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Rural Heart Attack Care

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Regis University
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Doctor of Nursing Practice Capstone Project

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Rural Heart Attack Health Care

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Doctorate of Nursing Practice Degree

Regis University

Rural Heart Attack Care Capstone Project Executive Summary

Problem Statement-PICO

The rural and frontier populations have fewer health care resources and remain an underserved health care consumer. New practice patterns for care of ST Elevation Myocardial Infarctions (STEMI) have reduced heart attack mortality by 2% per year (National Center for Health Care Statistics, United States, 2008) yet the interventions are not widely practiced in the rural health care settings. The population studied is the care providers, the intervention employed was the use of a pre-planned STEMI algorithm. The comparison was reducing time frames of care delivery before and after the algorithm with the outcome being a reduction in time of care delivery after the algorithm was employed.

Purpose

The purpose is to standardize care of the rural STEMI patient with an algorithm developed by teams, and using systems improvements. The nationally recognized urban algorithm for STEMI care (Kushner et al., 2009) was tested in the rural environment of Heart of the Rockies Regional Medical Center (HRRMC) in Salida, Colorado.

Goals

The goal of the rural heart attack care project is to bring multiple care providers together forming a care delivery network for those patients needing critical services, delivered in a timely fashion while experiencing an acute myocardial infarction.

Objectives

The project emphasis is process improvement. The objective is improved care delivery and patient outcomes through the use of the pre-determined care network of care providers involved in algorithm design for rural heart attack care. Specifically measured objectives include: reduced time for Emergency Medical Services care, use of a checklist by the Emergency Department, use of a one-call transfer system, transport and admission to tertiary care.

Plan

A multi-disciplinary team was developed at Heart of the Rockies Regional Medical Center (HRRMC) and the clinical practice guidelines were reviewed. A modified algorithm for STEMI care was developed. Initial closed medical record review revealed room for growth. Communication and education of the algorithm included the pre-hospital providers and staff at HRRMC. After an Exempt and Expedited Status were granted by the Internal Review Boards of Regis University and Penrose Hospital, use of the algorithm was encouraged. Early in 2012, the review of medical records for all cardiac patients in 2011 was completed and compared to the records from 2010.

Outcomes and Results

The outcomes revealed a comparison group of three STEMI patients and an interventional group of seven STEMI patients. The low volume of cases presents a statistically under powered project, which is not considered reliable or reproducible. The validity of the outcomes is location specific and may be used for process improvement. The care delivery time was reduced from 288 minutes in 2010, without the algorithm to 150 minutes with the algorithm in 2011. With larger case inclusion, over time, further statistical analysis could be accomplished. The algorithm proved clinically relevant and has become a useful tool in rural heart attack care for HRRMC.

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Capstone Project

In spite of our high technology culture and our sincere efforts at equity for all, it may surprise Americans to learn of the health care disparities within our modern age. Health care agencies advocate for more resources and access for the poor and other known underserved, such as very young and very elderly populations. Health care legislation purports remedies and funding needs, although often lacking funding sources. Amidst this headline news is a group of underserved with little access to well documented, positive outcome health care resources based upon their community location. The rural and frontier populations are in the last setting to receive newer care strategies, sophisticated diagnostics, or recently developed therapeutic interventions. The rural and frontier populations have fewer resources, do not inspire research/data banking, and remain an underserved health care consumer.

In this author's practice as a Cardiovascular Clinical Nurse Specialist (CNS), opportunities arose to participate in the development of product line care delivery which crumbled old mortality rates in recent years (National Center for Health Care Statistics, United States, 2008). Anyone brought to the tertiary care hospital would receive reperfusion and mostly reverse the ischemic tissue loss of the most lethal of heart attacks, ST Elevation Myocardial Infarctions (STEMI). If the patient happened to live outside the transport range for this facility, the prognosis was unchanged by the new diagnostics, recent advances, and percutaneous coronary interventions (PCI). The needs of the rural population were unmet, almost invisible.

Growing interest developed in Colorado for the application of sophisticated clinical practice guidelines to rural and frontier settings. To begin earnest work on this topic in the rural setting, needed skills sets at the epitome of clinical practice were necessary - the Doctorate of Nursing Practice. It has been this author's goal to study rural heart attack care, rural access, and

improved patient outcomes, which is the focus of the Capstone Project. In selecting one community in Chaffee County Colorado, use of a viable multi-disciplinary project to improve care strategies, become sustainable, and change outcomes for the STEMI population in Salida, Colorado.

Problem Recognition and Definition

Statement of Purpose

Evidenced based clinical practice guidelines (CPG) for heart attack care have been available, published, and updated regularly in *Circulation* since 2004. This is a joint effort of the American College of Cardiology (ACC) and the American Heart Association (AHA) (Kushner et al., 2009). This elaborate reference has details, levels of evidence, interventions, and suggestions for application of the recommended practice guidelines into current practice. Most cardiovascular professionals consider this to be the "gold standard" for patient care. Linked to the CPG is the largest outcome based data registry of more than 625,000 STEMI cases, which is managed by Duke University and the ACC (Kushner et al.). The data registry supports the CPG and it is one source, from which the standards are derived, reviewed, analyzed, projected, and tested (Kushner et al.).

Rural health care delivery presents with many barriers to quality, alarming increasing costs, and a heightened need for services as the population ages (Newhouse, Morlock, Pronovost & Breckenridge Sprout, 2011). Forty per cent of the hospitals registered with the American Hospital Association are non-metropolitan or rural (Newhouse et al.) with rural defined as populations of less 10,000 people. Rural settings are also faced with lower average income levels and lower average educational levels (Newhouse et al.).

The application of the STEMI CPG to rural settings is developing throughout the nation at this time. The CPG is perfect for the urban setting with robust Emergency Medical Services

(EMS) activity, multiple receiving facilities, and interventional cardiologists available every day around the clock (Kushner et al., 2009). Translation of the same interventions into rural settings and resources is the focus of this proposal. The CPG emphasizes timing of interventions and has a wealth of randomized controlled studies which elucidate the need for reperfusion in very short time intervals (Kushner et al.). Primary coronary interventions (PCI) need to reperfuse the myocardium within 90 minutes and fibrinolytic therapy interventions, clot buster drugs, need to be administered within a 30 minute window (Kushner et al.). Often the care provided to the point of reperfusion includes a multi-disciplinary team of pre-hospital providers, nurses, emergency physicians, transport teams, cardiologists, and other hospital services such as registration or admissions (Kushner et al.). These interventions have closely woven impact upon the next set of care providers and require timing, prioritization, monitoring, and case review in order to achieve the best outcomes of high grade successful reperfusion (Kushner et al.).

According to Newhouse et al. (2011), developing health care services for rural populations was dramatically enhanced in 1997 with the Balanced Budget Act which included the Medicare Rural Hospital Flexibility Program. Criteria were outlined for the licensing of Critical Access Hospitals (CAH) which included a distance of more than 35 miles to another hospital, average daily census less than 25 beds, 24-hour emergency services, and length of stay of less than 96 hours (Newhouse et al.). There were 1,315 CAHs as of June 2010 (Rural Assistance Center, 2010). CAH provided an avenue to upgrade the care provided those having a STEMI and needing resources most often found in the urban hospital setting. A network could be developed for improved care delivery using EMS, CAH emergency departments (ED), transfer algorithms, and urban health care facilities. This strategy would need planning, engagement of the care providers, implementation, evaluation, data gathering, and constant case review for process improvement.

Salida, Colorado, is the proud home of a critical access hospital, Heart of the Rockies Regional Medical Center (HRRMC), and uses the services of Chaffee County Emergency Medical Services. The county covers 1,013 square miles and had a 2010 population of 16,242 in three towns (Salida, Buena Vista, and Poncha Springs) and surrounding farms/ranches (US Census Bureau, 2010). The average household income in Chaffee County is $42,600, and 90% of the population has a high school education, with 29% having a Bachelor's degree. (Chaffee County Colorado, 2010) There are seven ambulances, a response time of four to eight minutes (Chaffee County, 2011), and a heliport for Flight for Life® air ambulance/rescue services.

Problem Statement

The problem to be evaluated is stated as "Would a provider developed pre-determined care algorithm shorten the time for ST Elevation Myocardial Infarction patients from diagnosis to re-perfusion in a rural CAH setting?" Heart attack and resuscitation care is not new to either rural or urban health care delivery. HRRMC developed care with some elements of the STEMI CPG evident in the interventions, but a broad encompassing, detailed algorithm based upon the CPG was not employed. The multi-disciplinary team members did not contribute to the algorithm and initially, collaboration was not mentioned by any care provider. The services for STEMI care have been provided to approximately ten to fifteen people per year without the advantage of the inter-woven, multi-disciplinary, highly prioritized algorithm of care based upon evidence and the CPG.

Using the resources of Centura Health® which includes the Flight for Life® transport air ambulance and Penrose Hospital in Colorado Springs Colorado, a network had loosely developed over several years. During the initial phases of work on this project, Centura Health® proclaimed a relationship with Salida and HRRMC. No one has defined the context of this relationship, but the timing placed a spotlight upon this project and its goals. In the past, the

connection was formed for Trauma Services, and now cardiac services could have a stronger association and impact.

Since this service would not be a new creation, but an organized, evidenced based application, comparing the work of the past to the model of the future came into focus. This work is an application of a very strong evidence base, the STEMI CPG to a modified setting - the rural health care delivery system. The resources are available at HRRMC through Penrose Hospital and Flight for Life®. Care provided by the collaborative application of the STEMI CPG would organize, prioritize, and focus interventions upon established quality outcome measures.

PICO Statement.

The question of the project study and Capstone may be stated as: Can rural healthcare providers, using pre-planned algorithms, access tertiary care facilities with patients having an ST segment elevation myocardial infarction (STEMI) in reduced time frames from the access utilized without algorithms? This question is developed from an accepted format used for nursing to clearly state a "properly formulated question" (Zaccagnini & White, 2011, p. 286) with considerations for patient/population, intervention(s), comparison, and outcome. The acronym PICO is often used in reference to this process. The full content of the PICO elements and identifications are found in Table 1. The PCIO Statement, Version 4.

Table 1. PICO Statement, Version 4

Element	***Identification***
Patient/Population	*First responders, care providers in rural Colorado for STEMI patients*
Intervention	*Develop a pre-planned access program/algorithm identifying receiving hospitals which can perform Percutaneous Coronary Interventions (PCI)*
Comparison	*Current system of care compared to a predetermined transfer system of care for STEMI patients*

Outcome	*Patient experience will follow use of pre-planned access program/algorithm to reduce time of first medical contact to open coronary vessel/fibrinolytic therapy administration*

As described previously, the elements of the population, the intervention, the comparison, and the outcome have developed over the entire course of study. Several revisions to the PICO statement have been made with considerations to input from Regis University nursing scholars, academic peers, and course content. The final PICO statement is the frame work for the Capstone Project, the population assessment, the strategies to be utilized, the data to collect, and evaluate.

Project Significance, Scope, and Rationale

The rural heart attack care Capstone Project is significant on several levels. There are program attributes which standardize care of the rural STEMI patient, using teams, and systems improvements. This focus is to be quantified in data, program outcomes, and sustainability of the project. The ACC and AHA are beginning to emphasize care delivery to rural settings using the STEMI CPG (Kushner et al., 2009). Each rural facility has uniqueness which requires program development to be individualized and customized (Newhouse et al., 2011). The scope of this multi-facility project requires dependence upon a strong practice guideline, well tested and founded in a strong evidence base (Kushner et al.). The rural care providers would not be highly motivated for a lesser standard. The STEMI CPG meets this obligation as it is strongly data supported for all interventions and updated regularly with the newest findings (Kushner et al.).

The use of tangible data outcomes as a measure of success has a strong correlation to process improvement success in a complex setting such as health care delivery. Dr Berwick (2008), as leader of the Institute for Health Care Improvement, frequently addressed the value of data collection and use in the enhancement of patient care delivery systems. The findings of any

process improvement project can be gathered, reviewed, program revisions made and again tested with data collections. The pattern may become self-sustaining.

Another project attribute is the unique fit of the rural heart attack care program to doctorate level of nursing activities. According to Chism (2010), the final Doctorate of Nursing Practice (DNP) project depends upon the candidate's point of entry into the program, dependent upon role experiences, specialization, and practice. Having a very long career as a CNS, many needed skill sets had been well developed (process improvement, team building, multi-disciplinary data abstraction) and blended with new DNP skills (evidence base use/development, research strategies, study of populations, applied theory base, data review, and result outcome presentation) by this author.

DNP nurses are committed to practice issues, oriented to outcome improvement, and responsible for practice enhancements, policy changes, and demonstration of scholarship (Chism, 2010). The application of educational program standards can be found on Table 2-DNP Essentials. Every educational goal of the DNP curriculum is employed in this Capstone Project experience.

Table 2. DNP Essentials

Essential Number	Content/Context	Essential application found in the Capstone Project & impact on role
I	Scientific underpinning for practice	Yes, use of CPG, applied practice theory
II	Organizational and systems leadership for quality improvement and systems thinking	Yes, leading a new multi-disciplinary, multi-facility quality team
III	Clinical scholarship and analytical method for evidence-based practice	Yes, data design, collection analysis and delivery to stakeholders
IV	Information systems/technology and patient care technology for the improvement and transformation of health care	Yes, use of multi- EMR, added technology in data collection and delivery to stakeholders

V	Healthcare policy for advocacy in health care	Yes, submitting for grant funds for educational materials for teams in EMS and ED, increased awareness in rural healthcare network
VI	Interprofessional collaboration for improving patient and population health outcomes	Yes, development of teams. Building systems to be used after project ends
VII	Clinical prevention and population health for improving the nation's health	Yes, tertiary prevention is early health care system access, application of CPG to rural setting
VIII	Advanced Nursing Practice	Yes, leadership, standard setting, teaching EBP to teams, assessment of community needs, implementation of change, evaluation, and role modeling

Adapted from Chism, L.A. (2010). *The Doctor of Nursing Practice- a Guidebook for Role Development and Professional Issues.* Sudbury, MA: Jones and Bartlett Publishers. pp. 15-20.

Theoretical Foundation

Two theorists' work thread through the Capstone Project: Patricia Benner and Everett Rogers. Benner's work, published originally in 1984 (and many times subsequently), is paramount for teaching, coaching, and creating evidence-based practice (EBP) motivated changes (Benner, 1984). According to Benner, using the talents of experts in clinical practice as this project does, presents practice pattern variance which may be difficult to accept for some expert practitioners. Benner credits the expert practitioner with intuitive thought process, almost habitual responses to clinical stimuli, and decision making. Evidence based practice patterns ask the clinician to modify choices, based upon new evidence of varying strengths or levels. As Benner predicts, most experts have transitioned into expert status without a notice of the decision making style. Clinical experts may be hesitant to change practice patterns not due to resistance, but related to accustomed practice patterns.

Lyneham, Parkinson, and Denholm (2008) have studied and applied the Benner theory to emergency room nursing in their Australian phenomenological study. According to Lyneham et al., "The findings validate the use of intuitive decision-making as a construct in explaining expert clinical decision-making practices. The validity of intuitive practice should be recognized" (p.384). This tenant of Benner's theory has been the most challenged and least supported, and it is substantiated by this work. The efforts needed to deal with expert practitioners in infusing EBP needs to be decisive, deliberate, and considerate of their expert thought patterning.

Effective change theory is essential to the essence of every process improvement work. Rogers' *Diffusion of Innovations* (2003) has been applied to change motivation theories for professions as broad as corn farming (the original work) to rocket science. Nursing and health care, adopting this tenant decades ago, has embraced the five stages: Knowledge, Persuasion, Decision, Implementation, and Confirmation (p. 169). Rogers includes methods for coping with the internet changes in innovation-decision making which increasingly speed up the adoption of new information and technologies. The basis of Rogers' theory suggests that a broad base of support creates change innovation at alarming speeds with long term acceptance and stakeholder buy-in. This idea is brought forth in the Capstone Project and evidenced by the team building and team membership composition.

An applied use by Lee (2004) demonstrated Rogers' Diffusion of Innovation theory, formatted to assess nursing acceptance of computer technology in respiratory intensive care units. This application of Rogers' theory led the author to conclude change can be accepted based upon its "relative advantage, compatibility, trialability and observability" (Lee, p. 236). The adoption of change met the challenges of Rodgers' theory in computer charting adoption by expert intensive care nurses. Lee's study upholds the Diffusion of Innovation stages and theory.

Literature Selection

In the course of preparation for the Final Capstone Project, a thorough review of the literature was employed. Several journal articles offered significant material, influencing the entire Project Proposal. See Appendix A. Literature Review. Empirical support was abundant, but not always relevant to the problem statement or processes employed.

