmitted. Although some of the patients received subsequent outpatient services (lab testing, radiology services, cardiac rehabilitation services, etc.) from departments in the study organization, no patients were placed in the hospital again for either observation services or for an admission for either group.

During record review, that some of the patients did appear to have a higher rate of utilization of ancillary services following the initial episode of low risk chest pain. These patients appeared to also have multiple providers ordering tests. It would be very interesting to study the differences in patient experiences following an episode of chest pain to determine the optimal referral destination for patients as some studies have shown a reduction in service utilization rather than an increase after an episode of chest pain (Goodacre, et al., 2004).

Further research might review differences in service utilization between those patients discharged home and those seen in the study organization’s HeartCheck® program following discharge. This nurse-driven, comprehensive health screening program provides patients with information about their individual cardiac risk factors and utilizes health-coaching techniques to

enhance patient awareness (D. Grembi, personal communication, September 4, 2013). It would be interesting to see if this type of service improves patient outcomes as measured by the number and types of subsequent visits.

Patient satisfaction has been studied intermittently in chest pain units, with varied findings (Cross, How & Goodacre, 2007; Rydman, et al., 1997). Provider reimbursement under the Affordable Care Act will be directly tied to patient satisfaction, incenting providers and organizations to continually improve their patients' perceptions of the clinical experience (The Advisory Board, 2011). It was expected that by placing patients in a new location, outside of the normal noise and sometimes disquieting atmosphere of an inpatient unit, higher levels of patient satisfaction would occur. It was also anticipated that expedited care processes in the CPU would result in a reduction in patient complaints related to "waiting all day" for services.

The nurses assigned to work in the CPU had extensive cardiac experience and were perceived by leadership and their peers to provide patients with an optimal experience. Prior studies have shown that access to an experienced nurse improves patient satisfaction with chest pain care (Johnson & Goodacre, 2008, Rydman, et al.1997). Nurses in the CPU were focused on a single patient cohort, often with a reduced patient to nurse ratio. Daily leadership rounds were conducted during the first month of operation of the CPU (prior to the study timeframe) to determine if there were specific patient satisfaction concerns with the new unit. With the exception of concerns expressed about meals ("they are sometimes cold", "the sandwiches are dry"), the feedback received from the patients in the CPU was resoundingly positive ("this is great, I have my own nurse", "everyone here is so nice", "I am glad that I get to go home so soon", "I love it here").

As the Avatar ®patient satisfaction survey consisted of aggregated responses it was difficult to determine the specific reasons behind patient responses. It may be helpful in the future to directly survey individual patients in order to illustrate specific opportunities for improvement. The study organization's parent company uses a mailed out survey for chest pain unit patients which could be utilized in the future to provide specific feedback about the patient experience in CPU in order to target opportunities for performance improvement.

Limitations

The limitations of this evaluation include the use of a convenience sample found in a single hospital .These findings may therefore not be generalizable to other organizations. As physicians retained the option to place patients at their discretion and to practice using their own guidelines, practitioner differences in the provision of care may have increased variability, therefore reducing the measurable effects associated with the CPU. Concurrently, the relatively small sample size (30 patients in each population) increased the likelihood of finding no statistically significant difference in the groups (Burns & Grove, 2007). Finally, the aggregated patient satisfaction survey information could not be compared across departments.

Ongoing Evaluation

A larger sample of patients should be evaluated in the future to determine if there are in fact any statistically significant differences between the CPU and RCU. Additional conversation with physicians and nurse staff to determine barriers to the efficient use of the CPU would also be helpful. Concurrently, reimbursement as a percentage of charges needs to be evaluated to truly determine any differences in payment associated with the placement of outpatients receiving observation services on designated units. Patient satisfaction should be further evaluated with the use of individual patient surveys and patient interviews to determine ways in which

improvements can be made. Finally, cost studies should be conducted to determine if the implementation of this new program has resulted in cost savings to the study organization.

Implications for Administrative Nursing Practice:

The findings of this evaluation were shared with the nursing staff of the CPU. Staff members were engaged in making changes to some of the patient care processes (i.e.: the transport of patients to stress testing) in order to continue to improve the outcomes evaluated.

Ideally, findings from this evaluation should also be used to continue to engage physicians in the conversation regarding the consistent use of practice guidelines and the opportunities for improvement in patient through-put available through alternative patient placements such as the CPU (The Advisory Board, 2010). Unfortunately, the creation of chest pain units alone has not been found to historically change the management of chest pain patients (Stomel, et al., 1999). Interestingly, the adoption of management algorithms has had the greatest impact on physician practice variations with regard to the management of patients with chest pain (Amsterdam, et al., 2010).

Working in collaboration with senior physician leadership, nursing leadership should facilitate the use of a consistent risk stratification assessment tool for all patients with chest pain. This type of consistent stratification methodology is also recommended by the Society of Cardiovascular Patient Care. Given that the Thrombolysis in Myocardial Infarction (TIMI) is already well-researched and widely accepted, it would appear that a recommendation to the organization's Heart and Vascular Council for the adoption of this tool organization-wide would be a next step. Concurrently, the implementation of an enhanced order set for all low risk chest pain patients (with a TIMI score of zero to three) utilizing evidenced based practice guidelines

should be accomplished in order to continue to improve patient care. Finally in conjunction with the Medical Director of the CPU these changes should be discussed with the medical staff and implemented. Following implementation, further evaluations such as this one, could be conducted to determine any additional improvements in patient, provider and organizational outcomes.

Products

Details regarding the creation and implementation of the CPU as well as the findings of this evaluation will be summarized and submitted to *Journal of Nursing Administration* (see Appendix C and Appendix D).

Conclusion

While statistically significant findings ($p < .05$) in outcomes between the CPU and the RCU were not identified in this evaluation, there are several implications for nursing practice as the result of the findings. It is clear, through the trends found in troponin testing and the overall length of stay, that improved efficiencies are beginning to be realized as the result of the implementation of this new program. The findings of this evaluation have been shared with the CPU nursing staff and some barriers to efficiency have been identified. Ongoing evaluation and continued changes should be made in the CPU by nursing leadership in order to improve patient outcomes.

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Table 1**Literature Review Summary**

Study 1	Subjects and Setting	Design	Intervention	Outcomes	Study Critique
Arnold, J. Goodacre, S. & Morris, F. (2007). Structure, process and outcomes of chest pain units established in the ESCAPE trial, <i>Emergency Medicine Journal</i> , 24, 462-466.	<p>14 hospitals in the United Kingdom agreed to participate in the ESCAPE trial</p> <p>7 hospitals were randomly selected and agreed to establish Chest Pain Units between November 2004 and June 2005</p> <p>7 hospitals did not set up Chest Pain Units and continued to provide “usual care”</p> <p>All findings reported were from the 7 hospitals with established Chest Pain Units</p> <p>Not a true comparison to usual care</p>	Descriptive study outlining the structure, process and outcomes associated with CPU implementation	Chest Pain Unit created using the ESCAPE standardized protocols	<p>Stated Outcomes: Proportion of patients discharged who experienced an adverse event within 30 days</p> <p>Findings: Varied from 0% to 3% No statistical significance was reported</p> <p>This did not vary substantially between hospitals with a range of 79% to 89%</p> <p>Other variables reported by unit:</p> <ul style="list-style-type: none"> • Staffing structure • Patient characteristics • Types of blood tests performed • Exercise Treadmill test provided <p>No analysis was conducted to determine any statistically significant differences between units</p>	<p>Variation in numbers of patients across sites was discussed but the impact was not evaluated</p> <p>Structure differences were reported but not compared to outcomes</p> <p>Patient characteristics were not evaluated in the context of the stated outcomes of interest</p> <p>Process differences in the types of blood tests and types of exercise testing used across locations were not discussed in the context of the stated outcomes of interest</p> <p>Critique: This could have been a more robust study if the data collected had been analyzed statistically to determine if there were differences across hospitals with varying structures and processes</p>