Most notably, of all contemporary readings is the Gold Standard, the evidenced based clinical practice guideline for STEMI care by Kushner et al. (2009) which summarizes more than two dozen randomized controlled trials and many smaller studies with less facility participation or less randomization of the study groups. Each intervention which may be employed during a STEMI event is discussed and compared with the previous standard, highlights the new evidence based adjustments to the practice guideline, identifies the level of evidence, and links to the primary study question (Kushner et al.). Recommendations are suggested for safety and efficacy of practice, such as the door-to-balloon (refers to balloon angioplasty opening of a coronary artery) time of 90 minutes and the door to needle (admission to fibrinolytic therapy) time of less than 30 minutes (Kushner et al.).

Rural settings and patient transport are discussed by Kushner et al. (2009), but the level of evidence is lower and the volume of the cases in the data banks is smaller. Every topic is included from contrast induced nephropathies to Low Density Lipid levels, and lipid lowering pharmacologic suggestions. This publication is the most cited *Circulation* journal article and in a format allowing and encouraging updates that are reviewed often. This is one of the journal articles the author selected to copy and distribute to all of the teams participating in the rural heart attack process improvement work. Almost every aspect of the work is useful in planning STEMI algorithms of care. This article ranks an overall evidence classification and level of Ia.

Also of value is the work of Diericks et al. (2009).This study re-enforces the essential role of the field caregivers and EMS providers in early diagnosis and time savings for tissue ischemic events. Importantly, Diericks et al. identifies the under-utilization of EMS electrocardiograms (EKGs) (less than 20% at that time) and the impact in patient outcome without this data known early during treatment and transport. The study has statistical power in the use of data from 271 hospitals and 7,098 cases, with only 1,941 having a field EKG completed (Diericks et al.). The study confirms the purpose and need for outstanding care starting with pre-hospital services and the impact of great pre-hospital care reduces complications and enhances outcomes. The study is useful in building the process improvement team, validating the need for strong EMS practice, and defining the field prehospital care delivery pattern. Chaffee County EMS does carry and use 12 lead EKG machines and has few barriers to success with field EKGs. Ongoing education for reading the 12 lead EKG will be a part of the Capstone proposal based upon the details of Diericks et al. research study. This article is awarded Class Ia level of evidence.

Lutfiyya et al. (2007) studied twelve quality hallmarks contrasting urban settings and rural settings. The data studied was offered voluntarily through Hospital Compare data banks and comprehensively covered 3,780 hospitals in urban markets and 423 rural CAH facilities (Lutfiyya et al.). Only one hallmark had higher quality in CAH setting, the pneumonia indicator. The care for heart failure and heart attacks was statistically significant and favored urban hospital settings (Lutfiyya et al.). The data were clearly presented in this study and the analysis well defined and displayed. The limits to the study were the use of twelve disease states evaluated in publically reported and voluntarily collated data bank (Lutfiyya et al.). The methodology was to retroactively review medical records and reports. The authors questioned the continuity of the data and some internal validity threats to the study may exist. In spite of some limitations,

Lutfiyya, et al. clearly demonstrated the need for improved CAH care processes and helped this author establish a need for improved cardiac care in this Capstone Project. This study was rated IIa in level of evidence- There is some conflicting evidence but the weight of the evidence is in favor of the usefulness/efficacy of the evidence.

Further literature review for rural transport of acute cardiac patients to urban, tertiary care facilities were noted by Aquirre et al. (2008) who studied the transport from six referral sites to two tertiary care facilities during January 2005 to March 2007. The n = 230 patients and the data analysis was comparison of nominal data points (Aquirre et al.). This study is influential as it highlighted three major time periods: first emergency door to departure, transport time, and second facility door to reperfusion (Aquirre et al.). The non-standardized STEMI transfer cases did not do as well as those with four-step algorithm like approach. The authors suggest a rural approach which reduces variance for improved outcomes, which directly relates to the premise of this Capstone Project. One limitation of the study is the ever evolving patient care practice standards. During the timeframe of this respective data collection, many practice changes impacted care decisions, with great evidenced based changes in 2006-2007. That issue aside, this IIa level of evidence study supports the premise on which this Capstone Project rests. This author distributed this study to the rural health care providers.

In the study of rural health care in a CAH, Newhouse et al. (2011) offered a detailed review of the nursing demographic data, the administrative structure, and the environment of care. Newhouse et al. completed the study in survey methodology, a convenience sampling of 688 nurse executives. Interestingly, the findings revealed many of the demographics for education (75% AD education), clinical ladder, (32% have staff clinical ladders) and union (21% union active) were similar in urban and rural settings (Newhouse et al.). Larger hospitals had The Joint Commission certification and smaller hospitals employ CAH standards (Newhouse et al.).

The study did reveal the quality and safety standards were higher with Joint Commission certification (Newhouse et al.) than CAH standard requirements.

According to Newhouse et al. (2011), the strategies employed to assure quality and safety was different between CAH and urban settings, with the CAH use of internal resources rating higher. Rural facilities linked within a network had better outcomes and quality markers than those stand-alone facilities (Newhouse et al.). The relationship between hospital size and resource availability seemed important to quality and rather linear. The tool used, the Nurse Environmental Survey (NES), was stated to need further validation and clinical testing, which presents as a limitation for this study (Newhouse et al.). This study helped this author acquire some cultural variance noted in CAH and gave a frame of reference for the staff demographic composition. This study is evidence rated IIc for expert opinion consensus where there is conflicting evidence.

Scope of Evidence

The Task Force of the American College of Cardiology and the American Heart Association define clearly the classifications and levels of evidence used in their CPG efforts (Kushner et al. 2009) seen in Appendix A. In review, for discussion clarity the classifications and levels are as follows. Class I evidence defines evidence in which there is good evidence and general agreement the treatment is effective (Kushner et al.). Level II classifications have conflicting evidence or divergence in acceptance: IIa has the weight of evidence in favor of using the intervention while IIb has usefulness/efficacy which is less well established in either evidence or opinions (Kushner et al.). Class III evidence is reserved for conditions or interventions which are not considered useful and in some cases may be harmful (Kushner et al.).

The levels of evidence also reveal the methodology of data collection. In Level of Evidence a, the data is derived from multiple site randomized controlled studies (Kushner et al.

2009). This is the gold standard for medical research studies. Level of Evidence b trials are derived from single randomized controlled studies or perhaps non-randomized controlled studies (Kushner et al.). Level of Evidence c data are formed from the consensus of clinical experts and carries with it the least strong evidence for evaluation (Kushner et al.). Consensus of expert opinion level of evidence may not withstand rigors of gold standard research, but includes interventions as clinically acceptable such as the use of oxygen during a myocardial infarction and the concept the critically ill patient would have two intravenous access sites. These are basic interventions which currently lack a research evidence base but are widely accepted and implemented, advocated by clinical expert opinion.

Review of Evidence

Background of the Problem

Refinement of care for heart attack interventions began to flourish in the mid- 1990s and multiple studies with clinical practice guidelines emerged (Kushner et al, 2009). With the availability of percutaneous interventions, ischemic flow was restored with rapid catheterization laboratory availability (Kushner et al.) and was not dependent upon coronary artery bypass surgery for re-perfusion. Clinical success was measurable in the catheterization lab setting and key variables became the focus of care improvement. In sequence, Kushner et al. defined the variables as: patient recognition and activation of the emergency system, early diagnosis with field 12 lead EKG, and rapid admission to cath lab, with an open coronary vessel within 90 minutes from diagnosis. Facilities without catheterization labs were to administer fibrinolytic therapy administration within 30 minutes of hospital admission. Many subsets of interventions during the algorithm were super imposed upon the original care, such as Diericks et al, 2009 study concluding the emergency medical services 12 lead EKG within ten minutes was ideal, or

Aquirre et al. 2008 study of shortened transport times to tertiary care facilities may impact outcomes.

As sophisticated as the algorithm has become, the applicability to rural settings was not linear with growth of the urban application. The American Heart Association (2011) began working on the Mission Life Line project to elevate the attention to the details of the algorithm and include rural communities in the application of the algorithm. This work is in process and this author led a team which evidence-based the state-wide Colorado Mission Life Line rural protocols for order sets. Next, the team will engage the hospitals in use of the order sets, as the clinical practice standard for rural setting STEMI care. The issues are hoped to be managed on the individual facility level and data will be collected to monitor the rural advocacy of STEMI guidelines throughout the state.

This Capstone Project is a single facility application of rural setting STEMI guidelines. This project preceded the American Heart Association work but the Mission Life Line work has enhanced assets, funding, data collection, data analysis and attention. The ACTION® Registry is the largest population health care data bank in the world (Kushner et al., 2009). It is likely the Mission Life Line work will experience a state wide launch at the time of this Capstone conclusion. The experiences and lessons learned from this work hope to enhance the other rural facility STEMI care programs.

Systematic Review of the Literature

The Systematic Review of the Literature was very intriguing and a challenging experience for this author. Initially, the literature was reviewed through search engines which supported the medical management of the STEMI patient. There were at least two dozen clinical practice guidelines and most were found in MEDLINE. This author used government agencies such as Center for Disease Control and the Agency for Healthcare Research and Quality to

identify studies of importance and found the original work through on-line library article searches. Using research through known centers of excellence for patient care such as the Institute for Healthcare Improvement was helpful. It was comforting and easy to fall back upon the American Heart Association and the American College of Cardiology publications frequently. At least half of the literature review was conducted from this medical perspective or medical model lens.

In review of progress, this author noted the direction of the literature review was limited and solely focused upon medical care delivery. The review lacked depth; the content represented only one facet of STEMI care. First, the search engine was modified to include CINAHL, EBSCO, and Academic Search Premier for a broader view of the topic. Next, this author reviewed all the cardiology studies in the Cochrane Collection. To add depth, the search terms were broadened to include the selected theorists, specific interventions, and care providers. This author also reviewed journals with nursing science focus, emergency medical services, air transport, and rural health care concerns.

After the Systematic Review of the Literature experience, this author recognized the narrow vision by which most literature searches had been done in the past. The ability to see the picture from a multi-faceted lens was enlightening. Although the medical model is the predominant focal point for much of the STEMI work, it is limited in its scope and adding nursing, economic, social sciences and epidemiologic foci offers a more enlightened perspective.

Project Plan and Evaluation

Market/Risk Analyses

By design, intent and the 1997 with the Balanced Budget Act which included the Medicare Rural Hospital Flexibility Program, CAHs have no direct competition. The location is remote, services not available elsewhere, and need for health care delivery requires a provider

solution hospital or clinic (Newhouse et al., 2011). As suggested by Fortenberry (2010), since the existence of the CAH is not competitive, the heart attack program was assessed for need, competition, and likelihood of sustainable advantages. Fortenberry discusses a market share may struggle even if a product has an initial market edge. Newhouse et al. purport rural facilities as needing resources and program design rich with quality of care hallmarks. As the heart attack program parallels HRRMC familiar critical care trauma programs, so the likelihood of HRRMC continuing the evidence based algorithm of STEMI care is supported by the care providers.

Risk may be reduced with detailed project planning and design. Fortenberry (2010) outlines a deliberate plan to reduce risk, based upon stages of growth and planned change. The Process Model for the DNP Project, as described by White and Zaccagnini (2011), has similarity to Fortenberry's stages as described in Table 3. Both models use steps or stages to progress through a new project leading to a goal of project success and sustainability. Both begin with recognition of an idea or strategy. Both evaluate the idea or need and then proceed slowly with deliberate goals, evaluation and analysis prior to project development. After plans are outlined and analyzed, testing and evaluation commences. White and Zaccagnini's model has more process at this point and includes implementation and data review steps. Both models finish with public presentation of the findings either through reporting results or commercialization.

Table 3. Process Model for DNP Project and Fortenberry's Stages to Minimize Risk

Process Model for DNP Project	Fortenberry's Stages to Minimize Risk
Idea	
i. Problem Recognition	1. New Product Strategy Development
ii. Needs Assessment	2. Idea generation
iii. Goals, Objectives and Mission Statement	3. Screening and Evaluation

Process Model for DNP Project	Fortenberry's Stages to Minimize Risk
iv. Theoretical Underpinnings	4. Business Analysis
v. Work Planning	5. Development
vi. Planning for Evaluation	6. Testing
vii. Implementation	
viii. Giving Meaning to the Data	
ix. Utilizing and Reporting results	7. Commercialization

Adapted from White, K. W. & Zaccagnini, M. E. (2011). A Template for the DNP scholarly project. In Zaccagnini, M. E., & White, K.W. (Eds.), *The doctor of nursing practice essentials* (p.458). Sudbury, MA: Jones and Bartlett. and Fortenberry, J. L., Jr. (2010) *Health care marketing- Tools and techniques* (pp. 11-23). Sudbury, MA: Jones and Bartlett.

Project Strengths, Weaknesses, Opportunities, and Threats

The strength of the project is enveloped in the passion of care givers to improve the patient care delivery system. Each entity from pre-hospital Emergency Medical Services, to the CAH emergency room staff, and physicians, critical care transport (Flight for Life®), and the tertiary care hospital are dependent upon the efforts of the rest of the team. Teams recognize their strength is measured by the weakest element. These teams work together, based upon past relationships, and did not have the luxury of a defined patient algorithm.

Strength developed from events and members outside of the care delivery team, as well: The spotlight placed upon this project, the recent development of business relationships between HRRMC and Centura Health®, along with the team building efforts have created bonding. Health care is enhanced with repeated delivery efforts and review of performance. Defined standards allow measurement of success and identification of areas for growth. Standards give

direction and the STEMI standards are strongly evidence based, successful and useful in this rural setting (Kushner et al., 2009).

Strength is found in the use of a national CPG in a new setting by a nursing doctoral candidate. This is a classic application of CPG to wider populations and well within the scope of nursing practice to evaluate. This is not original research and does not change the evidence base but encourages a process improvement level project to enhancement of patient care service delivery. This is great project idea with positive outcomes for the patients, staff, facilities, and student project leader.

Weaknesses of the project include the long upstart time. For more than one year the team has heard about data collection and has yet to be benefitted by the product. The quality improvement skill sets within the team were somewhat weak, but have not been strengthened by the timing gap between discussion/commitment and outcome data availability. The EMS provider, Chaffee County EMS, tends to not return phone calls and email communications. It is as if their attention has been lost. This is not enhanced by the 350 mile commute to contact the service provider team, although most rural settings are distant by definition. Attempts made to stay in touch with the team via phone calls, emails, and notes mostly failed. Contact with the Chaffee County EMS medical director rekindled communications. In absence of activity, training materials were sent to the staff. The real objective is patient care data outcomes, not team building, although the development of outcomes without a strong team commitment would lessen the project strength.

The largest project design weakness which looms over the project design is the low volume of cases. Although this project might benefit from a three year data collection series, there is no ability to achieve the set number to treat through power analysis calculation. It is challenging to derive interventions and changes to the plan based upon low volume. The annual

volume of STEMI cases in the past was less than ten cases per year. The author and team are aware of the volume's influence upon the metrics: one case can profoundly influence outcomes when the denominator of cases evaluated is a low number.

Opportunities have arisen from the concept of this project as well. Although this design is STEMI specific, it holds qualities which transfer to other patient care diagnosis. The pattern of the team work and development of an algorithm may be adopted with Heart of the Rockies Regional Medical Center. The concept of linking of a health care provider group from the rural setting to an urban care facility is gaining momentum and further discussion. Corporate Centura Health® is considering the design and proposal of a CNS position for rural health care delivery at Centura Health®. The linking of the physicians in the ED by conferencing technology to the physicians at Penrose Hospital is Colorado Springs is expanding to other issues and services. It is exciting to know the products of this project will feed into other care delivery situations and develop a larger comprehensive scope for more programs.

Threats created by this project are both real and imaginary. Over time, health care facilities have become competitive. This is much less prominent in rural facilities and Critical Access Hospitals which do not have another facility within 35 miles (Newhouse et al., 2011). A competitive threat expressed by the staff at HRRMC revolves around the transport of patients away from the community for care delivery. Knowing this would be a concern, a re-patriation discussion was offered early in the project. The care provided cannot be provided at HRRMC, so the specific threat was modified slightly. Imaginary threats included concerns for ambulance service when involved with transport to tertiary care in Colorado Springs (only one ambulance crew in Chaffee EMS), even though transport was planned by an outside agency for this exact reason. This author has not been told, but perceives a concern regarding the project being completed by a future nursing doctorate. The community is very down-to-earth, and most rural

facilities are staffed with nurses with associate degrees rather than Bachelor of Science in Nursing graduates (Newhouse et al.). Bedside nurses may not always identify with post-graduate degree nurses.

Driving and Restraining Forces

The driving force is a national prominence of rural health care efforts and the multitude of statewide programs developing at the time of this Capstone writing. Recent gains in improved mortality for STEMI (National Center for Health Statistics, United States, 2008) caused a national movement for a project known in the literature as D2B (Door-to-Balloon) (American Heart Association, 2011). Publication of the CPG (Kushner et al., 2009) resulted in local application of the guidelines with facility success in reducing the time from emergency room admission (door) to open vessel (balloon). Many subsequent studies (Aquirre et al., 2008; Coleman et al., 2006; and Diericks et al., 2009) focused upon aspects of the process with descriptions of further program enhancement and reduced ischemic time is well published and replicated. The American Heart Association (2011) efforts in Mission Life Line® was the first national effort to bring this CPG approach to the rural setting with transferred patients sent from rural and CAHs to tertiary care. Grants are available for groups working on statewide or regional efforts, with the funds being used for accelerated program growth (American Heart Association) and Colorado Mission Life Line® received a grant in February 2012.

The restraining forces include the reality of the rural health care environment, rural funding, rural resources and change acceptance (Lutfiyya et al., 2007; Newhouse et al., 2011). Preference for care delivery in the rural setting (Lutfiyya et al.) strains a program which relies upon emergent transport to a tertiary care facility. Planned rural hospital engagement strategies are now being developed in Colorado (American Heart Association, 2011) to address the concerns and rural reluctance to heart attack care.

Need, Resources, and Sustainability

Need for the project. Rural counties have less health care resources at their disposal (Newhouse et al., 2011). By definition the ratio of care providers to citizens is low (Newhouse et al.). The advent of CAHs included the presence of every day of the week around the clock EDs with a physician or licensed independent practitioner on site (Lutfiyya et al., 2007). Support is needed for care of critically ill heart attack patients, as the CPG calls for rapid intervention of either primary percutaneous interventions or the administering of fibrinolytic therapy to reduce tissue level ischemia (Kushner et al., 2009). The care may be initiated in the CAH environment, but further interventions outside the rural setting scope are required for best outcomes (Kushner et al.). The 2010 volume of three cases for this project is part of the story. Twenty patients were transported with the belief of possible infarction or critical cardiac disease, while only less than one-sixth of those patients had a STEMI diagnosis. False positive rates occur in all STEMI programs (Kushner et al.). All of those transported would have benefited from rapid assessment, initial CAH ED services, and definitive care at the tertiary care facility. The clinical problems are real and impossible to manage at CPG level without organized services and tertiary support.

Resources for the project. The resources essential to the STEMI CPG algorithm were all present before the project began. New resources were added to simplify complexities. For example, the use of Centura Connect® for transferring the critically ill STEMI patients was used for trauma services but not for cardiac services. This is a one-call intervention and provides: a consulting specialist (cardiologist or trauma surgeon), transportation arrangements via Flight for Life®, and a bed at the tertiary care hospital, Penrose Hospital in Colorado Springs. The process existed in the system; however, it was not focused upon the cardiac population. Another added service is the telecommunications via Skype® and other internet links. This allows the ED physician to discuss cases with the cardiologist, face-to-face and develop strong professional

consultative relationships. The two sets of physicians had talked on the phone but often through others, such as charge nurses and cath lab staff. The new avenue for direct communications remains, to date, underutilized.

Sustainability of the project. Sustainability will be evaluated long after the program is completed. If the staffs at all of these agencies see added benefit to the patients and allow the new practice patterns to take hold, the programs will be sustained. There is sense the algorithm is more efficient than informal communication systems. It is hoped the program will find sustainability and grow through transfer of some processes to other diagnostic care designs. Time will be the judge of the sustainability of the STEMI care program for Salida Colorado.

Using Rogers' *Change Innovation* was a deliberate change theory choice related to the emphasis upon sustainability after change is adopted. Lee (2004) identifies Rogers' theory as a practical manner to develop a strong early base of support. This allows support to be established early in the project and sustainability likely (Lee) with diffusion of ideas through a group.

Feasibility/Risks/Unintended Consequences

Rural heart attack care is required infrequently and therefore is a high risk, low volume care activity. Since most of these patients are quickly assessed and received fibrinolytic therapy, the treatment adds to both the benefit (reperfusion) and risk (bleeding, stoke, and death) (Kushner et al., 2009). Rapid transfer to higher care services in the catheterization lab is ideal for the patient outcome (Kushner) and preferred by the providers managing a critically ill patient in a rural emergency department (Lutfiyya et al., 2007). Employing an algorithm tends to reduce the work variance. Rapid transfer and improve intra-facility communication may improve with algorithm use.

Other unintended benefits have been noted in staff development. The author provided classes in accurate lead placement in order to improve quality of 12 lead EKGs at HRRMC.

Return demonstration provided the instructor and participants with increased confidence of accuracy with electrocardiograms. Another class is scheduled shortly after the Capstone completion to teach reading of the 12 lead EKG as an assessment tool for HRRMC staff and Chaffee County EMS providers. Also, the group assisting with the case review has identified care interventions which are similar processes between trauma and cardiac cases such as the use of the written checklist. It is likely the skill sets become stronger and increase in competence with repeated use in the clinical setting.

Stakeholders and Project Team

The primary stakeholders are the citizens of Chaffee County and surrounding frontier areas. The benefit of CPG application is identifying who would benefit from timely health care access. The next level of stakeholders is the participating staff groups: Chaffee County Emergency Medical Services, Heart of the Rockies Regional Medical Center, Centura Connect® and Flight for Life®. The third tier of stakeholders is staff in the receiving facility, Penrose Hospital in Colorado Springs. These staff groups are large and include groups that were not part of the project design process, such as admissions clerks, unit secretaries, staff nurses and physicians, hospital administrators and EMS directors. Many stakeholders have been included on the project design. Input from the stakeholders has been sought formally in meetings and informally while teaching skills (performing and reading 12 Lead EKGs) and discussing case reviews.

Lastly, as a project leader, the author is stakeholder in the outcome of this project. In preparation of a scientific review, the author has involved Capstone Chair, Capstone Mentors, clinical faculty, Regis University faculty, fellow cardiovascular specialists, and the American Heart Association resources for Mission Life Line®. It is likely all of those involved have some degree of interest in the outcome of this work. The stakeholder group is large and robust.

Cost/Benefit Analysis

Cost/benefit of any project is best approached formally. In the past, nursing has not always looked for the economic and clinical feasibility of project before moving ahead. To gain support from leadership, who have economic and conditional margins for project adoption, it is best to consider a frank analysis of the cost of the project and match expenses to the benefits of the project.

Wonderling et al. (2011) reviewed the use of cost analysis in clinical practice guidelines published by the National Institute for Health and Clinical Excellence. Concepts which were applied in those programs are relevant for application to a smaller scope project, such as rural heart attack care. Wonderling et al. found three myths as common threads in the pursuit of cost analysis. First, Wonderling et al. stated the aim of health care economics is not to save money, but to get the best purchase for the cost. Next, it was discussed that some very costly interventions are cost effective if the problem is managed early, completely, and to an enhanced outcome. Lastly, Wonderling et al. refuted the main aim of cost effective analysis is spend less on clinical interventions. Effective resolution of the clinical situation is an important consideration according to Wonderling et al. So it may be cost effective to develop an expensive but clinically significant resolution to the problem of rural heart attack care.

Review of the cost effectiveness of community based fibrinolytic therapy, followed by transportation to a tertiary care facility, and the use facilitated percutaneous coronary interventions (PCI) (defined as PCI following a full fibrinolytic dose) was completed by Coleman et al. (2006). This study matched 127 facilitated PCI patients with 127 primary PCI patients and found total hospital costs were reduced (used statistical analysis of a non-parametric bootstrap analysis). Other findings included the facilitated PCI patients had better blood flow reperfusion and bleeding complications remained stable between the two groups ($p = 0.002$)

(Coleman, et al.). Other findings were not statistically significant, mostly due to low statistical power. Length of stay was similar in both groups according to Coleman et al.

Benefits from the program reach the primary stakeholders (citizens of Chaffee County) and ultimately all stakeholders. The Rural Heart Attack Care Health Care program has suggested an effective care algorithm be utilized in place of a random care pattern for heart attack patients. The effectiveness lies in the vast stakeholder numbers, the use of current health care assets, and the gathering of data points which indicate key interventions. Cost may be incurred with data gathering aspects of the project. With a low volume of cases, this cost is not predicted to be over-whelming. The program methodology will be replicable within the agencies participating in the Capstone Project and in other patient care delivery facilities. The benefits of this project are tangible.

The budget for the Rural Heart Attack Health Care Project can be reviewed in Appendix B. The budget accurately reflects the costs incurred for the project. This specific project was academic in nature and completed at the cost of the author's time, energy, expertise and workload. Centura Health® offered support for gas/travel and donated the American Heart Association teaching materials for STEMI Certification. Support from the American Heart Association was donated through the voluntary efforts of the Colorado Mission Life Line team.

Mission and Vision

The mission statement for the rural heart attack care project would be stated as: The Rural Heart Attack Health Care program uses a pre-determined algorithm of care delivery to develop a network for rural patients with ST Elevation Myocardial Infarctions. Mission statements are to contain the direct process and be contained within one sentence, with a description of the reason for existence (Hansen & Bennett, 2009). The vision statement for the

rural heart attack care project should enhance the transparency and interdisciplinary collaborative efforts (Hansen & Bennett).

The vision statement would include:

- Development of a care algorithm based upon clinical practice guidelines for STEMI care
- Inclusion of all care providers in program development: including pre-hospital services, ED care providers, critical care transport, tertiary receiving hospital
- Use of the established care network for all STEMI patients
- Re-patriation of patients upon return to their community
- Data collection, program evaluation and outcome review of each use of the network of care delivery.

Goals

The goal of the rural heart attack health care project is to bring multiple care providers together forming a care delivery network for those patients needing critical services, delivered in a timely fashion while experiencing an acute myocardial infarction. The standards of care, well established in the urban setting (Kushner et al., 2009), would be applied to a rural setting. The selection of a setting such as HRRMC in Chaffee County and Salida Colorado is ideal. Components of the care delivery for STEMI patients existed prior to the project. Working together, in order to strengthen coordination of the existing components, the inter-disciplinary team would form a pre-planned network of care, ready for the demands of the STEMI patients.

The individual process goals are discussed thoroughly in the next section of the paper. The true value and importance of the project is the overall goal of improving care delivery and patient outcomes through the use of a pre-determined care network. Each service working

together forms a tightly bound team and the efforts for patient care are collaborative, smoothly executed, and measurable.

Process and Outcomes Objectives

The outcome measurement of the rural heart attack network is far simpler than the process of the team development and change activation. Use of the algorithm is answered with yes/no responses and therefore is a dichotomous variable. The use of the algorithm contains several elements and may be considered to be a bundle (The Joint Commission, 2011). Bundling implies several interventions are interdependent upon each other and the success or failure can be captured through a bigger picture of the whole clinical event or a process bundle.

The concept that the algorithm would develop clinical compliance is a nurse-sensitive outcome. Ingersoll, McIntosh, and Williams (2000) offer a rank order of Advanced Practice Nurse (APN) outcome measures, completed in their survey research. The findings include compliance/adherence as the fourth highest ranked outcome and use of appropriate services at appropriate time ranked eleventh of 27 APN outcomes (Ingersoll et al.). It is the role of the DNP to move the group to algorithm compliance.

The group work toward process improvement, the integration of multi-facility teams reviewing STEMI and employing steps of the STEMI algorithm are new experiences to these clinical practitioners. From that perspective, the compliance with the algorithm is also an organization(s) sensitive outcome measure. Compliance may have a variable result and the bundle compliance will most likely be intermittent. Adoption occurred more readily at HRRMC than EMS. EMS is tightly governed by rule driven protocols which may make the algorithm transition more complex than the CAH. Previous work with Flight for Life® crews on critical STEMI care has demonstrated very early uptake of guidance with algorithms and integration of

EBP. Based upon cultures at each organization, this author anticipated and met the challenges for the hospital and EMS.

The remaining outcome measures are process steps. The process steps or interventions are timed and most are organization-sensitive. See Table 4. Outcome Measure Specifics.

Table 4. Outcome Measure Specifics

Outcome Measure	**Responsible Entity**	**Purpose of Measure**
First medical contact to EKG	EMS	Rapid assessment of STEMI situation
First medical contact to Ambulance load (known as scene time)	EMS	Rapid movement of patient from scene to ED
Total EMS Time (Known as First Medical Contact to Emergency Department Arrival)	EMS	Total trip timing
HRRMC Emergency door to cardiac alert notification (Measured as admission to completion of facility EKG)	ED RN, MD	Diagnosis timing
Door to fibrinolytic therapy	ED MD, RN	Re-perfusion timing < 30 minutes
Call to Centura Connect® for transport	MD	New process for transport, bed at Penrose, physician notification, communication
Load for transfer to arrival at Penrose	Flight for Life	Emergency load and transport time
Arrival at Penrose Hospital	Flight for Life	Measure ischemic timing
Direct admission to Intensive Care	Emergency MD	Bypass ED, or direct to Cath Lab

Multiple exact time points were determined using the variables listed in Table 4. The comparison group includes the patients from 2010 (prior to the algorithm) and the intervention group includes all patients subsequent to the algorithm adoption (patients in 2011). The benchmark is over all reduced time in minutes. Any reduction is a positive result. The CPG indicates the outcomes improve at certain time reduction points (Kushner et al., 2009). Kushner et al. state increased time reductions are not noted to enhance outcomes further.

All original time points were not present in the medical record. The data collection was modified by the documentation available. In that case, clusters of the care delivered became the bundle of care evaluated. For example, EMS call to base was not documented and therefore not measurable. The call to base is routinely provided between the first medical contact and loading the patient in an ambulance to transfer to the hospital. Call to base was determined to be an activity in the EMS bundle of care. All other outcome measure specifics were abstracted from the medical records and evaluated.

Logic Model

The program logic model is designed to link outcomes with processes of a project (W. K. Kellogg Foundation, 2004). The logic model assists to develop strategies and processes while comparing reality to goals and objectives (W.K. Kellogg Foundation). This use of an evaluation tool contributes to ongoing program development and offers a thorough evaluation of any processes with complex relationships and multiple outcomes (W. K. Kellogg Foundation). The systematic and visual display of multiple processes clarifies the intervention details and suggests relationships with possible resources (W. K. Kellogg Foundation).

All process interventions in the care of the STEMI patient are evaluated for resources, program activity, output, outcomes, and impact are seen in Appendix C. The logic model allows distinct variation in each intervention to be clearly defined, and the table format encourages visualization of planned work and achieved outcomes. The logic model is valuable tool for complex project evaluation(s).

Population and Sampling Parameters

Each element of an intervention has been weighed and evaluated by the multi-disciplinary healthcare team. As in most process improvement ventures, data points needed to meet the following rigorous criteria. These include, but may not be limited to:

- Data must measure the event or intervention: for example EMS arrival on the scene is not a valuable time landmark but first medical contact with the patient is essential. Some arrivals at the scene are minutes away from actual patient contact.
- The intervention must be within the scope of the healthcare team members: the onset of the patient's STEMI symptoms until the patient calls for EMS services is not within the healthcare team control. This time is valuable and contributes to length in time of tissue ischemia, but is not controllable by the process improvement team.
- All timings are made with an atomic clock: the precision of this timing cannot allow for variance of personal watches or timing devices. Atomic clocks are found on cellular phones and computers.
- Sequencing appears on the algorithm and for major interventions will be evaluated as the clinical practice guideline sequence. Events without need for strict sequencing as less likely to be measured, reviewed, and evaluated.

The data points were taken from the medical record. Some basic demographic data was also collected to make the data collection more robust for clinicians. The records used included the computerized EMS records, the Electronic Medical Record (EMR) from HRRMC, the manual log from Flight for Life® Air Ambulance, the EMR at Penrose Hospital and the ACTION® Registry of Penrose Hospital (STEMI registry for The American College of Cardiology). Data points were selected with the knowledge the fields were available for documentation or available in open dictation into the medical record. It did not require any sacrifice of key elements within the algorithm and all measurements will be made from closed medical records.

The comparison group was derived from a listing of patients transported to Penrose Hospital from HRRMC with a cardiac diagnosis in 2010. The patient case list was reviewed by

the author and the HRRMC clinical leadership for possible STEMI cases. When focused upon STEMI, the listing narrowed considerably and cases over one year were used as the comparison group. This data was recorded onto the data spreadsheet in a data testing trial of the key interventional data points. A second reading of all medical records was completed in an attempt to reduce missing data elements. The data collected was compared to the ACTION® registry findings to allay discrepancies in the data collection.

In January 2012, the medical records from 2011 STEMI cases were reviewed by the same group of abstracters at HRRMC and the author. The intervention group was a post-algorithm intervention group of STEMI records. The 2011 medical records were read once and recorded on the data base spreadsheet. Again, the abstracted chart data was compared to the ACTION® registry findings to reduce discrepancies.

Setting of the Evidence-Based Project

Encompassing as the STEMI clinical practice guidelines appear, the care algorithms have been dedicated primarily to urban settings, major medical training facilities, and centers of excellence in cardiac services. Applications in rural and frontier health-care settings are left to forge the process of application of the otherwise well-known care algorithms. This is not a simple translation, as the location of definitive care would not take place in the rural settings; therefore, the patient must be transported to the care delivery setting. This strategy of critical care transport of the STEMI patient, coupled with the author's philosophy of caring for the underserved population set this author's Capstone Project in motion.