Study 2	Subjects and Setting	Design	Intervention	Outcomes	Study Critique
<p>Beck, L., Musial, F., Barrett, C. (2007). Using ED Observation Units to Decrease Lengths of Stay in Chest Pain Patients, <i>Advanced Emergency Nursing Journal</i>, 29(2): 140-144.</p>	<p>Randomly collected sample of patients 18 yrs., presented to ED with chest pain, determined to be low risk</p> <p>120 charts randomly selected by the Medical Records Department</p> <p>$n=46$ in 2000 (INPT) $n=46$ in 2003 (EDOBS)</p> <p>Large suburban medical center in Michigan</p>	<p>Retrospective Chart Review</p> <p>Pre and post EDOBS unit implementation</p> <p>Confidence intervals Independent t-test Levene's test for inequality of variances</p>	<p>Patient care provided to patients with unspecified chest pain a newly created Emergency Department Observation Unit (EDOBS)</p>	<p>Statistically significant differences ($p < .001$) in:</p> <ol style="list-style-type: none"> 1) ED registration time to unit 2) Overall length of stay <p>EDOBS: ED Registration: 3.5 hrs Time to discharge 16 hrs</p> <p>INPT: ED Registration: 6.4 hrs Time to discharge: 80 hrs</p>	<p>Random sample from one institution</p> <p>Data dependent on the accuracy of medical record documentation</p> <p>No information on clinical outcomes reported</p> <p>Findings: There appears to be a statistically significant reduction in length of stay for patients with low risk chest pain following the implementation of an EDOBS unit as compared with the care provided before implementation.</p>

Study 3	Subjects and Setting	Design	Intervention	Outcomes	Study Critique
<p>Goodacre, S. (2000). Should we establish chest pain observation units in the UK? A systematic review and critical appraisal of the literature, <i>Journal of Accident and Emergency Medicine</i>, 17, 1-6.</p>	<p>Computerized search of Medline for all articles comparing chest pain observation unit (CPOU) care to routine patient care: Five studies met the inclusion criteria for review</p> <p>Descriptive studies for patients who received CPOU care: Six studies met the inclusion criteria</p> <p>All eleven studies included some type of patient follow-up to assess rates of “missed acute myocardial infarction”</p> <p>Studies that compared the costs of CPOU care to usual care: 9 studies met the inclusion criteria</p>	<p>Systematic review of the literature</p> <p>No timeframe stated</p>	<p>Care provided in a Chest Pain Observation Unit as compared to usual care</p> <p>Descriptions of outcomes associated with chest pain observation unit care</p>	<p>No differences in the demographics of patients</p> <p>No significant differences in clinical outcomes (mortality, missed AMI, complications, 30 day re-attendance)</p> <p>One study showed improved patient satisfaction, all showed standard discharge rates of approximately 80%, all other comparable variables had similar findings</p> <p>Cost savings were less impressive in non-randomized studies</p> <p>Hospital costs captured, outpatient costs not always reflected accurately, variations in LOS may more accurately reflect cost differences</p> <p>Patients seen in CPOU who would normally be discharged from the Emergency Department might skew cost data</p>	<p>Author cited limitations: Concerns with inclusion bias, physician bias related to patient placement</p> <p>Only hospital costs used</p> <p>Critique:</p> <p>No timeframe stated, left to assume all studies prior to 1999 were reviewed</p> <p>Variations in sample size and facility type not discussed ($n=32$ to $n=6005$)</p> <p>Variations in CPOU protocols across sites may have account for variations in findings (only ST segment monitoring mentioned)</p> <p>No nursing or economics literature reviewed</p>

Study 4	Subjects and Setting	Design	Intervention	Outcomes	Study Critique
<p>Goodacre, S., Nicholl, J., Dixon, S. Cross, E., Angelini, K. Arnold, J. Reville, S., Locker, T., Capewell, S., Quinney, D. Campbell, S. & Morris, F. (2004). Randomized controlled trial and economic evaluation of a chest pain unit compared with routine care, <i>BMJ</i>. doi:10.1136/bmj.37956.664236.EE</p>	<p>972 patients with acute, undifferentiated chest pain</p> <p>Chest pain observation unit patients: $n=479$</p> <p>Routine care patients: $n=493$</p> <p>Emergency Department at the Northern General Hospital, Sheffield, United Kingdom</p>	<p>Cluster randomized controlled trial</p> <p>Used a block randomization schedule to assign patients to the CPOU between 5 Feb 2001 and 5 May 2002.</p> <p>Comparison group received care in Emergency Department or in hospital</p>	<p>Care delivered in either the CPOU as compared to care provided in the Emergency Department with admission to the hospital</p> <p>All patients received assessment, EKG, chest Xray, measurement of biochemical cardiac markers and when appropriate provocative cardiac testing</p>	<p>Findings:</p> <p>There was a statistically significant difference in hospitals admissions with routine care patients having higher rates ($p<.001$)</p> <p>There were no differences in inappropriate discharges</p> <p>There were no differences in adverse events over six months</p> <p>Health utility (self-reported health) was evaluated using ED-5 Q scores. CPOU patients rated quality higher at 48 hours and at one month than routine care patients ($p=0.023$, $p=0.008$)</p> <p>There were no statistically significant differences in the cost of care for the initial visits. Decreased utilization of services at six month period between the groups results in overall cost savings to the system</p>	<p>Author cited:</p> <p>Patient characteristics varied between groups with the CPOU patients having a higher rate of smoking, higher rate of a normal EKG and higher rate of referral than the control group</p> <p>Author notes selection bias, patient bias to a “new” therapy may result in higher ratings of quality as rated on the EQ-5D questions</p> <p>Critique:</p> <p>Power analysis (0.80) conducted to determine sample size to provide $p<0.05$ added validity to the study</p> <p>There was no explanation of the ED-5Q score/questionnaire</p> <p>Findings appear to support lower admission rates, higher reports of health and reduced costs over 6 month for CPOU patients as compared to routine care</p>

Study 5	Subjects and Setting	Design	Intervention	Outcomes	Study Critique
<p>Goodacre, S., Cross, E. Lewis, C., Nicholl, J., & Capewell, S. (2007), Effectiveness and Safety of Chest Pain Assessment to prevent emergency admission: ESCAPE cluster randomized trial, <i>BMJ</i>, 335, 659-62.</p>	<p>14 hospitals in the United Kingdom agreed to participate in the ESCAPE trial</p> <p>7 hospitals were randomly selected and agreed to establish Chest Pain Units between November 2004 and June 2005</p> <p>7 hospitals did not set up Chest Pain Units and continued to provide “routine care”</p>	<p>Cluster randomized before and after intervention trial</p>	<p>Chest Pain Unit care</p>	<p>Proportion of patients presenting with chest pain Findings: weak evidence that proportion of chest pain patients presenting to the Emergency Department increased in the hospitals with CPOU ($p=0.008$) Pre and post implementation of the intervention. This was not consistent across all sites with a CPOU</p> <p>Proportion of Emergency Department visits for chest pain resulting in admissions Findings: no difference in control and intervention group</p> <p>Re-attendance and readmission within 30 days Findings: Chest Pain Unit care was associated with an increase in re-attendance ($p=0.04$) and a mean increase in all admissions ($p<0.001$)</p>	<p>Study findings conflict with previous studies showing a decrease in admissions and decrease in reattendance</p> <p>Author cited limitations: no follow-up done to determine differences in long term patient outcomes</p> <p>Protocol implementation varied by site</p> <p>Authors indicate that results may therefore not be conclusive</p> <p>Critique: Authored used large sample sizes in order to enhance validity</p> <p>Research team members help the 7 hospitals establish the CPOUs. May have introduced bias.</p> <p>Findings may have been downplayed as they did not support the author’s previous findings</p>

Study 6	Subject and Setting	Design	Intervention	Outcomes	Study Critique
Jagminas, L. & Partridge, R. (2005). A comparison of emergency department versus in-hospital chest pain observation units. <i>The American Journal of Emergency Medicine</i> , 23, 111-113. doi:10.1016/j.ajem.2004.03.009	<p>Emergency Department Observation Unit (EDOU) patients: $n=1190$ seen from November 1997 to March 1998 for chest pain</p> <p>Dedicated inpatient observation unit (IHOU) patients: $n=1404$ seen from May 1998 to September 1998 for chest pain</p> <p>University hospital with 75,000 annual ED visits</p>	Retrospective observational study	<p>Chest pain care</p> <p>Variables reported:</p> <p>Age Sex</p> <p>Percentage of patients admitted to each unit following an ED visit</p> <p>Rate of conversion to inpatient status</p> <p>Costs</p>	<p>Findings from the study revealed that:</p> <p>Groups had similar demographics</p> <p>36.9% of all chest pain patients admitted for observation during EDUO timeframe</p> <p>69.3% of all chest pain patients admitted for observation during IHOU timeframe</p> <p>($p<.001$)</p> <p>7.9% of the EDUO patients 19.2% of the IHOU patients</p> <p>($p<.001$)</p> <p>\$890.00 for EDUO patients \$1040.00 for IHOU patients</p>	<p>Patients were not classified by risk score, less higher risk patients may have been admitted to the EDUO than to the IHOU explaining both the variations in percentage of admissions and cost</p> <p>Patients seen in the EDUO were managed in a single location by the ED physicians which may have allowed for more effective processing and a reduction in overall length of stay</p> <p>Patients managed in the IHOU were not in the same location, patients were managed by non-ED physicians</p> <p>Study relied on proper documentation which was not validated</p> <p>Study concluded that EDUO were safe, more cost effective care</p> <p>Critique: Concurrent timeframe, with risk stratified patients would provide a better comparison</p>

Study 7	Subject and Setting	Design	Intervention	Outcomes	Study Critique
<p>Jibrin, I., Hamirani, Y. Mitikiri, N., Ozdegirmenci, H. Wentz, C. & Bahr, R. (2008). Maryland's First Inpatient Chest Pain Short Stay Unit as an alternative to Emergency Room-Based Observation Unit, <i>Critical Pathways in Cardiology</i>, 7(1), 35-42. Doi:10.1097/HPC.ob013e318163eb83</p>	<p>Consecutive patients presenting to the St. Agnes Emergency Department in Baltimore, Maryland between June 1, 2005 and November 30, 2005</p> <p>All patients stratified to be low risk and treated using the Chest Pain Short Stay Unit protocol in either the Emergency Department (ER) or the Chest Pain Short Stay Unit (CPSSU) which is a 4 bed unit adjacent to the Critical Care Unit</p> <p>ER patients: $n=130$</p> <p>CPSSU patients: $n=202$</p>	<p>Prospective observational study</p> <p>Treatment location was determined by the attending ER physician</p> <p>It should be noted that Maryland is the only state that does not use the Ambulatory Payment classification coding system</p> <p>Hospitals are not incented to use observation units</p>	<p>CPSSU Protocol for low risk chest pain used in both settings</p> <p>Variables measured: Sex Age Race Risks</p> <p>Outcomes: Length of stay</p> <p>Angiography</p> <p>Costs (Revenues)</p> <p>Outcomes reported 30 days post discharge: Recurrence of chest pain ER visits for chest pain Admissions Cardiac Interventions</p>	<p>Demographics comparable Higher percentage of patients with risks in the CPSSU than ER</p> <p>ER= 7 hours CPSSU= (6.5 ED) + 19.0 CPSSU= 25.8 hours</p> <p>21 patients, does not report how many from each group</p> <p>ER: \$979.00 (\$1204.00) CPSSU: \$1543.00 (\$2948.00)</p> <p>8% of all patients 3% of all patients 2% of all patients 1% of all patients</p> <p>Secondary finding related to time of patient presentation to ED and difference in length of stay due to unavailability of testing (9 hours versus 6 hours)</p>	<p>Author cited limitations: Small sample size, short study period, no power analysis, findings may not be applicable to tertiary care settings</p> <p>There may have been physician bias with patient placement</p> <p>This study demonstrated a model unique to the state Maryland that appears to provide care that is comparable to other observation settings and preserves the integrity of hospital revenues</p> <p>Authors note that additional studies in different hospitals would strengthen their findings</p> <p>Critique: Innovative care delivery model in state with observation disincentives</p> <p>Did reduce overall length of stay compared to admitted patients</p> <p>Subsequent studies could focus on comparing CPSSU to usual care</p>

Study 8	Subjects and Setting	Design	Intervention	Outcomes	Study Critique
<p>Johnson, M., Goodacre, S. Tod, A. & Read, S.(2008). Patient's opinions of acute chest pain care: a qualitative evaluation of Chest Pain Units, Emergency Medicine Journal, 27(10), 120-</p>	<p>26 patient interviews conducted in 2005-2006</p> <p>14 patients were interviewed from Chest Pain Observation Unit (CPOU) sites</p> <p>12 patients were from control sites</p> <p>Patient telephone interviews four weeks following care at the hospital in either the CPOU or the Emergency Department</p> <p>Interviews were conducted between Sept 2005 to June 2006 by the same female researcher</p> <p>Interviews lasted 30 to 70 minutes, were taped and transcribed verbatim</p>	<p>Interview data analyzed using the Framework method</p> <p>5 stages:</p> <p>Familiarization with the data</p> <p>Identification of thematic framework</p> <p>Indexing the data</p> <p>Developing charts</p> <p>Linking and interpreting the findings</p>	<p>Assess patient opinions of care delivered in either a CPOU or in a routine care setting</p>	<p>Care experiences with CPOU and routine care</p> <p>Findings:</p> <p>Experiences appeared to differ based upon site rather than intervention</p> <p>Overall high levels of satisfaction with care with nursing care</p> <p>Themes:</p> <p>Access to a specialist nurse improved satisfaction</p> <p>Patients were not satisfied with the information provided about their condition</p> <p>Patients discharged home without a definitive diagnosis were less satisfied with care</p>	<p>Indicated that 36 interviews were needed, only conducted 26 interviews</p> <p>Patients interviewed were self-selected, may have biased data to patients with more positive experiences</p> <p>Several patients in the control group had not yet undergone cardiac testing and therefore did not have a definitive diagnosis, may have affected opinions of care</p> <p>Critique:</p> <p>Structure and discharge process variations across sites may have resulted in differences in satisfaction rather than intervention being studied</p> <p>Inadequate sample size and patient self-selection may have resulted in skewed results</p> <p>Telephone interviews did not allow for anonymity, responses may have been to interviewer, not context</p>

Study 9	Subject and Setting	Design	Intervention	Outcomes	Study Critique
<p>Macintosh, M., Goodacre, S. & Carter, A., (2010). Organizational Influences on the activity of chest pain units during the ESCAPE trial: a case study, <i>Emergency Medicine Journal</i>, 27, 672-676, doi: 10.1136/emj.2009.073908</p>	<p>6 of the 7 hospitals which participated in the Effectiveness and Safety of Chest Pain Assessment to Prevent Emergency Admissions (ESCAPE) trial</p> <p>26 interviews Cardiologists (<i>n</i>=4) Emergency Consultants (<i>n</i>=6) Nurses (<i>n</i>=16)</p> <p>Lead RN at all 6 sites was interviewed</p> <p>CPOU staff only</p>	<p>Case study with each hospital site identified as a case</p>	<p>Implementation of the structure and processes associated with a Chest Pain Observation Unit developed during the ESCAPE trail</p> <p>Key themes identified:</p> <p>Inputs: Organizational readiness Team characteristics Role boundaries</p> <p>Process: Leadership</p> <p>Continuity of staffing</p> <p>Operational delivery</p> <p>Outputs: Impact on team members Role expansion and service development</p>	<p>Findings from the interviews:</p> <p>All agreed service was needed</p> <p>Existing relationships, attitudes towards change and nature of the existing service were salient Experience with change influenced implementation Team cohesion important Need to minimize</p> <p>Differences in decision making Changes led to inconsistent implementation Patient assignment, access to testing</p> <p>Added value Wider benefits to team members Opportunities to educate other staff</p>	<p>Interviewees were self-selected, may skew results, associated with a clinical trial</p> <p>Author noted that interviewer may have previously know some of those interviewed</p> <p>No other members of the organizations were interviewed such as administrators, other departments supporting the CPOU</p> <p>Limited timeframe, not a longitudinal study</p> <p>Changing staff did not allow for continuity of original staff for the interviews, may have missed some of the less positive issues associated with implementation</p>