The Capstone Project involves re-design of every intervention from the CPG for safe time compression, prioritization, and coordination with previous and future interventions. The seamless flow between EMS, CAH Hospital ED, Critical Care transport, and tertiary receiving

hospital is essential. The need for communication, coordination, and team building between the multiple entities involved is pivotal. Each entity is dependent on the other entities for satisfactory algorithm achievement. The outcomes for rural communities can meet the known national/international benchmarks with coordination, pre-planning, and process monitoring.

The Capstone Project is an application of urban STEMI care measures in a rural environment. Little compensation is given for the environmental and social adjustments of rural life style. All standards remain rigid, the outcome measures acknowledged by the teams, and the teams determined to meet the needs of the patients experiencing the most life threatening form of heart attacks.

Due to low population density, rural health care presents with unique project issues regarding a low incidence of STEMI events. It is more difficult to use data for clinical program changes when volumes of studied events are low. It may require an extended period of time to collect significant sample volumes. Small sample size may reflect upon the acceptance of the project outcomes by some reviewers. Quality improvement (QI) is designed to be institution specific and of use to the stakeholders (Cook & Nelson, 2011). The usefulness of this work by other facilities is not a key consideration. Like demographic groups of patients, facilities, and care providers may find this work of value for use in their STEMI care programs.

Quality and process enhancement studies such as this Capstone Project include all patients in the population requiring STEMI care. According to Cook and Nelson (2011), practice improvement projects often include all patients lending to outcome evaluation of all patients included in the population. Results are designed to enhance safe, effective direct patient-centered care.

Evidence-Based Practice Design Methodology and Measurement

Design methodology and measurement. This project is designed as a pre-post study. The data is analyzed in time intervals. Since the healthcare process for STEMI care is very complex, multi-disciplinary, and varied in location, provider, and acuity; the measure of minutes make the analysis both unified and fluid. This measurement of the independent variables is compared to the same indicators, the same independent variables, and after the establishment of the clinical practice guideline algorithm. Success is measured by a reduction of overall minutes spent in care delivery from first medical contact by EMS, HRRMC, and critical care transport until the transport to the tertiary care facility.

Statistical testing for pre-post study design is the testing of the difference of two means. This is accomplished by the two-sample *t* test (Polit, 2010) which is ideally designed for two groups with numeric outcomes. Polit explained that a "sampled means is seldom exactly the same as population means because of sampling error" (p. 115). One method to reduce sampling error is to increase the project group size, which is not possible. The project group size is limited by the time allowed for data retrieval and is far less than ideal for reducing error.

Power analysis allows the study investigator to know the desired sample size to reduce risk (Polit, 2010). The use of small sample size is risky, as Type II error is likely with small sample sizes (Polit). The sample size, power, effect size and significance criterion are used to determine power analysis. According to Polit on the "Power Table for One-Way between Groups ANOVA" (p. 422) for alpha = 0.5 and a needing a power of .80, the case number needed to be 53 cases. Clearly, the comparison group of three cases and the intervention group of seven cases fall very short and the project is under-powered statistically. In spite of the Capstone lacking power for statistical significance, the project endures as a process improvement project and may have clinical relevance in the institution(s) studied (Cook & Nelson, 2011).

Some assumptions are made when the independent variable is nominal level, dichotomous, and uses interval-scale characteristics (Polit, 2010). The assumptions include: the participants are randomly sampled, the dependent variable is normally distributed, (easier to validate with larger sampling sizes) and the homogencity of variance is assumed (Polit). If the population sizes are unequal between the two sets, the *t* test may have Type II errors (Polit, p. 117). Type I errors are likely with small group sizes. The comparison group is three cases, so the project presents statistical challenges also based upon the size of the intervention group of seven cases. Low *n* contributes problems to statistical testing in most quantitative work (Polit).

There is a dichotomous variable (Polit, 2010) as an answer to the algorithm compliance project question. The bundled care either is algorithm compliant or it is not: yes/no. The bundled care is a very extreme measure of clinical excellence. Some noted discussions are offering the slang name of *Perfect Care* as this is a very high standard of practice (The Joint Commission, 2011). *Perfect Care* does not always directly offer concrete feedback for ongoing growth as process improvement, so discrete reviews of individual variables become a valued approach.

Missing data management. Closed record outcome studies may have some missing data (Kane & Radosevich, 2011). One cause of missing data, which is less likely in closed record chart review, is attrition. This project studied the care provided in one contact experience and therefore is unlikely to have issues of patient attrition. The closed medical record review did have missing data elements, as experienced during the challenge of the comparison group chart review. The medical record is entered at the time of care delivery. Closed chart reviews occur after care delivery and data is often permanently lost. Missing data threatens the integrity of outcome research (Kane & Radosevich).

The acceptable manners for dealing with missing data are complex. If in review, the data element commonly missing does not contribute to the outcome research, the data variable may

be dropped (Kane & Radosevich, 2011, p 309). Working with the nursing administration team at HRRMC, this author dropped several missing data variables without impact on the project outcome. One example of dropped data collection was the EMS call to base. It is part of the process but can be assumed to occur between the first medical contact by EMS and loading the patient for transport to the hospital. Since the study team did not redevelop the process of the call to base intervention, they did not hesitate to drop that data. Kane and Radosevich stated that it is better to drop variables than to drop subjects or patient cases. It is possible to substitute a dummy variable code which flags the element as missing, but it does not impact the overall data review (Kane &Radosevich). In linear regression techniques, substitution is often used when the majority of variables are present, and a small number of variables are missing (Kane & Radosevich). This author did not flag or substitute missing data elements.

Protection of Human Rights and Ethical Considerations

A fine line exists between process and quality improvement projects and research. Both processes use patient data, medical records, or queries, albeit averaged, de-personalized, and collated into group data. Both may be published, therefore exposing the patient's private information. The Health Insurance Portability and Accountability Act (HIPPA) offers the need for regulatory oversight of all research projects (Morris & Dracup, 2007). Although quality improvement (QI) may have direct bearing upon patient care improvements, many of the QI characteristics seem to closely match research initiatives and methodology (Cook & Nelson, 2011).

Classically, research acknowledges the potential for risk to patients, requires consents and Institutional Review Board (IRB) oversights (Morris & Dracup, 2007). QI can be confused with research as it addresses clinical questions, downloads patient data or directly retrieves data from the bedside, applies data analysis, and distributes the findings (Morris & Dracup). The

pivotal issue appears to be the assignment of risk to the patient, the patient's rights, and privacy. QI purports to include all patients, work towards improved care delivery and has direct applicability to the patient population (Morris & Dracup). Morris and Dracup also state the lack of fixed, rigid protocols and the design invested to sustain process improvements make QI substantially different from research. Improving health care quality and process is actually a foundational, integral activity of health care institutions and providers.

A manageable strategy for determining if oversight is needed is to simply apply to the IRB for review and possible oversight. Mostly, QI projects are either expedited or exempt from the IRB review situations (Morris & Dracup, 2007). The concerns of privacy, data use, publication, intervention application, and patient rights are fully the responsibility of the IRB oversight group. As website offerings, presentations, and publications urged by institutions for marketing and community status increases, the IRB is useful for patient rights and protection.

This Capstone Project was reviewed by the IRB for Regis University and the IRB of Penrose Hospital, the tertiary care facility. In preparation for those reviews, the educational offerings from Collaborative Institutional Training Initiative (CITI) and National Institute for Health (NIH) were completed with post-exams and certificates awarded. Completion verification is found for CITI training in Appendix D and for NIH Training in Appendix E.

Applications were sent to both IRBs in July, 2011. As a trusted resource, the direction from the IRB is taken to heart and applied to work of the rural STEMI Capstone Project. The acceptance of the Regis University IRB was confirmed as IRB # 11-254 and deemed exempt, on the letter dated October 13, 2011, as seen on Appendix F. On October 31, 2011, the Penrose IRB status was declared Expedited Review, Project # 266116-1, as seen in Appendix G. In compliance with Penrose Hospital policies, a letter of support from Nursing Administration was also required and is found in Appendix H.

Instrumentation Reliability and Validity

Reliability is the outcome measure of reproducibility, while validity is a process of assuring the work measures what it was designed to measure (Kane & Radosevich, 2011). With more detail added, reliability considers the impact of random error or chance impact upon the outcome while validity is concerned with bias (Kane & Radosevich). Ideally, error or random chance should have a very limited, predetermined margin of about 5% (less for pharmaceutical trials).

Reliability and validity of studies are important measures of study design, all focused upon reducing error (Kane & Radosevich, 2011). Kane and Radosevich remark that reliability is a function of the instrument employed, the users and the methodology used. Five approaches to measuring reliability are offered by Kane and Radosevich:

1. Inter-rater or inter-observer reliability
2. Intra-rater reliability
3. Test-re-test reliability
4. Split-half reliability testing
5. Internal consistency measures (p. 65)

The rural STEMI Capstone Project needed to meet the reliability tests for inter-rater reliability as several staff did gather the data. A double check of documentation abstraction is an easy method to verify inter-rater reliability. This double check may serve to demonstrate intra-rater reliability as well. At the time of data abstraction from the medical record, elements were compared between abstracters and verified as accurate. Both abstracters recorded findings and all findings matched at the end of the record review. Test and re-test measures may occur as the project lingers, over time, to develop a useful number (*N* and *n*) of cases.

The data was also verified against the ACTION® registry of the American College of Cardiology (Kushner et al., 2009). ACTION® data was entered by abstraction experts, with

training in chart abstraction skills from Penrose Hospital. Penrose Hospital independently reviewed the same medical records and abstracted hundreds of indicators. This project has a very small over-lap with the large data bank of the ACTION® indicators. The Capstone Data Tool employed may be seen in Appendix I.

One case presented as a discrepancy between HRRMC data abstraction and the ACTION® registry in the intervention group from 2011. The case had not been identified for inclusion at HRRMC using transfer logs, diagnostic coding and Flight for Life® records to determine all possible cases. Inclusion of the case was determined to be credible, as the final diagnosis of STEMI was made at Penrose Hospital. This indicated the inter-rater reliability proportion to be 90% between the HRRMC team and Penrose Hospital's ACTION® registry. The individual data elements were not found to have discrepancies between the HRRMC team and ACTION® entries. Working with a small sample size, the impact of one variance looms large for inter-rater reliability.

Kane and Radosevich (2011) identify three C's of validity. Content validity refers to the "…comprehensiveness of the measure. Criterion validity refers to the gold standard and construct validity implies scientific theory supports or refutes the constructs" (p. 71). The presence of these three variables in the Capstone work can be explored further.

Using the methodology of QI may limit the comprehensiveness of the project question, as QI is usually limited to the setting in which it is performed. This Capstone Project is not a comprehensive examination of the measures. The algorithm used as the independent variable is the gold standard of STEMI care; therefore, criterion validity would be rated very high. These interventions are built from strong evidenced based practice (construct validity), well-studied, and published clinical practice guidelines, based in scientific theory. Therefore, the validity of the project is variable and the work does not qualify as research.

QI work has very high internal validity and is used within its organization(s) to change care delivery (Morris & Dracup, 2007). By nature and design it is developed with the organization specifics in mind, applied in the setting in which the data is abstracted and in some cases many have sustained benefits over time. QI is very specific to the group studied, the timeframe the abstraction took place, and the stakeholders involved. Most QI work is very high in internal validity.

On the other hand, QI is more likely to be lower in reliability. QI as a designation specific project by its nature is not always reproducible in other settings. The work of this DNP Capstone is an application of the ACC/AHA clinical practice guideline (with a data bank of > 645,000 acute myocardial infarction patients in the ACTION® registry (Kushner et al., 2009)) to a new setting in the rural healthcare networks. In one manner, this project is testing the reliability of the national standard. It is not intended that this project be globally applicable, but this author does have the goal of reproducibility for Centura Health® in very closely matched rural health care networks providing STEMI care.

Threats to validity for this project include low statistical power generated from the low sample size found during the short time of this academic course of study. The lasting impact of the project is the strong application of clinical practice guidelines combined with process review, QI, and intervention enhancement.

Unlike typical research, there is no randomization, no assigned control group with different care provisions in quality improvement/process improvement programs. QI is contextual and to be judged by the full range of impacts upon outcomes (Berwick, 2008). The generalizability of QI may be limited, but the contribution to health care delivery is superior (Cook & Nelson, 2011). QI focus is directed at the stakeholders, patient care delivery, and primarily designed for the organization's benefit (Cook & Nelson). There is a direct impact upon

the practice or process of health care delivery outcomes with process evaluation, modification, measurement and communication of those efforts/results.

Data Collection and Treatment Procedure

Data collection was an early consideration during the plan for the Capstone Project. The Process Model for the DNP Project (White & Zaccagnini, 2011) did not refer to data collection and dedicated a complete description, "Step VIII Giving meaning to the data" (White & Zaccagnini, p. 498) to analysis and application of data. According to Tymkow (2011), collection of meaningful data may be challenged as the outcomes often do not directly relate to the DNP effectiveness in the project. The primary objective of the data collection is to improve the process of care delivery yet the role of the author in developing the change in practice would ideally be evident in the data collection (Tymkow).

The data collection was derived from the CPG designed by Kushner et al., (2009) and the key elements were interventional steps in a larger process. Each intervention became a data point for collection. See Appendix I. The process of Chaffee County EMS arrival, assessment, load and transport were one subset. Next, the care delivery at HRRMC in Salida had interventional steps of arrival, 12 lead EKG, delivery of fibrinolytic therapy, repeat EKG, and call for transport to tertiary care. Critical care transport interventions followed with arrival at HRRMC, load of the patient, transport and arrival at the receiving hospital, Penrose Hospital in Colorado Springs, Colorado. Finally, the process of Penrose Hospital arrival and admission were intervention steps worthy of consideration, although not changed in the process improvement plan.

During team meetings in Salida, the team selected the demographic data for collection and review. This data included the date, age, gender, time of medical contact and use of EMS or walk-in presentation. The HRRMC team wanted to know if the patients were local residents or

visitors from out of state, so “Hometown” was added to the demographic profile. EMS providers wanted the mileage from the patient pick up site to HRRMC to be included. Case reference numbers were added to de-personalize the data collected from the medical record and to respect human rights during the data collection and dissemination.

Initially, some steps were of interest but not available in closed chart review. One example is the collection of blood work for laboratory testing upon starting an intravenous line. This finding was EMS based, proved to not be in the medical records and was subsequently removed from the data collection.

Other data elements were difficult to consistently find in the medical record or less relevant to the larger interventions. Initially, the first EMS contact with HRRMC was to be included but the call to the base station was not documented with a time notation. The time of the Aspirin dose and Plavix® (Clopidogrel) were not as important as the timing of fibrinolytic dose and not gathered from the medical record. Aspirin and Plavix dose timing were removed from the data collection. Finally, the data collection needed to include the new interventions of the algorithm: EMS time from patient contact to load, total EMS time, use of checklist by HRRMC, use of Centura Connect® for transport, and total HRRMC time.

The method of data collection was tested in late 2010, after IRB approval for the project, with an initial review of medical records. The team at HRRMC selected a group of leaders from the Emergency Department, the Operating Room, Respiratory Therapy, and Nursing Education led by the Trauma Coordinator who had experience in chart review, data abstraction, and data collection tools. Flight for Life® generated a list transfer cases that had arrived at Penrose from HRRMC. The team reviewed charts for data points of interest. The team noted which elements were not available in the medical record and read the records, manually transcribed date onto an Excel spreadsheet.

In January 2011, the remainder of the cases from 2010 were reviewed. This was to be the comparison group, the baseline data. The listing of patient records had trimmed down from the original 20 to 10 medical records which appeared to be the STEMI cases. The inclusion of the final diagnosis of STEMI cases trimmed the listing to three cases. The omitted cases were other forms of critical care heart disease such as non-STEMI infarctions, heart failure, cardiac arrest, or unstable angina. Final diagnosis was determined at Penrose Hospital based upon the cardiologist's diagnosis, cardiac catheterizations, echocardiography and disease findings such biomarkers for troponin.

Penrose Hospital employs chart abstractors and participates in the ACTION-GWTG® (ACTION-Get with the Guidelines) registry. The national cardiovascular registry (National Cardiovascular Data Registry [NCDR], 2012) joins the previous ACTION registry with the former Get with The Guidelines-CAD registry. The redesigned registry NCDR (2012) proclaims to provide robust data collection, emphasize CPGs so the treatment of heart attack patients is consistent, does not lag behind new findings in the CPG, compares practice between providers/facilities and remains based upon science. The data abstraction for NCDR and ACTION® is clean, verified data and publically reported (NCDR, 2012). This data is reliable, retraceable and the author considered it to be clinically relevant to this project. Final diagnosis of STEMI was taken from this national data bank, which resulted in the small comparison group of three cases.

In January 2012, the charts from all of 2011 were reviewed by the same team of HRRMC staff and the author. There were fewer charts for initial consideration and this data collection included the new steps from the algorithm for the interventional group. There were a total of 18 possible charts; 12 were reviewed. Six charts were considered as STEMI cases, from the detail in the HRRMC medical records. When compared to the ACTION® data bank managed by Penrose,

one more case was identified as a STEMI transfer from HRRMC. The group of cases in the intervention group consisted of seven cases.