Study 10	Subject and Setting	Design	Intervention	Outcomes	Study Critique
Shah, P., Gupta, N., Sharma, A., Bhargava, R., Bajaj, S., Mittal, V., Johnson, C., Shamoon, F., Bikkina, M. (2012). Chest Pain Unit using Thrombolysis in Myocardial Infarction Score Risk Stratification: An impact on the Length of Stay and Cost Savings, <i>Critical Pathways in Cardiology</i> , 11(4), 206-210.	<p>777 patient charts were reviewed from July 2010 to June 2011</p> <p>Patients were classified based upon the Thrombolysis in Myocardial Infarction score (TIMI)</p> <p>St. Joseph's Medical Regional Medical Center in Paterson, New Jersey</p> <p>651 academic tertiary care hospital</p>	<p>Retrospective chart review</p> <p>All low risk chest pain patients charts were reviewed</p> <p>Inclusion and exclusion criteria clearly stated</p>	<p>Hypothetical CPOU Model</p> <p>TIMI score determined protocol used</p> <p>Estimated length of stay, testing and cost were created and then compared to actual length of stay, testing and cost</p>	<p>Length of stay in days</p> <p>Findings: Average length of stay for model CPOU patients was significantly lower than the actual length of stay (.054 versus 1.7 days, $p<0.001$)</p> <p>Cost of care</p> <p>Findings: estimated savings of \$1592.00 per patient in the CPOU</p> <p>Total savings to the organization: \$1.2 million per year</p>	<p>First study to use the TIMI to risk stratify patients in order to estimate length of stay and costs</p> <p>Author notes that they did not know the long term outcomes for this patient population</p> <p>6 month readmissions were noted to low (1.6%) but the authors could not capture care outside of their system</p> <p>The only cost reported were for cost of care, not organizational costs (space, equipment, staffing)</p> <p>Would be eager to see a similar study conducted once an actual unit opened to see what the actual CPOU results would be compared to hypothetical results as well as compared to routine care</p>

Study 11	Subject and Setting	Design	Intervention	Outcomes	Study Critique
<p>Winchester, D. Stomp, D., Shifrin, R. & Jois, P. (2012). Design and Implementation of a Stand-alone Chest Pain Evaluation Center within an Academic Emergency Department, <i>Critical Pathways in Cardiology</i>, 11(3), 123-127</p>	<p>181 patients in a newly opened, standalone Chest Pain Evaluation Center</p> <p>First six weeks of operation in 2011, setting described as an academic medical center</p> <p>Chest Pain Evaluation Center was 8 private and semi-private beds in the Emergency Department</p> <p>All patient data included in the study</p>	<p>Pre and post intervention admission data review</p>	<p>Establishment of process for screening low-intermediate risk patients, placement of these patients in a separate unit for evaluation, testing and discharge</p>	<p>Rates of admissions for all chest pain patients during the same 6 week period in 2009, 2010 and post-intervention in 2011</p> <p>Findings: A statistically significant reduction in the proportion of admissions from 2010 to 2011 ($p < 0.001$)</p>	<p>Authors are assuming the distribution of low-intermediate risk patients was the same in all three time periods</p> <p>\</p> <p>They mentioned 30day follow-up but did not report any findings</p> <p>Unable to determine if outcomes were the same for the patients (re-attendance, readmission, mortality) after the intervention</p> <p>Reported statistically significant findings, however no design parameters were included (alpha, beta)</p> <p>These findings appear to be significant but would be more robust if outcomes were validated as being equal to care provided before the intervention</p>

Table 2**Summary of Patient Demographic Characteristics**

<i>Characteristics</i>	<i>Range</i>	<i>Mean</i>	<i>P</i>	
Age				
Group	24-88	56.6	<i>p</i> =.018*	
Chest Pain Unit	27-84	52.3		
Routine Care Unit	24-88	60.9		
<i>Characteristics</i>	<i>N</i>	<i>Percent</i>		
Gender				
Male	26	43.3%	<i>p</i> =.50	
Female	34	56.7%		
Chest Pain Unit				
Male	13	43.3%		
Female	17	56.7%		
Routine Care Unit				
Male	13	43.3%		
Female	17	56.7%		
Race				
White	56	93.3%		<i>p</i> =.50
Non-White	4	6.7%		
Chest Pain Unit				
White	28	93.3%		
Non-White	2	6.7%		
Routine Care Unit				
White	28	93.3%		
Non-white	2	6.7%		
Payer				
Medicare and Medicare HMO	18	30.0%	<i>p</i> =.335	
Medicaid and Medicaid HMO	6	10.0%		
Blue Cross and TriCare	24	40.0%		
All Commercial Insurance	12	20.0%		
Chest Pain Unit				
Medicare and Medicare HMO	7	23.3%		
Medicaid and Medicaid HMO	3	10.0%		
Blue Cross and TriCare	14	46.7%		
All Commercial Insurance	6	20.0%		
Routine Care Unit				
Medicare and Medicare HMO	11	36.7%		
Medicaid and Medicaid HMO	3	10.0%		
Blue Cross and TriCare	10	20.0%		
All Commercial Insurance	6	20.0%		

**p*<.05, two-tailed for Age, Independent T-test, for Nominal variables, Chi-Square

Table 3**Analysis of Troponin Time, Length of Stay, Insurance Payments and Readmissions***

<i>Variable</i>	<i>Mean</i>	<i>95% CI</i>	<i>P</i>	<i>ESs</i>
Troponin Testing time (minutes)				
Group	380	[365,397]	<i>p</i> =.06	0.194
Chest Pain Unit	377	[353,401]		
Routine Care Unit	384	[362,407]		
Length of Stay (hours)				
Group	23	[22,25]	<i>p</i> = .09	0.172
Chest Pain Unit	21	[20,24]		
Routine Care Unit	25	[22,27]		
Insurance Payments (dollars)				
Group	3595	[3087,4104]	<i>p</i> =.45	0.194
Chest Pain Unit	3787	[2984,4590]		
Routine Care Unit	3403	[2737,4070]		

**There were no readmissions within 30 days for either group*

Appendices

Appendix A: Patient Satisfaction Survey for Observation Patients

Admissions

- (31) The admission process was completed in a timely manner.
- (33) The admission process was efficient and easy.
- (36) The person who handled my admission was polite and professional.

Billing

- (34) Billing and payment procedures were explained clearly to me.
- (74) Billing and payments were handled properly.
- (597) The bill was easy to understand.

Environment

- (44) The hospital was very clean, including entrances and hallways.
- (45) My room was kept very clean.
- (46) Everything in my room worked properly (for example, the lights, bed, intercom).
- (48) The staff who cleaned my room were polite and professional.
- (50) My sleeping hours were disturbed only when necessary.
- (51) I felt safe in my room.
- (52) My room was quiet and restful.

Expectations

- (79) Before I came to RMH Healthcare, my expectations of the overall quality of the hospital were extremely high.
- (81) Before I came to RMH Healthcare, I expected the hospital to meet my personal needs extremely well.
- (83) Before I came to RMH Healthcare, I expected things not to go wrong at the hospital.

General Care

- (18) There was good teamwork among the doctors, nurses, therapists, and other staff who cared for me.
- (20) Tests and procedures were adequately explained to me before they were done.
- (21) My needs were handled promptly and efficiently by the hospital staff.
- (22) Hospital staff identified who they were when they cared for me.
- (23) I consistently received respect and compassion while at RMH Healthcare.
- (2869) I was educated about drug, food and herbal interactions, and what to eat or not eat while taking medicine.
- (2870) RMH Healthcare staff informed me of my rights as a patient in a manner that I could understand.
- (2871) RMH Healthcare staff informed me of my responsibilities as a patient.

General Reputation

- (75) This hospital has very high quality doctors.
- (76) This hospital has very high quality nursing staff.
- (77) This hospital has up-to-date medical equipment and facilities.
- (78) This hospital has a very complete line of medical services.

Getting Around

- (65) Trips to other areas in the hospital (for example, X-ray) were scheduled conveniently.
- (66) Signs inside and outside the hospital were easy to understand.
- (68) Parking was adequate.
- (593) Hospital staff were helpful with directions for getting around the hospital when asked.

Key Results

- (91) Overall, the care I received was worth the cost.
- (92) I would prefer to return to RMH Healthcare without hesitation, if care is needed.

- (594) Compared to other local or regional hospitals, RMH Healthcare provides the best care.
- (1906) I would recommend RMH Healthcare without hesitation to others.

Leaving the Hospital

- (70) Medications and care at home were explained to me in a way I could follow.
- (72) The person who handled my discharge was polite and professional.

Meals

- (53) When I felt well enough to eat, the flavor of the food was satisfactory.
- (54) My meals were delivered at the right temperature.
- (57) My meals were served at the right time each day.
- (59) The people serving my meals were polite and professional.

Nursing Care

- (10) The nursing staff were responsive in answering my calls or requests.
- (11) The nursing staff spent the right amount of time with me.
- (12) The nursing staff helped me to understand my health condition.
- (13) The nursing staff were sensitive to my needs as a patient.
- (14) I was given good explanations of my daily routine by the nursing staff.
- (16) The nursing staff identified who they were when caring for me.
- (2658) The nursing staff made me feel as comfortable as possible.
- (3956) The nursing staff anticipated my needs very well

Pain Management

- (2490) My request for pain control was responded to quickly by nursing staff.
- (2491) The medicine for my pain helped to take away the pain.
- (2492) I was satisfied with the way my doctor treated my pain.
- (2493) I was taught about the pain scale and how my pain would be managed.
- (2569) I was adequately prepared to manage my pain at home.

Patient Safety

- (3311) Staff checked my name before giving me medication.
- (3312) Staff washed their hands or used hand sanitizer before caring for me.
- (4029) Staff confirmed with me what procedure I was going to have.
- (5009) I was given a list of my current medicines before I left the hospital.
- (5014) My family and I were taught how to report any safety concerns we had.

Physician Care

- (1) My doctor(s) showed concern and sensitivity to my needs.
- (2) My doctor(s) answered my questions about my health.
- (3) I was given the chance by my doctor(s) to provide input to decisions about my healthcare.
- (4) I received the right amount of attention from my doctor(s).
- (6) My doctor explained my illness or treatment in a way I could understand.

Problem Resolution

- (818) RMH Healthcare staff tried their best to help me if there was a problem.
- (819) My need was taken care of promptly and to my satisfaction if there was a problem.
- (1880) I had no significant complaints or dissatisfactions while at RMH Healthcare.

Visitors/Family

- (38) My family and visitors received the help they needed while I was in the hospital.
- (39) My family was kept well informed about my condition.
- (40) My family and visitors felt safe while they were at the hospital.
- (41) Visiting hours were acceptable to my family and friends.

Appendix B: UVA IRB Approval/Study Hospital Approval

<div style="display: flex; justify-content: space-between; align-items: center;"> <div style="text-align: center;"> UNIVERSITY of VIRGINIA IRB-IISR </div> <div> Institutional Review Board for Health Sciences Research </div> </div>	
DETERMINATION OF UVa AGENT FORM	
INFORMATION ABOUT THIS FORM <ul style="list-style-type: none"> This form is to determine if UVa personnel are or are not considered to be working as an Agent* for UVa on this project. If it is determined that UVa personnel are considered to be working as an Agent* for UVa the study team will be required to submit an additional submission to the IRB-HSR, unless the project is determined to not involve human subject research. See <u>Determination of Human Subject Research Form</u> <p><i>*Agent- all individuals (including students) performing institutionally designated activities or exercising institutionally delegated authority or responsibility.</i></p> <p>Enter responses electronically. Email the completed form to IRBHSR@virginia.edu for pre-review. An IRB staff member will reply with any changes to be made.</p>	
Name of Individual to be Working on Project:	Martha Schneider
Email:	mea2m@virginia.edu
Phone:	540-820-1952
UVa Messenger Mail Box #	2824 Garth Road, Charlottesville 22901
Project/Protocol Title if Known:	<input type="checkbox"/> Unknown or Title: Closer to the Heart: The Evaluation of Patient, Provider, and Organizational Outcomes Following the Implementation of Chest Pain Unit
Explain your role in the project: (200 words or less)	I am the principal investigator for this study, and will be completing all aspects myself.
Explain the reason for traveling to the outside institution.	I am a full time employee at the outside institution

Website: <http://www.virginia.edu/vpr/irb/hsr/index.html>
 Phone: 434-924-2620 Fax: 434-924-2932 Box 800483

1. Answer the following questions:

- ☐ Yes ☐ No I was involved in the design of this research project.
☐ Yes ☐ No A UVa IRB has approved this research. IRB-HSR # [REDACTED]
☐ Yes ☐ No Funding to conduct this research will come from UVa.
☐ Yes ☐ No The only reason I am traveling to this outside institution is to work on this research.
☐ Yes ☐ No Working on this research is required for my degree program.

2. I confirm that

- ☐ Yes ☐ No I am a student, employee and/or faculty member of the University of Virginia.
☐ Yes ☐ No My work on this project will be overseen by the Principal Investigator and the IRB at the outside institution. This includes completing any training in human subject research protection as required by the outside IRB.
☐ Yes ☐ No I will communicate with the IRB and the Contracts Office, to determine what approvals may be needed, prior to receiving any data from the outside institution.

OR

3. I confirm that :

- ☒ Yes ☐ No I designed this research.
☒ Yes ☐ No I am a student at UVa but am employed by another institution.
☒ Yes ☐ No All subjects will be enrolled at this outside institution.
☒ Yes ☐ No The research will be overseen by their IRB and, if applicable, their HIPAA Privacy Board. This includes completing any training in human subject research protections as required by the outside IRB.
☒ Yes ☐ No There is no funding for this study.
☒ Yes ☐ No I have notified the outside IRB that a UVa IRB will not be overseeing my work.
ATTACH COPY OF OUTSIDE IRB APPROVAL.

FOR IRB-HSR OFFICE USE ONLY

☒ UVa personnel are not considered to be working as an Agent for UVa on this project.
 No approvals from the UVa IRB-HSR are required.

☐ UVa personnel are considered to be working as an Agent for UVa on this project.
 Submit a research application to the UVa IRB-HSR.

Susie Hoffman
 Signature of IRB Chair, Director or Designee

3/26/13
 Date

Website: <http://www.virginia.edu/vpr/irb/hsr/index.html>
 Phone: 434-924-2620 Fax: 434-924-2932 Box 800483



March 12, 2013

Ms. Martha Schneider, MSN, RN, NEA-BC
RMH Healthcare
2010 Health Campus Drive
Harrisonburg VA 22801

Martha,

RE: Closer to the Heart: The Evaluation of Patient, Provider and Organizational Outcomes following the Implementation of a Chest Pain Unit

At the convened meeting of the Rockingham Memorial Hospital Institutional Review Board on March 12, 2013, the above referenced protocol dated 2/26/13 was unanimously approved by the full board (9 votes for, 0 against, 0 abstentions).

The study will expire on March 12, 2014. At that time, the annual protocol will be reviewed for continuing approval. Any serious adverse events will require reporting per the Rockingham Memorial Hospital IRB Guidelines.

Sincerely,

Betsy Early, Pharm.D.
Designee
RMH Healthcare
Institutional Review Board



Appendix C: Author Guidelines for the Journal of Nursing Administration

Journal of Nursing Administration Online Submission and Review System

Author Resources

[Instructions for Authors \(this page\)](#)

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Editorial Purpose

The Journal of Nursing Administration (JONA) is designed for nurse executives, administrators, and leaders in a variety of healthcare systems, such as hospitals, home care agencies, accountable care organizations, and clinics. **JONA** provides information on management and leadership development; human, material, and financial resource management; staffing and scheduling systems; staff development; labor-management relations; policy, legislation, regulations, and economics related to healthcare and program development; legal, ethical, and political issues; interdisciplinary collaboration; organization-wide projects; corporate issues; diversity management; community relations; innovations; and professional trends. **JONA** is not a research journal; we seek practical, applied content, informed by data (that may have been gathered through a formal research process).