The data were treated carefully with multiple data abstracters reading the findings. The emphasis was upon the documentation of the events, and no contact was made with the patient, the care providers, or the physicians to substantiate the medical record findings. Use of Penrose Hospital's ACTION® data was important to verify the credibility of all data collected. Since HRRMC does not participate in cardiac registries, they have delegated data abstraction to Penrose Hospital. Many smaller hospitals cannot afford the registry fees, the cost of data abstraction, the training and salary of the abstracters and the low frequency of the data returned (based upon low frequency of patient events). The use of the tertiary care facility for data abstraction is common and likely to help the CAH in quality reviews (Mission Life Line, 2011). The final diagnosis of STEMI cannot be made until the diagnostic testing at the tertiary care facility is completed, so there are meaningful reasons to include the registry data during closed medical record reviews. The inclusion of the CPG in the all of registry data presents as an ideal data standard for the Capstone Project.

Project Findings and Results

Findings by Objective

The findings from the closed chart review of the comparison group process for STEMI patient care and the closed chart review of the intervention group process for STEMI patient care may be viewed in Table 5. Findings of the Outcome Measures. This data reveals the comparison group, prior to the algorithm, received care in 2010 and had an $n = 3$. Of those three cases, only one employed Chaffee County EMS. The intervention group, care provided after the algorithm, in 2011 had an $n = 7$, with four cases employing Chaffee County EMS.

Table 5. Findings of the Outcome Measures

Outcome Measure or Data Point	**Comparison Group 2010 *n* = 3 EMS n = 1**	**Intervention Group 2011 *n* = 7 EMS n = 4**	**Change in Time 2010/2011**
First medical contact to EKG	10 minutes	17.5 minutes	+7.5 minutes
First medical contact to Ambulance load (Scene time)	5 minutes	13.5 minutes	+8.5 minutes
Total EMS Time (First medical contact to ED admission)	28 minutes	32.5 minutes	+4.5 minutes
Mileage from Scene to ED	23 miles	34.9 miles	NA
HRRMC Emergency door to cardiac alert notification (Completion of first facility EKG)	11 minutes	11.42 minutes	+ .42 minutes
Door to fibrinolytic	23 minutes	19.8 minute	-3.2 minutes
Call to Centura Connect® for transport	0/3 0%	2/7 28.5%	+28.5%
Total HRRMC time (Admission to load for transfer)	260 minutes	117.8 minutes	-142.2 minutes
Load for transfer to arrival at Penrose	75 minutes	72.8 minutes	-2.2 minutes
Direct admission to Intensive Care Unit	1/3 33%	2/7 28.5%	-4.5%

The first bundled process evaluated included: first medical contact, first medical contact to ambulance load (scene time), and total EMS time (first medical contact to ED admission). Mileage from the scene to HRRMC is included to allow for consideration of location, commute and distance in the overall bundle outcome of total EMS time. The bundled EMS data shows an increase of four and half minutes from comparison group (Group I) to intervention group (Group II).

As previously discussed, the project is not statistically significant as the case volume was under powered. Within each group, limited use of EMS was noted. In the comparison group of three cases, one used EMS services. In the intervention of seven cases, four used the EMS

services. If statistical analysis were to be employed, the one-tailed *t* test would provide the following outcomes for the EMS bundle in rural heart attack care:

- Group I: *n* = 1. Mean =28 minutes, standard deviation = 0, standard error = 0 (not to be used in analysis due to low *n*)
- Group II: *n* = 4. Mean = 32.5 minutes, standard deviation = 11.846, standard error = 3.923 (not to be used in analysis due to low *n*)
- *p* = 0.25133 (not to be used in analysis due to low *n*)

The second bundle of care analyzed was provided at Heart of the Rockies Regional Medical Center. The care delivery bundle includes HRRMC ED door to cardiac alert notification which is calculated from arrival to first facility 12 lead EKG, door to fibrinolytic therapy, call to Centura Connect® for transport, and total HRRMC time (calculated from admission to load for transfer).

The comparison group (Group I), prior to the algorithm in 2010 had *n* = 3, while the intervention group (Group II) after the algorithm in 2011 had *n* = 7. As discussed earlier, the project is not statistically significant as the case volume was under powered. If statistical analysis were to be employed, the one-tailed *t* test would provide the following outcomes for the HRRMC bundle in rural heart attack care:

- Group I: *n* = 3, Mean = 260 minutes, standard deviation = 285.832, standard error = 165.025 (not to be used in analysis due to low *n*)
- Group II: *n* = 7, Mean = 117.85 minutes, standard deviation = 41.6710, standard error = 15.750 (not to be used in analysis due to low *n*)
- *p* = 0.24007 (not to be used in analysis due to low *n*)

The third bundle of care analyzed was provided by critical care transport, Flight for Life®. This care delivery began at HRRMC in Salida at loading the patient for transport and ended with admission to Penrose Hospital in Colorado Springs. The comparison group (Group I), prior to the algorithm in 2010 had *n* = 3, while the intervention group (Group II) after the algorithm in 2011 had *n* = 7. As mentioned earlier, the project is not statistically significant as

the case volume was under powered. If statistical analysis were to be employed, the one-tailed *t* test would provide the following outcomes for the critical care transport bundle in rural heart attack care:

- Group I: *n* = 2, Mean = 75 minutes, standard deviation = 21.213, standard error = 15.0 (missing data for one case in 2010) (not to be used in analysis due to low *n*)
- Group II: *n* = 7, Mean = 72.8 minutes, standard deviation = 29.151, standard error = 11.018 (not to be used in analysis due to low *n*).
- *p* = 0.45888 (not to be used in analysis due to low *n*)

The last bundle of the care provided to rural heart attack patients was the location of admission at the tertiary care facility, Penrose Hospital. This is a dichotomous variable, answered "yes/no" to the location of admission to intensive care unit (ICU). The comparison group (Group I), prior to the algorithm in 2010 had *n* = 3, while the intervention group (Group II) after the algorithm in 2011 had *n* = 7. As mentioned earlier, the project is not statistically significant as the case volume was under powered.

- Group I: *n* = 3, Admitted to the ICU at Penrose Hospital = 33%, implying 66% went directly to the catheterization lab (not to be used in analysis due to low *n*)
- Group II: *n* = 7, Admitted to the ICU at Penrose Hospital = 28.5 % implying 72.5% went directly to the catheterization lab (not to be used in analysis due to low *n*)

In the broadest view of the patient experience with a heart attack in this rural setting, the overall bundle of care, involves the EMS outcomes bundle plus the HRRMC outcomes bundle plus the critical care transport outcomes bundle to arrive at the total time of care prior to admission at Penrose Hospital. There was no process improvement intervention offered to critical care transport or to Penrose Hospital during this project. This shortens the pertinent project findings to include only the EMS outcomes bundle plus the HRRMC outcomes bundle.

Review of findings for the EMS care delivery bundle plus the HRRMC care delivery bundle reflects the overall bundle of care:

- Group I: *n* = 3 EMS bundle 28 minutes + HRRMC bundle 260 minutes = total rural STEMI care of 288 minutes (not to be used in analysis due to low *n*)
- Group II: *n* =7 EMS bundle 32.5 minutes + HRRMC bundle 117.8 minutes = total rural STEMI care of 150.3 minutes (not to be used in analysis due to low *n*)

The total care delivery from first medical contact through loading the patient for transportation to the tertiary care facility seems to be reduced in time but the validity of the data is not substantiated by the power analysis and low case volume. As a process improvement Capstone Project, it is worthwhile to "unbundle" the outcomes and look for processes which benefited from the applied algorithm. Clinical significance is not paralleled with statistical significance and evaluation of the individual process steps added to the algorithm are worthy of analysis.

Results by Objective

Evaluation of the individual elements of the bundles reduces *Perfect Care* (Berwick, 2008) into clinical relevant interventions. The pre-hospital 12 lead EKG is paramount to all STEMI care and the ten minutes standard (Kushner et al., 2009 and Diericks et al., 2009) is a clinical goal for urban and rural settings. The EMS provider experienced an increase in the first medical contact to 12 lead EKG from 10 minutes in 2010 to 17.5 minutes in 2011. This disparity may be due to one outlier case of 42 minutes from first medical contact to 12 lead EKG (See Appendix J.). The process of obtaining a 12 lead EKG is complex, and this element could be reviewed with more detailed information.

The scene time for EMS was determined by the first medical contact until ambulance load. Scene time for EMS was 5 minutes in 2010 and 13.5 minutes in 2011. The Chaffee County EMS uses a ten minute load goal for the trauma patients and it was a goal to add the cardiac

STEMI patient to this category. This was not to be a totally new intervention, but the use of a familiar clinical goal in the broader setting of STEMI. One barrier for this intervention is the completion of the 12 lead EKG which takes several minutes to obtain. Other barrier considerations may include the low volume of cases, consideration of location (privacy needed for 12 lead EKG) of the patient and the new application of the 10-minute load intervention to cardiac services.

Overall, the volume of cases employing Chaffee County EMS is low. There are many possible variables to consider: cost of ambulance ride, knowledge of the public about the risks inherent in private vehicle transportation, use of 911 services, proximity to the hospital, past experiences, and individual preferences. This variable exists in urban heart attack care and does substantially impact outcomes for patients as the first hours of a STEMI are the most lethal (US Census Bureau, 2010), with sudden death cardiac arrest a possibility.

The first parameter to be evaluated at HRRMC was admission through the door of the ED to the completion of the 12 lead EKG. This is often referred to as the diagnostic time (Kushner et al., 2009) and a variable which defines the ability to rapidly assess history and primary complaint. HRRMC was consistent in both 2010 and 2011 with the mean time about 11 minutes each year. Kushner et al. identify the national standard as ten minutes, and this is a complicated process, very near the national benchmark. The importance of the timing of the 12 Lead EKG was recognized and respected at HRRMC, as demonstrated by a twenty-four month consistent time interval, close to the national benchmark. Accuracy of the 12 lead EKG was supported with educational discussions, case studies, and return demonstration presented by the author.

Most rural programs will transport patients and offer fibrinolytic therapy prior to transport. Kushner et al. (2009) define fibrinolytic therapy as the key intervention in rural heart attack care. Aguirre et al. (2008) describe large outcomes variance if not given within the 30

minute window from admission to the emergency department. HRRMC had a mean time of 23 minutes prior to the algorithm in 2010 and a mean time of 19.8 minutes after the algorithm in 2011 (See Table 5). The staff demonstrated outcomes for rapid re-perfusion and exceeded national benchmarks.

A new intervention of streamlined communication for critical care transport was established with the Capstone Project. The use of Centura Connect® had been in place for trauma care. This one-call method allows the Centura Connect® dispatcher to find a consultant to accept the patient, secure critical care transport, and arrange for admission (a critical care bed and the catheterization lab staff called in for duty) of a STEMI patient. The use of Centura Connect® services was not in use in 2010; therefore, 0% of cases used Centura Connect®. In 2011, the launch was not easy from a clinical point of view although the use increased to 28.5%. The HRRMC did not attempt the new process for many months. Late in the year, when attempted, Centura Connect® leadership reported the cardiologist on the Penrose Hospital receiving end of the intervention was not entirely receptive to the new method. In the past, the cardiologist got second hand information and did not deal directly with HRRMC ED physicians. Resistance persisted and remains. Progress is slowly being made with a case-by-case review methodology.

Another new intervention with the algorithm was the use of a checklist prior to critical care transport by the nursing staff. Checklists had not been used for STEMI patient care and were added to the algorithm based upon the Institute of Healthcare Improvement recommendations (Berwick, 2008). This outcome data was evaluated as a dichotomous variable. A new intervention in 2011 the checklist use was at 71.4% (See Appendix J). The benefit of a check list during emergent care was adopted in this rural setting.

Findings of Key Elements/Instrumentation

Key elements are found in the outcome data collection. One finding is the relative low number of heart attack cases in Chaffee County. Considering all of the care provided for heart disease at HRRMC, the incidence of heart disease is low. Certainly the low population density impacts the outcomes findings. This author's experience with STEMI care at other rural mountain clinics demonstrated more heart attacks per year, from 2004 to 2012. For example, based upon the author's experience in 2008-2011: Summit Medical Center (Summit County) has about 15-20 heart attacks annually and Granby Clinic (Grand County) has about 10 heart attacks annually. Population comparison is difficult with tourism varying the census, population density variance, and altitude differences which may impact STEMI incidence.

The demographic data is important. Considering all ten STEMI cases over two years, only one female patient was diagnosed, making the two project groups 90% male. The median age was 64.8 years with a range of 48 – 75 years. The hometown of the two project groups was 50% of the patients from Salida, 30% of the patients from Buena Vista, 10% from Nathrop (an unincorporated town in central Chaffee County), and 10% from West Bend Wisconsin. With tourism as primary industry in Chaffee County, the team anticipated the STEMI patient group to be compromised of tourists. Most of the heart attack patients were citizens of Chaffee County; only one patient was a tourist from out of the state of Colorado.

Heart attack care by HRRMC is noteworthy. The ED at HRRMC achieved Door-to-Fibrinolytic timing of less than 30 minutes, the national benchmark (Kushner et al.), consistently. According to Diericks et al. (2009), fibrinolytic timing is a key indicator of long term outcome following STEMI events. Once the algorithm (see Appendix K) was developed and offered to HRRMC, the Emergency Department adopted the checklist prior to transfer at a rate of 71% in the first year. The Emergency Department obtained a Door-to-EKG time of 11 minutes for 2010

and 2011. The national benchmark for door to EKG is ten minutes (Kushner et al., 2009), making this low volume, high risk intervention a strong clinical tool for HRRMC.

Instrumentation.

The instrument was developed specifically for this Capstone Project. It was used for data collection. The instrument was an excel spread sheet with care delivery variables across the horizontal axis and cases down the first vertical column. The data collection tool was organized with demographic elements occurring first and other aspects of care in the chronological order of care delivery. This can be noted in Appendix I. The form was color coded by the care providers/bundles for clarity. Each of the multi-disciplinary team members had a photo copy for direct chart abstraction. This data was then placed on the electronic version.

The instrument design was a product of the HRRMC project team and the author. The team selected the meaningful variables found in the STEMI CPG and the instrument was developed to meet the needs of the project group. There is high validity, since this data are the outcomes of interest to the team. The reliability is low, as the instrument has not been tested in multiple locations. Appendix J has the results of the project on the final version of the instrument. The project team edited and redesigned the instrument as variables were edited for use in the project.

Reliability of Findings

Reliability is the cornerstone of data analysis. Studies with data collections review both internal consistency and reliability (Polit, 2010). According to Polit, internal consistency refers to the estimate by which the tool or instrument represents the critical attributes being measured. Polit explains that larger samples are often more representative of a population than smaller sampling sizes. The inclusion of large data sets may reduce error, improve reliability, and improve internal consistency.

When studies are considered for reliability, the ability to translate the project to other groups than just the project group may be judged by a power analysis. In a power analysis for one-tailed analysis (the intervention improved the timing of the STEMI care is one- tailed), to a power of .80 with a $p = .05$, 53 cases were needed in the project (Polit, 2010, p. 422). This capstone falls short of recommended power. There were not enough subjects to detect a difference in the outcome variable. Therefore, the results are not reliable or generalizable. The data displayed previously was clearly marked not for analysis due to small sample size. At the current rate of case accumulation for STEMI diagnosis in Chaffee County the project would need to run for approximately five to eight years or involve more counties to obtain the needed statistical power for reliability.

The cumulative finding of reduced care delivery time from 288 minutes pre-algorithm for STEMI care to 150 minutes post-algorithm for STEMI care is not a reliable finding. The values do pertain to the actual cases involved, but may not be used for projection to other populations or facilities. As process improvement work is measured, the trend may be noteworthy and further data collection would be encouraged. Statistical significance is not equal to clinical significance and continuing the application of the STEMI algorithm for care is encouraged.

Results Related to Evidence-Based Practice Question

The study question for rural heart attack care was: Can rural healthcare providers, using pre-planned algorithms, access tertiary care facilities with patients having an ST segment elevation myocardial infarction (STEMI) in reduced time frames from the access utilized without algorithms? The project was able to gather many data points, some considered to be beyond the defined project question. A direct relationship between the project question and project results is found in Table 6. The PICO Elements and Study Results. From a statistical analysis perspective, the project was under powered. Therefore the results were not statistical significant and did not

meet the measure of proven relationships between the algorithm and STEMI patient care delivery. However, from a lens of process improvement, great strides were made with use of a checklist prior to transport of critical ill STEMI patients, increased use by 71%. Moderate results were found with use of a one-call transport system, as use of the system increased by 28%. No improvement was seen in reducing scene time for EMS (increase of 4.5 minutes).