Manuscript Review

JONA is a refereed journal. Published manuscripts have been reviewed, selected, and developed with the guidance of our editorial advisors. Manuscript content is assessed for relevance, accuracy, and usefulness to executives and administrators in healthcare service settings.

Manuscripts are reviewed with the understanding that neither the manuscript nor its essential content has been published or is under consideration by others. The review process starts on the first day of every month. As example, February 1 is the start of the review process for all manuscripts received during January. Publication decisions and author notification generally occurs within 8 weeks from the beginning of the review process.

Authorship Responsibility

All persons designated as authors should qualify for authorship. Each author should have contributed significantly to the conception and design of the work and writing the manuscript to take public responsibility for it. The editor may request justification of assignment of authorship. Names of those who contributed general support or technical help may be listed in an acknowledgment that is placed after the narrative and before references.

It is the responsibility of the corresponding author to ensure that the *LWW COPYRIGHT TRANSFER AND DISCLOSURE FORM* is completed and uploaded for *each author* **at the time of submission** of the article.

Query Letters

Although not necessary, query letters allow the editor to indicate interest and developmental advice on manuscript topics. These can be sent to JONAEditor@gmail.com.

Manuscript Preparation for Online Submission

Unless otherwise stated, prepare manuscripts according to the *American Medical Association (AMA) Manual of Style* (10th edition). **The maximum manuscript length is 3600 words (abstract through references)**. As a general rule, a paper of this length should have no more than 4 figures or tables. Content exceeding this number may be submitted as supplemental digital content (see section on SDC). For examples of style, please see a recent issue of the journal.

Institutional Review Board Approval

If your research or a quality review project met any of the following criterion (intervention to evaluate new or existing practices, adds human subject risks beyond the institutional standard of care, generates new knowledge, and/or the findings have implications beyond the unit or institution), you should provide information in the manuscript about your Institutional Review Board (IRB) process and informed consent. A manuscript reporting a quality improvement initiative generally does not need IRB approval if it meets these criteria: assesses internal process improvement, results are specific only to author's institution and are not intended for use in other organizations, describes standard of care, and is informational in nature, lessons learned).

Format (adhering to the format requirements will expedite the review of your submission)

1. Double space the manuscript using a 10 point type size, any font style.
2. **The maximum manuscript length is 3600 words (abstract through references).**
3. Attach your various individual files containing elements of your entire manuscript. No file should contain information found in any other file:
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 - As many individual files as necessary, each containing 1 table or figure
 - Supplemental digital content

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Information for the title/biography page is placed in a 1 page Word file. The information should not be placed in any other file. This 1 page Word file should contain only:

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Example of a title/bio page with one author

Title: Nursing Revisited: Creative Solutions To Old Problems

Author: Helen Williams, EdD, RN

Author Affiliation: Chief Executive Officer, Y Institution, Big City, Calif.

Correspondence: Dr Williams, Grace Medical Center, PO Box 54, Gray, TX 22222 (hwill@GMC.com).

Example of a title/bio page with two or more authors

Nursing Revisited: Creative Solutions To Old Problems

Jane Doe, PhD, RN, Kathy Free, MSN, RN, May Brown, PhD, RN

Authors' Affiliations: President (Dr Doe), Health Systems, Inc., Gray, Tex; Chief Nurse Officer (Ms Free), James University Medical Center, Louisville, Mass; Instructor (Dr Brown), Adjunct Professor (Dr Doe), School of Nursing, Sunny University, San Diego, Calif.

NOTE: If all authors are from the same place, just list job titles followed by each person's name in parentheses, then the department, institution, city, and state.

Corresponding Author: Dr Doe, Health Systems, Inc., 2656 Loop Road, Gray, TX 77054 (janedoe@hs.com).

Conflicts: None to declare.

Abstract

Abstract for non-research paper: 50-75 word abstract that stimulates readers' interest in the topic and states what readers will learn or how they will be better off after reading the article.

Abstract for a research paper: structured abstract of no more than 150 words, with 5 headings - objective, background, methods, results, and conclusions.

Tables and Figures

Tables (information in 2 or more columns) and figures (information in text format, photos, graphs/charts with boxes and/or lines, arrows, etc.), if any, should each be saved in individual files. If you have 4 tables, you will upload 4 Word files.

All tables must be numbered consecutively with Arabic numbers and have a title. All figures must be numbered consecutively with Arabic numbers and have a title.

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lifting equipment when appropriate and were responsible for the evaluation, maintenance, cleaning, and inventory of all patient lifting/transfer equipment...”

Example of Master List Compilation of all SDC citations at end of manuscript

Video, Supplemental Digital Content 1, which shows the lift team staff using the portable ceiling mounted lift

- Author: Alice Smith
- Videographer: Jane Denholm
- Participants: Members of the hospital lift team
- Length: 5 minutes
- Size: 10MB

References

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McSherry R, Wadding A, Pearce P. Healthcare Governance through Effective Leadership. In: Jasper M, Mansour J. *Effective Healthcare Leadership*. Malden, MA: Blackwell; 2005:58-72.

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Appendix D: DRAFT MANUSCRIPT for the Journal of Nursing Administration

Title: The Development and Initial Evaluation of a Chest Pain Unit

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Conflicts: This manuscript was developed in conjunction with the degree requirements for a Doctorate of Nursing Practice degree at the University of Virginia. There are no conflicts of interest associated with this manuscript.

Abstract

In February 2013, a Chest Pain Unit (CPU) was established in a 238 bed community hospital. The unit was the first in the region to offer a distinct physical location within the hospital to treat low risk chest pain patients. This article will outline implementation activities associated with the establishment of this unit and provide a preliminary evaluation of provider and organizational outcomes.

Objective:

This article outlines the development activities associated with the CPU and provides the findings from an evaluation which compared outcomes for the CPU and patient receiving routine care. This information is relevant to all nursing leaders struggling with the challenge of providing high quality care to outpatients receiving observation services in their facilities. The practical solutions outlined in this article may provide insight into this challenge.

Introduction:

Over eight million people are seen annually for chest pain in the United States (1). Coronary artery disease remains the leading cause of death with angina (pain) as a primary symptom (2). Public health initiatives have targeted information on the importance of seeking medical care in the presence of chest pain (3). Although the majority of the patients with chest pain do not have a life threatening condition, chest pain continues to be the most frequently treated symptom in hospital emergency departments (4).

There is significant liability associated with the failure to diagnose an acute coronary syndrome and in the absence of alternatives, patients with low risk chest pain are often admitted for evaluation rather than discharged (5, 6).

An alternative to inpatient admission for low risk chest pain patients is the assessment, diagnosis and treatment of these patients in either an ED observation unit or a dedicated chest pain unit (7).

Although dedicated chest pain observation units have consistently demonstrated improved outcomes, organizations continue to treat low risk chest pain patients primarily in EDs and on inpatient units. It is estimated that individual hospitals are currently losing 4.6 million dollars each year as the result of these inappropriate patient placements (8). It has also been estimated that the cost savings per low risk chest pain patient specifically could be over \$1500 (9). As insurance reimbursements continue to decline, it is imperative that nursing leaders not only recognize opportunities to improve patient care through evidence-based practices but also participate in the creation of alternative patient care processes within their organizations which will maximize efficiency and reduce costs (10).

Background:

Chest pain patients with a low risk of acute coronary syndrome, commonly referred to as “low risk chest pain patients” are defined as hemodynamically stable patients with no arrhythmias, a normal electrocardiogram and negative initial cardiac injury markers (1). Low risk however does not equal “no risk” and conservative evaluation has been shown to reduce post-discharge mortality (11). While patients determined to have a high risk of myocardial infarction are quickly identified and treated, most patients presenting with low risk chest pain experience delays in diagnosis and testing and long lengths of stay as the result of non-differentiated care processes for observation patients (7, 12).

As the sole hospital provider to patients in eight counties in western Virginia and eastern West Virginia, the study organization maintains a comprehensive cardiovascular service for the treatment of patients with acute coronary syndrome including onsite interventional services. Although discussions had previously taken place regarding the development of a chest pain unit for observation patients, the organization had not formally proceeded with its development.

Development Activities

In May of 2012 a Taskforce, co-lead by the Director of Nursing responsible for cardiovascular services, developed a proposal for the implementation of a chest pain observation unit. It was determined that the objectives of the new unit would be to not only expand the organization's cardiovascular service line, but to also improve emergency department through-put and inpatient bed capacity. Through modifications to documentation it was also anticipated that reimbursement for these types of observation services would be optimized. These objectives were consistent with findings in the literature related to the development and implementation of chest pain observation units (6).

Review of the Literature

In the past 30 years, the treatment of patients with chest pain has transitioned from a focus on acute myocardial infarction to the treatment of low risk chest pain patients in the context of a chest pain observation unit (6). The development of chest pain units internationally has resulted in demonstrated improvements to selected outcomes. As many organizations are beginning to focus on observation services in order to optimize efficiencies and maximize reimbursements, many low risk chest pain patients are now being placed on these types of units (13).

Based upon a review of the literature there was sufficient evidence to support the conclusion that chest pain units provide safe care to low risk chest pain patients while improving selected outcomes. These include: reductions in inappropriate admissions, reductions in overall length of stay, increases in patient satisfaction and reductions in costs (7, 9, 14-19).

Implementation:

The unit opened in February 2013 and was designed to accommodate up to five patients in a separate physical location. Continued declines in the volumes of interventional cardiology procedures resulted in space availability in the interventional cardiology suite. Convenient to a myriad of cardiac services, this location was also close to the ED. As the majority of low risk chest pain patient traditionally present to the ED for evaluation, proximity to the ED was thought to be ideal.

Evidence-based protocols as outlined by the American College of Cardiology (ACC) and the American Heart Association (AHA) were used by the newly appointed CPU Medical Director, a private practice cardiologist affiliated with the hospital, to create an algorithm and an order set targeting low risk observation status chest pain patients (20).

The Nursing Director was given the responsibility to coordinate the development and implementation phases of the project. Evidence-based practices and outcome metrics were studied and it was determined that those required for accreditation by the Society of Cardiovascular Patient Care (SCPC) would direct the operational processes of the unit. These metrics include outcomes such as: in-hospital screening protocols, troponin testing metrics, the use of continuous cardiac monitoring and recommended processes for stress testing (21).

Methods:

Immediately following the opening of the CPU, a study proposal was presented to the hospital's Investigational Review Board (IRB). Using a quasi-experimental design, this evaluation was structured to determine if there were any statistically significant differences ($p < .05$) in outcomes between the chest pain unit (CPU) patients and the routine care unit (RCU) patients on four variables. A power analysis revealed that a sample of not less than 30

patients treated in each area would yield the recommended power (80%) for measuring the differences between these groups.

Patients presenting to the organization's ED were triaged following organizational policy. Patients determined to have low risk chest pain (0 or 1) and stable vital signs were eligible for care in the CPU. Patients who were determined to have low risk chest pain as defined above were also eligible for placement on an inpatient unit. A calculation was done to determine the inpatient unit with the highest number of low risk chest pain patients during the evaluation timeframe. An eighteen bed medical surgical unit providing telemetry services, was determined to have the highest volume of low risk chest pain patients and was therefore designated the RCU.

Records for patients who received care in the CPU were selected using a random numbers table. Thirty records were selected. All 30 patient records were manually reviewed for inclusion and exclusion criteria. All patients had a TIMI score of either zero or one, no less than two troponin tests, their total length of stay documented and insurance coverage and payments.

Records for patients who received care in the RCU were initially screened to determine the TIMI for each patient. Unlike the patients in the CPU, a TIMI score of zero or one was not a criterion for admission to the RCU. If needed, TIMI scores were calculated retrospectively using admission documentation. A total of 54 patients were found to have a TIMI score of zero or one. From this group of 54 patients, 30 patients were randomly selected. All the records selected were then also manually reviewed for all inclusion and exclusion criteria.

Demographic information was obtained and included the patient's age in years, identified gender (male or female), the patient's race and the type of medical insurance. Collection and reporting times associated with blood samples

used for troponin testing. The interval between the first and second collection times was defined by the total number of minutes. If the patient's record did not contain two testing times the patient was excluded from the analysis.

The patients' length of stay was calculated using the recorded time of arrival to the ED and the recorded time of patient discharge and was captured as the total number of hours. If the patient's arrival time in the ED was not accurately documented, the patient was excluded from the analysis. Additionally, if patients were determined to meet inpatient criteria during the episode of low chest pain they were excluded from the analysis.

Reimbursement was documented in patient's financial record following adjudication from the insurance company. Data on amounts billed, co-payments from the patients and adjustments to payments were available for review although not included in this evaluation. Patients who did not have insurance were excluded.

Readmission data were also collected from the each patient's medical record following the initial visit for low risk chest pain. Records were reviewed to determine if there were any admissions within 30 days for either inpatient services or observation services.

Results:

Demographics

The aggregated patient population (N=60) had an average age of 56.6 years, was predominately white (93.3%) and female (56.7%) with Blue Cross insurance (40%). The two locations were compared for homogeneity using an independent *t* test for patient age and Chi-square for the nominal variables; gender ($p=.50$), race ($p=.50$) and insurance type ($p=.335$). A statistically significant difference ($p=.018$) was found between the two groups for

patient age. The patients in the CPU had a mean age of 52.3 (± 11) years of age as compared with the patients in the RCU whose mean age was 60.9 (± 16) years of age (see Table 1).

Troponin Testing

The troponin testing time intervals were normally distributed for patients in the RCU but were found to be positively skewed for patients in the CPU (Figure 1). A comparison of the groups revealed a trend toward significance ($p=.06$) in troponin testing time intervals between the groups but it was not statistically significant (see Table 2). Average times in testing intervals did however improve by seven minutes in the CPU.

Length of Stay

The length of stay was measured in hours between the time of arrival at the ED and the time of patient discharge. The length of stay data were found to be normally distributed in the CPU but negatively skewed in the RCU (see Figure 2). A comparison of the groups found no statistically significant differences ($p=.09$) between the groups for length of stay (see Table 2). There was, however, an average reduction in the length of stay by an average of four hours for patients in the CPU. This finding will be further researched to determine cost-savings to the organization.

Financial Reimbursement

Financial reimbursement was measured by the amount of payment received from an insurance company. The average payment for the patients in the CPU was \$3787.33 and \$3403.92 for the patients on the RCU. There was no statistically significant difference ($p=.455$) between the groups for payment amounts (see Table 2). This finding

will be further researched to determine if there is a difference in the ratio of total charges to reimbursement between the two units.

Readmissions

Readmissions were measured using the total number of admissions within 30 days. No patients from either group were admitted to the hospital as either an inpatient or an observation patient within the thirty days following their initial evaluation for low risk chest pain (see Table 2).

Discussion:

Following the implementation of a five bed CPU, an evaluation was conducted to determine differences between care provided in the CPU and the RCU. The difference found in patient age across the locations may have been a function of either the evaluation tool used to determine patient risk for myocardial infarction (TIMI) or as the result of provider concerns about increasing comorbidities with advancing age. Perceived risk of adverse events related to age may have also played a role in the provider's decision to place patients on the "new" CPU unit versus the RCU unit (11).

It was anticipated that patient placement in the CPU would result in a significant improvement in provider proficiency with regard to the time interval between the first and second troponin test. It should be noted that modest improvements did occur, with the average interval between tests decreasing on average by seven minutes

in the CPU (377 minutes) versus the RCU (384 minutes). Additionally, a visual inspection of the time intervals also revealed a positively skewed distribution in CPU, indicating a tendency toward a reduced time interval. Although it was expected that the interval would significantly improve for patients in the CPU, nurses noted that patient care technicians were not routinely available to assist with phlebotomy in the CPU which may explain the lack of significant improvement.

Patients in this evaluation did experience, on average, a reduction in length of stay of approximately four hours (see Table 3). The length of stay was also found to be negatively skewed in the RCU, indicating, on visual inspection, that the majority of the RCU patients were on the unit for greater than 20 hours.