Table 6. The PICO Elements and Study Results

Element	***Identification***	***Study Results***
Patient/ Population	First responders, care providers in rural Colorado for STEMI patients	Team included Chaffee County Emergency Medical Services, Heart of the Rockies Regional Medical Center staff and physicians, Centura Connect® dispatchers, Flight for Life® critical care transport, Penrose Hospital staff and physicians.
Intervention	Develop a pre-planned access program/algorithm identifying receiving hospitals which can perform Percutaneous Coronary Interventions (PCI)	Multi-disciplinary team reviewed the Clinical Practice Guidelines and developed an algorithm of care for STEMI patients at Heart of the Rockies Regional Medical Center. New interventions included: reduce scene time to 10 minutes, use checklist prior to transfer in the ED, use one-call transfer system and measure if patients are admitted to Intensive Care Unit at Penrose Hospital.
Comparison	Current system of care compared to a predetermined transfer system of care for STEMI patients	Abstracted data from 2010 for use in project as comparison group: Started with 10 closed medical records and had 3 cases of STEMI confirmed by Penrose ACTION® registry. Abstracted data from 2011 for the intervention group: Started with 12 closed medical records and 7 cases of STEMI confirmed by Penrose ACTION® registry.
Outcome	Patient experience will follow use of pre-planned access program/algorithm to reduce time of first medical contact to open coronary vessel/fibrinolytic therapy administration measured as first medical contact to load for transfer to Penrose Hospital	The total STEMI care time in 2010 Comparison group was 288 minutes and after the algorithm, in 2011 the total care time was 150 minutes. Emergency Medical Service time for Comparison Group (in 2010) was 28 minutes for one case. Emergency Medical Service time for intervention group (2011) was 32.5 minutes. The EMS load time increased with the algorithm from 5 minutes to 13.5 minutes. HRRMC total time for Comparison Group was 260 minutes and for the intervention group was 117.8 minutes. The use of Centura Connect® for one call transport increased from 0% to 28.5% with use of the algorithm. The use of the checklist went from 0% to 71% with use of the algorithm.

This project had outcomes in addition to the care algorithm interventions. The total care time from first medical contact to transport to tertiary care was 288 minutes before the algorithm

and the multi-disciplinary team meetings about STEMI care. After the start of the project, the timing dropped to 150 minutes for total care. A decrease of 138 minutes is over two hours (2.3 hours) is clinically significant in the care of STEMI patients. The time reduction is not statistically related to the use of the algorithm. The reduced time may be the effect of knowing work will be monitored and reviewed. Unable to assign credit to the Capstone Project, the reduction of care delivery time by over two hours is to the patient's benefit. Shortened care delivery time was the intended goal.

Limitations, Recommendations, Implications for Change

Limitations

Several limitations exist in the Capstone Project. Sample size is a limitation. The project included only STEMI cases. The frequency in the rural setting was low; therefore, the project was under powered and the results statistically unreliable. Power analysis calculated the number of cases needed at 53 cases. The ten cases in the data base were a limitation, assuring the results could not be applied to other settings.

The tool used to collect data was not tested for validity and reliability, as it was a small edited version of the ACTION® registry data tool. The larger tool is valid and data abstraction from the tool is encouraged for the use of process improvement. The tool could be tested in other CAH sites to test the comprehensiveness of the indicators selected and inclusion of the algorithm interventions.

Some process limitations arose unexpectedly. Although originally engaged, the Chaffee County EMS leader did not communicate with the author. Phone messages, email messages, and personal stops at the base station failed to improve that relationship. Other EMS providers were seen at HRRMC and asked about the project and remained fully engaged. With less than one month until the end of the project, a contact with the medical advisor assisted in outcomes

retrieval. Reduced communication throughout the experience limited the process improvement with EMS as planned. Some of the EMS barriers included a new medical documentation system on computers, odd schedules (typical of firefighters), and a family health issue. Earlier contact with the medical advisor may have contributed positively to the project process improvement goals.

The timeline presented a limitation. The project was begun, initial efforts made with HRRMC staff, and then intervals of project absence were experienced by the HRRMC staff. The group willingly gathered, defined the algorithm (See Appendix K), and then waited for IRB action before data could be collected. The pause from July 2011 until the end of October 2011 for IRB action was perceived as very long. Some staff development occurred during this time lag, but project momentum was reduced by the work flow pause.

Most hospital based process improvement project flow is determined by the work schedule of the team. The academic timing of content, classes and assignments, known as the Timeline, impacted this team (See Appendix L). Early involvement of the team is essential for Rogers' Innovations of Change Theory (Lee, 2004), but the project momentum was not a fluid experience for HRRMC involved staff.

Limitations of time prevented process improvement work with Flight for Life® critical care transport and Penrose Hospital cardiac services. The critical care transport maintains a full review of every case and therefore process improvement is an active, internal ongoing process for Flight for Life® staff. The work with Penrose Hospital cardiac service providers would be a task requiring increased focus upon Penrose Hospital work pattern and more time than the Capstone Project allowed. This contributed to a weak acceptance of change to Centura Connect® as a one-call system of transfer.

Recommendations and Contributions to Nursing Theory

The focus of this Capstone Project was to develop a practice change determined by a group of providers and based upon known and accepted evidence. The care givers were experts in the care delivery to patients experiencing a STEMI. Nursing theorist, Dr. Patricia Benner (1984) credits the expert practitioner with an intuitive thought process, almost habitual responses to clinical stimuli and decision making. Application of new interventions and new care delivery models is challenging to expert practitioners. Lyneham, Parkinson and Denholm (2008) supported Benner's novice to expert theory and demonstrated the inclusion of new technology by clinical experts was feasible in emergency room settings. The successful inclusion of new interventions for this Capstone, such as check list utilization, by HRRMC ED staff supports this previous research. This does not add to the nursing theory base or generate new mid-level applications of nursing theory but does support Benner's novice to expert theory application to the practice of nursing.

Rogers' innovation of change theory (Rogers, 2003) was the model used for creating change in the rural health care delivery environment. Some of the stages of change process as described by Rogers (2003) were seen in the HRRMC ED staff acceptance of the checklist: knowledge, persuasion, decision and implementation. Rogers' last stage of confirmation would require measurement of the check list use over time as an evaluation measure.

The Capstone Project applied an urban CPG to one rural setting. A key role for Doctorate of Nursing Practice CNSs is the employment of evidence based care delivery, the application of known CPGs, and the engagement of the care providers in enhancements to care delivery. The clinical application of rigorous CPGs was the central experience for those involved with the work of the rural heart attack care Capstone. The translation of evidence-based care to clinical practice was a major contribution of the Capstone Project.

Recommendations and Contributions to Research

This project does contribute to the body of research literature in cardiac services and nursing. If the project time were lengthened to admit a qualifying number of cases, the process to confirm the algorithm could be initiated. However, impact on this specific study population was demonstrated. Inclusion of the CAH system in STEMI care is essential to improve the health of rural communities. Heart disease remains the leading morbidity in the United States. The Rural Heart Attack Health Care project could be expanded to similar counties/communities or continued in order to include a larger number of cases.

The low use of pre-hospital services has been mentioned, with only half of the two years of STEMI cases transported using Chaffee County EMS. A literature search performed on March 3, 2012 in Academic Search Premier, CINAHL and MEDLINE revealed only three studies on low use of EMS with heart attack patients. None of these studies included rural settings, with one study conducted in Russia. The rural EMS use is an area for future study.

Inclusion of CAH and rural health care in national practice guidelines is underserved and in need of support on a variety of levels. CPG developed for urban settings need to be modified for rural application. Rural Heart Attack Health Care is a research opportunity for care providers, grant developers, advocacy groups and specialty interest groups such as the American Heart Association. The development of CAH facilities was to provide rural health care services with a venue for process development, insurance opportunities, standards development and provider practice structure. Inclusion of CPG applications in the rural and frontier settings remains a clinical challenge. Monitoring the variance from practice standards is essential to excellence in all health care delivery settings.

Recommendations and Contribution to Advanced Practice Nursing

The Rural Heart Attack Health Care Capstone Project contributes to the body of knowledge for APNs. A nurse driven project, crossing care delivery environments and professional groups, led a team of care providers through application of CPG for STEMI care. This is impactful and represents the role of APN in health care improvement. The author is committed to the development of cardiac health care services within the rural setting throughout Colorado. Although the project did not have statistical power, clinical significance supports the ongoing employment of the algorithm for heart attack health care.

A recommendation for DNP APN application of the Capstone could be the translation of other CPG applications from urban to the rural settings. With a broader point of view, urban based CPG can be used to provide services in underserved rural and frontier areas. If each practicing expert APN were to include a rural setting in process improvement, the delivery of health care would greatly reduce the inherit inequities in the current health care delivery system.

Development of health care policy is not a governmental responsibility but calls upon the providers of health care to improve the policies of health care delivery. Attention to rural health care needs in policy development is important. CPGs generated could be considerate of the challenges of rural settings and new rural inclusive models of health care delivery could be developed. The ACTION® registry is the largest health care data bank in the world. ACTION® registry applications need rural and frontier outcomes in the data bank. The DNP APN is likely to lead reformation, having a role of patient advocacy, sensitivity to underserved populations and knowledge to influence the entire care delivery team and environment.

Implications for Change

The CAH setting is meeting the challenge of process change for enhanced patient care. Ongoing change in the future may be approached by continuing to evaluate the outcome

measures of the algorithm defined in Rural Heart Attack Health Care Capstone. In addition, change could occur if this Capstone Project is implemented in other CAH settings.

Continuing the Capstone Project may enhance patient outcomes further. The Rural Heart Attack Health Care Capstone Project modified the well accepted CPG in STEMI care to a different setting- the rural health care delivery system. The CAH, HRRMC, accepted the proposed changes and embraced opportunities to improve patient care. Change was not as readily accepted by the EMS providers. The Rural Heart Attack Health Care was likely a new opportunity for a project in EMS. Ongoing team work designed to include EMS with hospital projects may enhance collaboration for a common project goal in the future.

If the Rural Heart Attack Health Care experience was able to translate to other rural settings, the process improvement environment would grow. This conclusion is based upon the acceptance by the HRRMC staff of the team, the project goals, the algorithm development and sharing of the results. The group demonstrated strong participatory presence. The author felt inspired by their efforts and impressed with their change process.

There is an opportunity to create process improvement groups with other CPG topics in the rural and CAH setting. The same type of process may be applied to different CPG and develop new PI projects such as stroke management, heart failure care, preventative cardiac health care and women's heart disease management. Care pattern algorithms could be developed with measurable data point outcomes. The opportunity for process improvement developments is an almost endless opportunity.

As an initial rural health care effort, the Rural Heart Attack Health Care Capstone Project created some enduring change. The individual interventions added to the algorithm seemed well accepted. An important change has been created by the team project experience and success. It is likely the group would be willing participate in other PI projects.

A change has been experienced by the author as well. Team development is an essential APN skill. The role of team lead and facilitator is pivotal to most DNP APN group work. These skills set into motion an opportunity to create change with a previously unknown group of health care providers, in a new environment and at a higher level than most professional PI project of the past. To be viewed as a Doctorate of Nursing Practice student, then a candidate has created a change in the professional presentation to the Capstone Project team. The growth of the team mirrors this author's acquisition of doctoral level skills, a rehearsal for a new role, and evolution of a style of clinical nursing leadership reflecting doctoral preparation.

The Rural Heart Attack Health Care Capstone demonstrated the methodology needed to bring evidence based care delivery to the patients and to the care providers. The translation from CPG to practice is found in the process steps, uniquely sequenced, allowing for the completion of the full Capstone Project process. The PICO process came into focus through the rigors of the DNP course of study. The transformation of complex urban CPGs for use in a rural setting remains a challenge and is influential on patient outcomes. The work of the Rural Heart Attack Health Care Capstone Project is a catalyst to future rural projects and future Doctorate of Nursing Practice scholarship activities.

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Appendix A

Systematic Review of the Literature

Article Title and Journal	2007 Focused update of the ACC/AHA 2004 guidelines for the management of patients with ST-elevation myocardial infarction. A report of the American college of Cardiology/American Heart Association task force on practice guidelines. *Journal of the American College of Cardiology. 117(2).*296-329. doi: 10.1161/ CIRCULATIONAHA.107.188209	Rural interhospital transfer of ST elevation myocardial infarction patients for percutaneous coronary revascularization. *Journal of the American College of Cardiology. 177:1145-1152*	Efficacy and safety of immediate angioplasty versus ischemia-guided management after thrombolysis in acute myocardial infarction in areas with very long transfer times. . *Journal of the American College of Cardiology 55(2):*102-10.	Achieving door-to-balloon time that meets quality guidelines. *Journal of the American College of Cardiology 46:*1236-1241, doi:10.1016/j.jacc.2005.07.009
Author/year	Antman EM, Hand M, Armstrong PW, Bates ER, Green LA, Halasyamani LK, Hochman JS, Krumholz HM, Lama GA, Mullany CJ, Pearle DL, Sloan MA &Smith Jr SC. 2008	Aguirre FV, Vargheses JJ, Kelley MP, Lam W, Lucore CL, Gill JB, Page L, Turner L, Davis C, & Mikell FL.2008	Bohmer E, Hoffman P, Abdelnoor M, Arnesen H & Halvorsen S. 2010	Bradley E.H., Roumanis S.A., Radford M.J., WebsterT.R., McNamara R.L., Mattera J.A., Barton B. A., Berg, D.N., Portnay E. L., Moscavitz H., Parkosewich J., Holmboe E.S., Blaney M. & Krumholz, H.M.
Database and keywords	CINAHL: STEMI	MEDLINE: angioplasty, myocardial infarction, reperfusion	MEDLINE: PCI STEMI	Medline: STEMI

Research design	Meta-analysis of all current studies reviewed	Observational cohort of consecutive presumed STEMI	Randomized controlled study, single facility	Qualitative study of 11 top hospitals based upon data submitted to NRMI
Level of evidence (see attached AHA Levels of Evidence)	This report is Ia, individual guidelines has individual levels of evidence	IIa	Ib	Ib
Study aim/purpose	Response to new evidence, new data collated into practice guidelines using data, consensus of expert opinion, peer reviewed data, placebo controlled studies designed to impact care delivery and performance	Retrospective review of cases from January 2005 – March 2007 from 6 referral facilities and 2 STEMI receiving centers in central Illinois, to evaluate the interhospital transfer guideline based strategies	Compare strategy of immediate transfer for PCI to ischemia guided approach after thrombolysis in patients with very long transfer distances	To identify actions and interventions taken by top performance hospitals
Population studied/ sample size/criteria/ power	Evaluation of all data from previous ACC , AHA, university based studies, evidence and practice guidelines	230 patients in central Illinois.	.Population aged 18-75 years, symptoms of STEMI , 6 hours, EKG indicative of STEMI, delay time from first medical contact >90 min, rec'd thromobolytics. 524 patients enrolled, 276 randomized. Alpha 5% and power of 80%.	Studied 35 programs with last 50 cases <90 minutes, selected top 11 hospitals and interviewed physicians, nurses, techs, QA, administration
Methods/study appraisal/ synthesis methods	Scholarly appraisal teams for STEMI, PCI and ACCF/AHA Task Forces developed writing groups to review all literature and develop guidelines	Three major time points evaluated: door1 to departure, transport time, door1 to balloon. 16 time intervals measured, with the noted three impacting	Patients from 5 community hospitals in southeastern Norway transferring patient to Oslo University Hospital, Feb 2005-April 08. 276 patients	Used three reviewers with skill sets in qualitative research evaluation to review the interview tapes, interviewed 122 staff.

		quality.	randomized into aggressive vs. conservative strategies	
Primary outcome measures and results	This was the current practice stand for care of the STEMI patient, update of original work. For all facilities, physicians, care providers, nursing, laboratory etc.	87% of patients received PCI, 8.5% received fibrinolytic therapy. Door 1 to departure CI= 32-62 minutes, transport time CI= 25-35 minutes, Door1 to balloon time CI =98-137, mean= 117 minutes. Waiting for transport to arrive was time consuming. All transport system were pre-arranged.	138 in immediate PCI strategy, 138 in conservative strategy. Follow up at 3 months and one year. Mean transfer time was 138 minutes. Aggressive care group mortality 10% , conservative 21% at three months: 21% and 27% respectively at 112 months. Not statistically significant	Developed algorithm of top hospital's process for STEMI care for EMS or walk in pts.
Author conclusions/ implications of key findings	2009 practice standards to follow for STEMI care	Non-standardized STEMI treatment strategies contributes to untimely reperfusion of STEMI patients. Using four-step protocol improved times.	Study did not show significant reduction in primary outcome at 12 months, significant reduction in death reinfarction or stroke with early invasive (aggressive) strategy.	Use benchmarks and process from best practices. Examples given.
Strengths/ limitations	Publication team prestige. Meta-analysis of all studies published US and Europe. Widely supported ACC/AHA project	Relatively young mean age (59) contributed to outcomes (mortality 3%). Time of 117 minutes exceed the ACC recommendation, but the cohort had mean symptom onset time of 3 hours .	Study managed rural populations, randomized strategies and studied the cohorts for 12 months of outcomes. Limitation: powered only to detect differences in primary composite outcomes, not infarct size, open label design offered	Strong study from the Yale Cardiology group. Described facility selection techniques.