Although the CPU is in closer proximity to the ED and to non-invasive stress testing, the CPU was located “away” from the inpatient units. The majority of the patients placed in both the CPU and the RCU were attended to by hospital employed providers. Based upon observations made by the nurses in the CPU, these practitioners spent the majority of their time on the inpatient units. It was reported to nursing leadership that several of the physicians expressed concerns about the location of the CPU, citing its distance from the inpatient units. Many of the chest pain units that have seen significant reductions in length of stay have noted that dedicated resources allowed for improved efficiencies (7). The study organization may need to further investigate the employment of a licensed independent practitioner in the CPU to maximize organizational efficiencies.

Increased payments were anticipated as the result of proper patient placement (observation status) and changes to the billing processes associated with the CPU. The increases noted in this evaluation may be a reflection of the distribution of payers in the two locations and the allowed amounts reimbursed for each insurance plan. Although the total number and types of payers were normally distributed across both units, a higher percentage of patients

in the CPU had Blue Cross and Tri-Care insurance (46.7%) as compared to the RCU (40.0%). It was not surprising that Medicare insurance was the primary payer for the greatest percentage (36.7%) of patients in the RCU, given the differences in age distribution between the locations.

Limitations

A single setting with a small sample size reduced the likelihood of finding statistically significant differences between the groups. Concurrently, the continued ability of physicians to select patient placement location may have reduced the effect of the intervention (CPU).

Conclusion

While statistically significant findings ($p < .05$) in outcomes between the CPU and the RCU were not identified in this evaluation, there are several implications for nursing practice as the result of these findings. It is clear, through the improving trends found in troponin testing and the overall length of stay that efficiencies are beginning to be realized as the result of the implementation of this new program. The findings of this evaluation were shared with the CPU nursing staff and barriers to efficiencies, such as delays in patient transport, were identified and changes implemented.

Nursing leadership is poised to assume a strategic role in creating the future of hospital-based care through the development and implementation of innovative evidence-based practices targeting high volume, low risk patients who are currently being treated in the inpatient context. Ongoing evaluation and continued changes will be made in the CPU by nursing leadership in order to improve patient outcomes.

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Figure 1: Troponin Testing Intervals in the CPU and the RCU

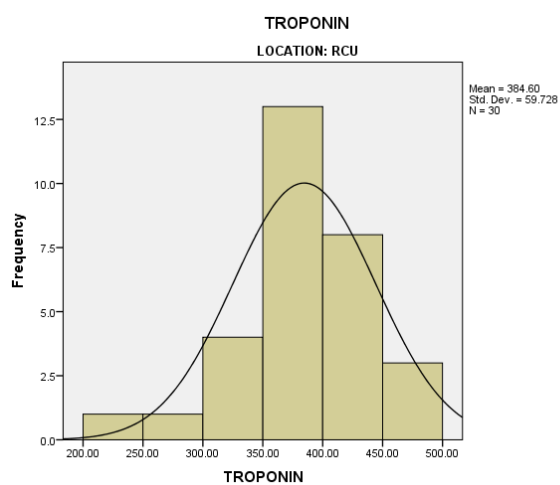
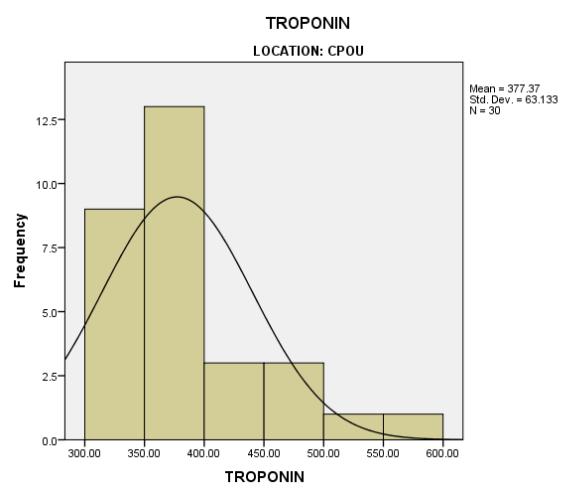


Figure 2: Length of Stay measured in hours in the CPU and the RCU

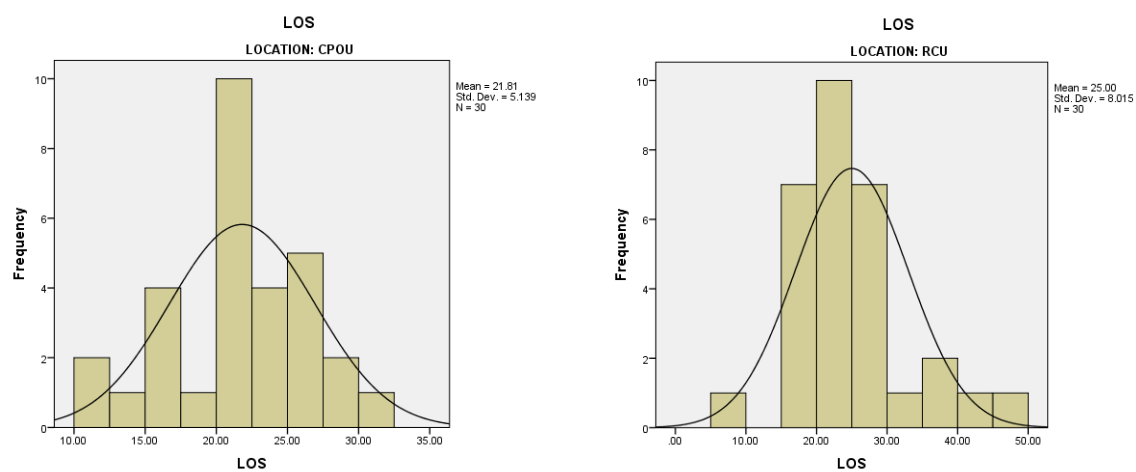


Table 1: Summary of Patient Demographic Characteristics

Characteristics	Range	Mean	P
Age			
Group	24-88	56.6	p=.018*
Chest Pain Unit	27-84	52.3	
Routine Care Unit	24-88	60.9	
Characteristics	n	Percent	
Gender			
Male	26	43.3%	p=.50
Female	34	56.7%	
Chest Pain Unit			
Male	13	43.3%	
Female	17	56.7%	
Routine Care Unit			
Male	13	43.3%	
Female	17	56.7%	
Race			
White	56	93.3%	p=.50
Non-White	4	6.7%	
Chest Pain Unit			
White	28	93.3%	
Non-White	2	6.7%	
Routine Care Unit			
White	28	93.3%	
Non-white	2	6.7%	
Payer			
Medicare and Medicare HMO	18	30.0%	p=.335
Medicaid and Medicaid HMO	6	10.0%	
Blue Cross and TriCare	24	40.0%	
All Commercial Insurance	12	20.0%	
Chest Pain Unit			
Medicare and Medicare HMO	7	23.3%	
Medicaid and Medicaid HMO	3	10.0%	
Blue Cross and TriCare	14	46.7%	
All Commercial Insurance	6	20.0%	
Routine Care Unit			
Medicare and Medicare HMO	11	36.7%	
Medicaid and Medicaid HMO	3	10.0%	
Blue Cross and TriCare	10	20.0%	
All Commercial Insurance	6	20.0%	

**p*<.05, two-tailed for Age, Independent T-test, for Nominal variables, Chi-Square

Table 2: Analysis of Troponin Time, Length of Stay, Insurance Payments and Readmissions*

<i>Variable</i>	<i>Mean</i>	<i>95% CI</i>	<i>P<.05</i>
Troponin Testing time (minutes)			
Group	380	[365,397]	<i>p=.</i> 06
Chest Pain Unit	377	[353,401]	
Routine Care Unit	384	[362,407]	
Length of Stay (hours)			
Group	23	[22,25]	<i>p=.</i> 09
Chest Pain Unit	21	[20,24]	
Routine Care Unit	25	[22,27]	
Insurance Payments (dollars)			
Group	3595	[3087,4104]	<i>p=.</i> 45
Chest Pain Unit	3787	[2984,4590]	
Routine Care Unit	3403	[2737,4070]	

**There were no readmissions within 30 days for either group*