			some bias (clinical judgments of end points were blinded). Added shortened intervention time as practice standard not studied.	
Funding source	Not stated but clearly expensive author group with disclosures	Not specified	Not specified	AHA/ACC
Comments	"In 2009, the bible for cardiac care"	Recommends a standardized rural ED approach for improved outcomes. ED physician initiated cardiac alerts worked for this study.	Important rural STEMI study in Europe.	Yale & Duke continues to lead in study publications

Article Title and Journal	Public reporting of quality measures *Journal of the American College of Cardiology: 53*.831-833 doi:10.1016/j.jacc.2008.10.056	How does an "opinion leader" influence practice? *Clinical Journal of Emergency Medicine:* 12 (5). pp. 431-4	Current guidance on the management of acute coronary syndrome. *British Journal of Nursing: 18, 1292-1298.*	Utilization and impact of pre-hospital EKGs for patients with acute STEMI. . *Journal of the American College of Cardiology: 53*:161-166, doi:10.1016/j.jacc.2008.09.030
Author/year	Califf R.M., & Peterson E. D., 2009	Carpenter, C. R., & Sherbino, J. 2010	Chummun H, Gopaul K & Lutchman A. 2009.	Diericks DB, Kontos MC, Chen AY, Pollack CV, Wiviott SD, Rumsfeld JS, MagidDJ, Gibler B, Cannon CP, Peterson ED, & Roe MT. 2009.
Database and keywords	Medline: Percutaneous coronary intervention	MEDLINE: Diffusion of Innovation	CINAHL: acute coronary syndrome, management, myocardial infarction,	MEDLINE: Pre-hospital EKG

			pathophysiology	
Research design	NA	NA	NA	Randomized, retrospective, cohort design, review of registry data bank.
Level of evidence	NA	NA	NA	Ia
Study aim/purpose	NA	To discuss and identify opinion leaders by behavior, outcomes and influence within medical practice.	Current practice guideline summary and justification with pathophysiological concepts.	Determine association of pre-hospital EKG and the timing of reperfusion therapy (fibrinolytic or PCI) for STEMI patients
Population studied/sample size/criteria/ power	NA	NA	NA	7,098 of 12, 097 patients with STEMI, registered with National Cardiovascular data Registry (271 hospitals) in 2007 used pre-hospital services. Of the 7,098, 1941 received an EKG; therefore included in the study. Inclusion criteria: STEMI <24 hours old or new LBBB and persistent ST segment elevation on EKG.
Methods/study appraisal/ synthesis methods	NA	NA	Guidelines reviewed with each item described and assigned to scientific base or foundation	Defining only those with pre-hospital EKG done by EMS: categorized as fibrinolytic or PCI interventions.

				Demographics, categorical variables, timing of process measures of care and outcomes evaluated for those with fibrinolytics and those with PCI interventions presented.
Primary outcome measures and results	Public reporting of mortality rates is both good and bad, but here to stay. Need to support data collection registries, audit the registries, and monitor procedural appropriateness.	Emergency physicians and other health care professionals can employ OLs to positively influence their peers and clinical milieu. The identification of OL can vary by practice site, specialist and community. An OL need not be an innovator, but must have access to innovators, clinical credibility and an established social network.	NA	Patients with pre-hospital EKG were more likely to have primary PCI, receive ASA and clopidogrel and IIb, IIIa inhibitors in first 24 hours Door to needle or door to balloon times were faster for those with pre-hospital EKG, even if stratified for on- hours care and after-hours care.
Author conclusions/ implications of key findings	Public reporting has just begun and will impact case selection	In an era of information overload, simple awareness of research findings is insufficient to modify established practice for the many health care professionals. Engaging OLs to champion an	Understanding of pathophysiology will improve clinical management. Alignment with the Nation Service Framework for Coronary Heart Disease will improve patient outcomes.	Greater use of pre-hospital EKG by EMS is needed. In spite of national attention on this clinical program <20% of pre-hospital providers completed pre-hospital EKGs on those with EMS

		idea may permit an effective change to group practice.		transport. Challenges include budgetary needs, training, interpretation and transmission of pre-hospital EKG to readers.
Strengths/ limitations	Editorial format, outstanding history of public reported mortality data.	NA	Well written journal article. Not research.	Study did not collect information on clinical presentation of patients, how EKG interpreted and if transmitted prior to admission. Limited by specificity and or sensitivity of pre-hospital EKG for STEMI. If the patient had a pre-hospital EKG and did not present immediately to ED or cath lab, the patient was excluded from the study. Strengths include the size of the study, the volume of facilities involved and superior demographic reporting.
Funding source	NA	Not stated		Not specified
Comments		Medical use of Rogers theory of diffusion of innovations.		Clinically significant results of <20% of EMS using EKG for STEMI recognition.

Article Title and Journal	A nursing intervention to reduce prehospital delay in acute coronary syndrome- a randomized clinical trial. *Journal of Cardiovascular Nursing: 21(3)*:186-93.	Implementation of specialty centers for patients with ST segment elevation myocardial infarctions- the Los Angeles STEMI receiving center project. *Prehospital Emergency Care: 13(2)*:215-22.	What do we know about the long term medication adherence in patients following percutaneous coronary interventions? *Australian Journal of Advanced Nursing.25: 53-61.*	A regional system to provide timely access to percutaneous coronary intervention for ST-elevation myocardial infarction. *Journal of the American College of Cardiology: 116***:** 721-728**doi:** 10.1161/ CIRCULATIONAHA.107.694141
Author/year	Dracup K, McKinley S, Riegel B, Mieschke H, Doering LV, & Moser DK. 2006	Eckstein M, Koening W, Kaji A and Tadeo R. 2009.	Fernandez R, Davidson P, Griffiths R, Juergens C, & Salamonson Y. 2008	Henry TD, Sharkey SW, Burke N, Chavez KJ, Graham CR, Henry DL, Lips JD, Madison KM, Menssen KM, Mooney MR, Newell MC, Pedersen WR, Poulose AK, Traverse JH, Unger BT, Wang YL & Larson DM. 2007
Database and keywords	CINAHL: Acute coronary syndrome	MEDLINE: myocardial infarction, reperfusion, balloon, catheterization,	CINAHL: medications, percutaneous coronary intervention, adherence.	MEDLINE: STEMI
Research design	Randomized, two group experimental design	Prospective, observational study in LA County	Survey of 270 patients with PCI between 2003-2004, 12-24 months following the PCI.	Quantitative study design. Developed standardized systems of care. Zone 1is 11 hospitals, Zone 2 is 19 hospitals. Metaanalysis of all PCI 2003-2006
Level of evidence	Ia	IIa	IIc	Ib
Study aim/purpose	Study to determine whether a brief education and counseling intervention	Determine performance of regional system with EKG identification of STEMI and transport to	To evaluate the long term adherence to medication in patients following PCI.	Response to European data for transfer time reduction for PCI for STEMI instead of fibrinolysis

	delivered by a nurse can reduce prehospital delay in the face of symptoms of ACS.	STEMI Receiving Centers		
Population studied/sample size/criteria/ power	3,500 patients in United States, Australia and New Zealand 80% power to detect a medium effect size of 30 minutes reduction in delay time	1,200 patients with suspected STEMI identified on 12 Lead EKG and transported for PCI in LA County Dec 2006 to January 2008	270 patients with PCI between 2003-2004, 12-24 months following the PCI.	Zones were defined by sending hospital distance from Minneapolis Heart Institute(MHI). Zone I , 60 miles, Zone 260-120 miles. All patients were STEMI or new LBBB, arriving in community hospitals and being transferred to MHI
Methods/study appraisal/ synthesis methods	Patients recruited from CV hospital units and medical practices in the community. Intervention completed after discharge and all patients followed for two years. Control group received usual instructions and study group nurse administered education and counseling. All follow up on phone at 3, 12 and 24 months.	31 STEMI Receiving Centers identified of 71 paramedic receiving facilities in LA County. Key time points in care reported and reviewed. No transmission of EKG (all read by paramedics). All facilities self-reported statistics to the study.	Self-administered 20 item questionnaire sent to patients for completion	Followed in-hospital, one month and annual outcomes via ACC National CV Data Registry definitions.
Primary outcome measures and results	Main outcome measure is time from ACS symptoms to arrival in ED. Secondary study of EMS use, ASA use ,knowledge , attitudes and beliefs about heart	89% of patients had Door to Balloon times < 90 minutes. Six hospital practices associated with faster times. False positive rate dropped from 40% the first month	Used the Molsky Medication Adherence Scale to assess do you ever forget to take your medications, do you feel better is stop taking your medications and do you	1,345 patients studied, 627 from Zone 1 and 421 from Zone 2. 70% transported by helicopter, 29.5% by ground. Relative risk reduction 42% (95% CI, 29-53, P<0.001)

	attacks.	to 18% during the final month (Computer generated diagnosis on EKG machine)..	feel worse when taking the medications. 3.5% missed medications regularly, 10.9% missed meds in the last week. 90% reported not missing medication doses.	
Author conclusions/ implications of key findings	Trial has not been completed	Strive for lowest possible false positive rates. In LA each person lives within 30 minutes of receiving facility for STEMI.	High compliance rate for doses not missed and 83% stored meds in the original containers (correctly). Voluntary return of the survey, 75%.	Standardized protocols implemented, 30 day mortality of 4.9% and one year mortality of 7.2%.Door to intervention times up to 120 minutes for hospitals up to 210 miles away.
Strengths/ limitations		Each facility submitted data. Definitions of time points were not standardized initially. Focus future studies on accuracy of data submission	Self-reporting may result in over estimation of compliance. Factors to influence adherence were not clearly obtained. Nitroglycerine pill most often stored improperly.	Not randomized. Difficult to randomize patients in community hospitals. Facilitated PCI not included in the study.
Funding source				ACC/AHA grants
Comments	This article is a description of the study and not a report of its findings. I am disappointed.	Unclear if study goal of "determining performance" is selective enough for study. Might look at specifics different with different purpose statement.	Interesting self-reporting method for study.	Best United States study to date.

Article Title and Journal	Early invasive versus conservative strategies for unstable angina and non-ST elevation myocardial infarction in the stent era. *The Cochrane Collaboration.*	Implementation of a statewide system for coronary reperfusion for ST-segment elevation myocardial infarction. *JAMA: 298(20)*:2371-2380. Doi:10.1001/jama.298.20.joc70124	Can a nurse trained in coronary care expedite emergency department management of patients with acute coronary syndromes? *Heart and Lung:30 186-190.*	2009 Focused Updates: ACC/AHA Guidelines for the management of patients with STEMI (Updating the 2004 guidelines and 2007 focused update) and ACC/AHA/SCAI guidelines on PCI. A report of the American College of Cardiology Foundation/American Heart association task force on practice guidelines. *Circulation 54*, 2205-2241. doi:10.1016/j.jacc.2009.10.015
Author/year	Hoenig MR, Aroney CN, & Scott IA. The Cochrane Collaboration, The Cochran Heart Group. 2010	Jollis JG, Roettig ML, Aluko AO, Anstrom KJ, Applegate RJ, Babb JD, Berger PB, Bohle DJ, bhFletcher SM, Garvey JL, Hathaway WR, Hoekstra JW, Kelly RV, Maddox Jr WT, Shiber JR, Valeri FS, Waling BA, Wilson BH & Granger CB. 2007	Kucia AM, Tina K, Taylor N & Horowitz JD. 2001	Kushner F.G., Hand M., Smith S.C., King III S.B., Anderson J.L., Antman E.M., Bailey S.R., Bates E.R., Blankenship J.C., Casey, Jr. D.E., Green L.A., Hochman, J.S., Jacobs A.K., Krumholz H.M., Morrison D.A., Ornato, J.P., Pearle D.L., Peterson E.D., Sloan M.A., Whitlow P.L. and Williams D.O. 2009
Database and keywords	COCHRANE: myocardial infarction	MEDLINE: STEMI	COCHRANE: acute myocardial infarction	CINAHL: STEMI
Research design	Meta-analysis	Quality improvement study to change the speed of reperfusion in 5 regions in North Carolina	Prospective randomized controlled study	Meta-analysis of all current studies reviewed

Level of evidence	Ia	Ib	Ia	This report is Ia, individual guidelines has individual levels of evidence
Study aim/purpose	To determine the benefits of an invasive compared to conservative strategy for treating UA/NSTEMI in the stent era.	To establish a statewide system for reperfusion, as exists for trauma care, to overcome systematic barriers.	Goal of the study was to determine if skilled coronary care nurse could make a difference in the timing of care between door to intervention with work completed in the emergency department.	Response to new evidence, new data collated into practice guidelines using data, consensus of expert opinion, peer reviewed data, placebo controlled studies designed to impact care delivery and performance
Population studied/sample size/criteria/ power	7,818 participants of five studies RCTs.	1164 STEMI patients eligible for reperfusion, median age 61, 31% women, 4% Killip class III or IV. 925 NSTEMI patients treated at non-PCI hospitals (median age 62, 32% women, 4% Killip class III or IV.	893 patients, 44 had STEMI and PCI.	Evaluation of all data from previous ACC , AHA, university based studies, evidence and practice guidelines
Methods/study appraisal/ synthesis methods	Selected five studies, RCT, closely matched for subjects, intent, variables, methodology, study aims and research design. Included a review of all literature.	Early diagnosis and expedient reperfusion methods. Participating hospital accepted patients regardless of bed availability	Patients admitted to emergency department during the 16 hours/week with the CCU nurse in the ED were the experimental group. Control group was patients admitted through the ED when no CCU RN was present.	Scholarly appraisal teams for STEMI, PCI and ACCF/AHA Task Forces developed writing groups to review all literature and develop guidelines
Primary outcome measures and results	Mortality showed a trend towards hazard with invasive strategy. Reduced UA, re-hospitalization, MI (assess at 3, 6, 9, 12	Median reperfusion times significantly improved (81 reduced to 74 minutes, P<.0.001), transfer times reduced (165 60 128 minutes	Door to intervention times were not statistically significantly different.	This is the current practice stand for care of the STEMI patient. For all facilities, physicians, care providers, nursing, laboratory etc.

	months, 3 &5 years). Two fold increase in intra-procedure MI and 1.7 fold increase in bleeding (not stroke) in the invasive group.	P<0.001) Non PCI facility had no change in times. Clinical outcomes including death, arrest or shock did not change.		
Author conclusions/ implications of key findings	Invasive strategy is particularly useful for those at high risk, plus obtains above primary outcome measures.	Statewide program based upon regional areas significantly improved care.	Pilot data does not show a difference for care provided by CCU RNs in the ED or care provided by ED RN	New practice standards to follow for STEMI care
Strengths/ limitations	Robust findings of the review for 33% reduction of angina and reduced re-admissions. Procedural risk for MI is higher, but reduced risk after 3, 5 years. Suggests further RCT for best strategy.	Further study needed to justify improved mortality and morbidity. Sample not randomized, relatively small sample size, unable to make inferences about outcomes Used all preexisting resources and developed not new resources..	Pilot study, set up of 16 hours of week for study group, completed in Australia	Publication team prestige. Meta-analysis of all studies published US and Europe. Widely supported ACC/AHA project
Funding source	COCHRANE group	Unrestricted grant by Blue Cross and Blue Shield, ACC, N Carolina Department of Emergency Services, Genentech		Not stated but clearly expensive author group with disclosures
Comments	Unbelievable meta-analysis	Outstanding study. Worth replication in CO	No difference if CCU RNs cared for patient early in ED hospital stay.	“The bible for cardiac care”

Article Title and Journal	Impact of an audit program and other factors on door-to-balloon times in acute ST elevation myocardial infarction patients destines for primary coronary intervention. *Academy of Emergency Medicine 16: 333-342.*	Nurse's adoption of technology: application of Roger's innovation-diffusion model. *Applied Nursing Research.17*231-2328	A comparison of quality of care indicators in urban acute care hospitals and rural critical access hospitals in the United States. *International Journal for Quality in Health Care. 19*, no. 3	Explicating Benner's concept of expert practice intuition in emergency nursing. *Journal of Advanced Nursing 64* (4) 380-387.
Author/year	Lai CL, FanCM,LiaoPC, TsaiKC, Yang CY Chu SH & Chein KL. 2009.	Lee, T. T. 2004	Lutfiyya M.N., Bhat D.K., Gandhi S.R., Nguyen C., Weidenbacher-Hoper V.L., & Lipsky M.S. 2007.	Lyneham J., Parkinson C., & Denholm C. 2008
Database and keywords	MEDLINE: myocardial infarction, catheterization, angioplasty	ACADEMIC SCIENCE PREMIER: Roger's Diffusion of Innovation	EBSCO: Rural Hospital Care, Quality	Academic Science Premier: Benner
Research design	Audit program data collection from Taipei County, Taiwan	Interview methodology regarding events and attitudes towards new workplace innovations	Cross-sectional study analyzing secondary Hospital Compare data	A phenomenological study was conducted using van Manen's approach and a Gadamerian analyses. 14 expert emergency nurses in Australia were interviewed between January 2000 and December 2003
Level of evidence	IIb	IIc	IIa	IIb

Study aim/purpose	To show the association between an audit program implementation and STEMI times and to explore factors that influence door-to-balloon times.	"This study examined the applicably of Rogers' model, specifically the users' perception of an innovators characteristic's, for analyzing nurses perceptions toward using a computerized care plan system and how they adopt this new technology."	To compare quality hospital care provided in urban acute care hospitals to that provided in rural critical access hospitals.	This paper is a report of a study exploring the experience of intuition in emergency nursing in relation to Benner's first stage of practice development "the expert practitioner".
Population studied/sample size/criteria/ power	Audit program began in February 2007. Reviewed 104 cases from prior to audit (Control group) program and 76 cases after audit program (experimental group).80% power at control group of 100 patients and experimental group 73 patients.	"The content that emerged was compared with the model's five innovation characteristics (relative advantage, compatibility, complexity, trialability and observability) as perceived by new users."	Used data from Hospital Compare (voluntary by) short-term and largely urban acute care hospitals (3,780) and rural small, remote CAH (423). Used data from 2005 with an initial set of 10 quality performance measures.	A self-selecting recruitment process was used, through advertisements in two Australian nursing journals. The nurses from any state with > 5 years of experience in the emergency department and had experienced an intuitive experience. One male and 13 female nurses, experience ranging from 4.5-30 years agreed to participate.
Methods/study appraisal/ synthesis methods	Study consisted of checklist of time markers. Evaluation of time intervals and confounding factors (16) was developed. Evaluated time points during procedures and	In 1999 the study was conducted in three separate respiratory intensive care settings, 6 months after the computer programming was initiated. 9 nurses had > 3 years of	Raw numbers were abstracted from the publically available information, the data were aggregated by setting. After applying the weighting variables a two-tailed t-test for independent samples was calculated for each hospital	"The analysis resulted in the reconstruction of Benner's expert stage into three distinct phases; cognitive intuition, where assessment is proceeded subconsciously and can be rationalized in

	long term mortality (end point).	experience.	quality indicator. P=0.01	hindsight, transition intuition where a physician sensation and other behaviors enter the nurses awareness and embodied intuition when the nurse trusts the intuitive thoughts."
Primary outcome measures and results	Mean door to intervention time was reduced from 164.9 minutes to 141.9 minutes (means). Length of stay reduced from 5.4 days to 3.28 days. No difference in long term mortality was noted.	Results indicated that Rogers model can accurately describe nurses behavior during the process of adopting workplace innovations such as computerization.	8 of the 12 quality indicators showed a difference between urban and rural settings, as tested by t-test, and were statistically significant>0.01. In seven instances these difference favored urban settings and the indicator favored rural hospitals. The one indicator favoring rural facilities related to pneumonia.	"The findings validate the use of intuitive decision-making as a construct in explaining expert clinical decision-making practices. The validity of intuitive practice should be recognized."
Author conclusions/ implications of key findings	Adding to time frame were females with posterior MI, off-hours presentation,, lack of use of IIb/IIIa inhibitors.	"Rogers innovation-diffusion theory state that uses' acceptance to an innovation is influenced by their perception of relative advantages, compatibility, complexity, trialability and observability. The benefits and burdens of change will first be weighed to determine is relative advantages, the it's compatibility with user's existing values and experiences."	In general, heart failure and STEMI are more effective managed in the urban hospital setting compared to the CAH.	"It is essential to recognize the conditions that support practice development, and in the prenovice stage (during their university course) factors such as reflections, research (in its broadest sense) and clinical curiosity should be fostered."

Strengths/ limitations		Smaller number of cases, with broad number of indicators collected. Used a variety of settings, multi-facility study.	The study only focused on three disease states an many not reflect overall care delivery. The data were based upon voluntary reports and Hospital Compare was a new tool at the time.	Using a self-report method, no conclusions can be drawn about the participants actual practice behavior.
Funding source		Not stated	Not stated	None stated
Comments	Transfer time challenges in the far east, seem similar to the United States and Europe..	The findings indicate that Rodgers' model appropriately described nurses perceptions towards new technology used in their daily practice.	Outstanding work, relevant to my project.	Very well done, great review of the literature about Benner.

Article Title and Journal	Reperfusion is delayed beyond guideline recommendations in patients requiring interhospital helicopter transfer for treatment of STEMI *Annuals of Emergency Medicine*	Clinical nurse educators as agents for change: increasing research utilization. *International Journal of Nursing Studies 42* 899-914	Rural hospital nursing. Report of a national survey of nurse executives. *Journal of Nursing Administration:41 129-137*	Comparison of the Dissemination and Implementation of Standardized Public Health Nursing Competencies in Academic and Practice Settings. *Public Health Nursing 23* no. 2, pp. 99-107
Author/year	McMullan J.T.,Hinckley W., Bentley J., Davis T., Fermann G.J., Gunderman M., Hart K.W., Kinght W.A., Lindsell C.J., Shackleford A., & Gibler W.B. 2010	Milner, P. M., Estabrooks C.A., & Humphrey C. 2006	Newhouse RP, Morlock L, Pronovost P & Breckenridge Sprout A. 2011	Oppewal S., Lamanna B.F. & Glenn L. L. 2006
Database and keywords	Medline: STEMI transport	EBSCO: diffusion of innovations	EBSCO: rural nursing	EBSCO: Diffusion of Innovation

Research design	Multi-center retrospective chart review of cases from 2007	Survey using the Alberta Nurse Survey (an extension of utilization research results in Canadian health-measured 14 dependent and independent variables	National survey of nurse executives completed the Nurse Environment Survey (NES) of the Essentials of Magnetism instrument.	Non-experimental, descriptive study using a cross sectional survey.
Level of evidence	IIc	IIb	IIc	IIb
Study aim/purpose	Study to evaluate if STEMI transported by helicopter met the 90 minute benchmark	To determine demographics of nurse educators, to model the determinants of research utilization among nurses by role and level of education, and to explore differences in research utilization	Objective was to describe nursing characteristics in small and larger rural hospitals and determine whether differences exist in market, hospital and nursing characteristics.	To assess the use of the "Core Competencies of Public Health Professionals" standard in practice and academic work settings by public health nurses (PHNs) and to determine differences between practitioners and faculty.
Population studied/sample size/criteria/ power	Selected 16 referring hospitals and 6 receiving hospitals involved with single helicopter transport EMS system. Limited patients to > 18 dx STEMI and transferred. Excluded inpatients. 84% white, 64% male, 20% shock, 45% EMS presented pt	Used random sampling method for data collection from the initial pool, 389 participants completed the survey	Small rural hospital≤ 25 beds, large >25 beds	The investigators developed a 17-item web-based survey with open- and closed-ended responses, using Rogers' diffusion of innovations as a theoretical framework. Total of 334subjects responded to the survey from an estimated possible number of 1, 786 for a return rate of 18.7%.
Methods/study appraisal/ synthesis methods	Placed patients into fibrinolytic therapy (22%) or PCI groups(78%). Used	Statistical testing with SPSS using ANOVA and the Turkey post hoc test to determine the	Convenience sample of 688, used modified Dillman method and paid $20 to complete NES survey. 4 item response	Survey was offered to PHNs via email based upon organizational membership (some had

	SPSS for data review. 3/5 patient survived CPR enroute	similarities and the differences between the groups by role and regional size.	format. SPSS 15 analysis. Independent *t*, Chi Square, Mann-Whitney U tests used.	duplicate memberships). SPSS was used, statistical test used Students' t test or the w2 test, depending on whether the variables were categorical or continuous.
Primary outcome measures and results	49% got lytic therapy in 30 min window, mean was 31 min. 3% Got PCI ,90 min, mean 138 min. In review of data EKG to helicopter mean 32' (long) for PCI (57' Lytics)	Of the respondents 82 were nurse educators. Detailed demographic data was obtained. There was a significant relationship between age, awareness, attitude, cosmopolitanism, innovation, involvement educators, and staff nurses, diploma, degree and overall research utilization.	Response rate 41%: Mostly from the south and Midwest, had average census 43, 40% were part of larger system. No difference between larger and small hospital types. RN were AD (75%), BS (21%) MS (3%).93% float, 32% have clinical ladder, 21% union. System hospital had higher external influence, higher quality & safety activities. Larger hospitals are TJC certified, smaller hospitals are Critical Access Hospital (CAH) starting certification in 2001.	Most of the PHNs had practiced or taught 19.4 years. Almost 85% held a master's degree or higher. 58% of the 334 respondents indicated that they had access to a copy of the PHNs competencies, 93% of the respondents indicated that they would consider using, or increase their use of the competencies if the information was a more usable form. 70% indicated that they have used them.
Author conclusions/ implications of key findings	Helicopter transport of STEMI delays reperfusion	"the communication elements of innovation diffusion theory are markedly similar to community of practice theory, examined from a social-practice perspective" "Rodgers (1995) point out that opinion leaders and change agents have more success communicating	Quality and safety efforts increase with The Joint Commission membership. Promote BSN education for rural hospitals. Rural hospitals need different strategies to adopt best practices.	Two years since the competencies were published. 60% academic PHNs knew about the competencies, 46% of practitioners. In addition to the context in which diffusion process takes place and the communication channels, characteristics or perceived attributes of the innovation

		new in organizations when the agents have membership within the group."		itself can improve the chances of adoption and implementation. (Rogers, 1995),
Strengths/ limitations	Used 2007 data and applied 2009 benchmarks. Conclusion is off base as sample was convenience (one helicopter group)	The population studied, clinical nurse educators, may have had artificially high scores. Although the study adequate power, it may be advised to apply the outcomes to other nurse educator groups.	NES needs more psychometric testing, used single nurse executive to represent nursing, used convenience sample.	Limited by email web addresses of members, the survey took place after a national convention in the PHN competencies were content.
Funding source	Unsure	Not stated		Not stated
Comments	Flawed study design	"Reconfiguring the clinical nurse educator role and providing education and support to enhance their research knowledge and skill may be important strategies."	Rural defined by Office of Management and Budget as those located in counties that qualify as metropolitan statistical areas generated by US Census Bureau.	Questions about the study design arose.

Article Title and Journal	Benner's remnants; culture, tradition and everyday understanding. *Journal of Advanced Nursing*.38(6). pp. 566-573.	Contemporary mortality risk prediction for percutaneous coronary intervention. Results from 588,398 procedures in the National Cardiovascular Data Registry. *Journal of the American College of Cardiology*	Psychometric evaluation of the acute coronary syndrome (ACS) response index. *Research in Nursing & health: 30, 584-594.*	Embodied dispositions or experience? Identifying new patterns of professional competence. *Journal of Advanced Nursing 61* pp. 512-521. Doi:10.111/j.1365-2648.2007.04543.x
Author/year	Paley, J. 2002	Peterson ED, Dai D, DeLong ER, Brennan JM, Singh M, Rao SV, Shaw RE, Ho KKL,	Riegel B, McKinley S, Moser DK, Meischke H, Doering L & Dracup K. 2007.	Rischel V., Lrsen K. & Jackson K. 2008.

		Klein LW, Krone RJ, Weinraub WS, Brindis RG, Rumsfeld JS & Spertus JA. 2010		
Database and keywords	EBSCO: Benner	MEDLINE: PCI mortality	Interscience: reliability, acute coronary syndromes, treatment delays.	CINHAL: Benner, Competence
Research design	NA	Used logistic regression on data from 181,775 procedures to develop risk models. Independently validated in 2 cohorts 2004-2006 (121,183) and 2006 2007 (285,440)	Use of modified index tool used in REACT trails. 5 PhD authors tested validity and reliability of the 41 items.	Observational report of a study to explore nurses' competence as revealed during an admission assessment.
Level of evidence	NA	Ib		IIc
Study aim/purpose	"Having identified the principal tenets of what we might conveniently call the Benner-Goertz theory. I proceed to interrogate the theory, using the recent anthropological literature-and in particular, materialist attacks on the idea of culture as a system of meaning-in order to cast doubt on it."	To create contemporary model for predicting mortality risk following PCI.	Tested knowledge of disease/symptoms (21 items), tested attitudes and beliefs (12 items) of those with ACS.	Report of a study to explore nurses' competence as revealed during an admission assessment. Based on the work of Benner (1984) AND Benner et al.(1992). Hypotheses was when assessing a patient, a less experienced nurses uses a structure while a more-experienced nurses uses intuition and experience.
Population studied/sample size/criteria/	NA	Used National Cardiac Data Registry Cath PCI registry data base to	3, 522 ACS patients	"The data from 12 structured non-participant observations of admission assessments in

power		develop tow cohorts one for model development and one for prospective validation. Used 470 hospital sites. Univariate analysis was used to identify candidate variables. First full model developed, second "pre-cath model" developed and limited pre-cath risk prediction model developed last.		a orthopedic ward by four nurses: two with <1 year experiences and two with more than five years' experience."
Methods/study appraisal/ synthesis methods	NA	Full model performed well, has 21 variables. Simplified model has 8 variables.	Compared three cohorts of ACS patients: those who attended cardiac rehabilitation, those with care provided by cardiologist and those with access to more than one source of expertise.	Observation of admission of orthopedic patients by experienced nurses. "As the admission assessment is a situation of interpersonal interactions, Spradley's (1980) framework for observation of social situations guided the construction of the variables. Spradley identifies nine major dimensions to be considered in observation."
Primary outcome measures and results	NA	Patients with PCI during STEMI faced substantial increased risk.	Those who attended cardiac rehabilitation programs had overall higher scores.	Each nurse had unique patterns of practice that did not correspond to the level of competence expected in relation to their length of experience as a nurse. Nurses' competence seems to be situation rather than related to levels in the

				development model.
Author conclusions/ implications of key findings	Although not research, it is a literary review of the use of the term "culture" by Benner's theories and it is an in-depth anthropological view of the impact of culture upon competence.	Comprehensive contemporary model with predictive accuracy throughout the spectrum of care. Multiple applications including beside risk adjustment, hospital performance comparison and risk adjustments.	Validating an instrument is an ongoing process of gathering evidence. Study showed low variance related to patient's knowledge, beliefs and attitudes.	"Irrespective of the length of experience, nurses showed both general and individual patterns of competence that seemed to be related to personal capacity rather than having been gained by experience. During the admission assessment, individual styles of practice are exposed by different types of questions, the nature of terms used and the substance of the conversation.
Strengths/ limitations	Writer bias permeates the article. (almost entertaining!)	Participation in NCDR is voluntary and therefore some populations may be under represented. NCDR is the largest patient data bank in the world. Only complete 30 day mortality is Medicare data, not capturing those under age 65.	Now that the tool is available need to test ACS knowledge, beliefs and attitude and correlate those to outcomes especially the delay of seeking assistance.	The interpersonal relationship between nurses and patient observed during admission assessment may expose certain perspectives of competence that differ from other nursing situations such as technical skill sets.
Funding source	Not stated	Not specified.		Not stated
Comments	High level study of the words, terms and phases used by Benner in writings and an admittedly strong attempt to discredit the work as non-theoretical.	Huge impact clinically.	Study of the testing of tool. Not directly related to outcomes of ACS.	Does not support Benner's work in this setting.

Article Title and Journal	Impact of delay to angioplasty in-patients with acute coronary syndromes undergoing invasive management. Analysis from the ACUITY (Acute catheterization and urgent intervention triage strategy) trial. *Journal of the American College of Cardiology*	Intensive Care unit utilization and interhospital transfers as potential indicators of rural hospital quality. *Journal of Rural Health: 20 394-400.*	Direct paramedic transport of acute myocardial infarction patients to percutaneous coronary intervention centers: as decision analysis. *Annals of Emergency Medicine.*
Author/year	Sorajja P, Gersh BJ, Cox DA, McLaughlin MG, Zimetbaum P, Costantini C, Stuckey T, Tcheng JE, Mehran R, Lansky AJ, Grines CL & Stone GW. 2010	Wakefield DS, Ward M, Miller T,Ohsfeldt R, Jaana M, Lei Y, Tracy R, & Schneider R. 2006.	Wang HE, Marroquin OC & Smith KJ. 2009.
Database and keywords	MEDLINE: STEMI	EBSCO: rural nursing	MEDLINE: STEMI
Research design	Prospective, open label, randomized multicenter trial of Non-STE-ACS, stratified by time of hospitalization to intervention.	Retrospective case review of transfers from CAH, rural, rural referral and urban hospitals in Iowa	Quantitative study design of decision tree for paramedics selecting hospital/facility for STEMI care.
Level of evidence	Ia	Ib	IIb or IIIb

Study aim/purpose	Determine the impact of delay of PCI upon Acute Coronary syndromes (ACS)	To evaluate the usefulness of ICU utilization in CAH as measure of quality	Compare the decision for PCI in distant facility vs. fibrinolytic therapy in community hospital had impact on 30 day mortality.
Population studied/sample size/criteria/ power	PCI performed in 7,749 patients at median time of 19.5 hours after presentation. Patients were male (73% and mean age 63 years)	Used data from 2001 American Hospital Association data bank (91 hospitals, used data from 86 hospitals). Data assumptions made from billing statements of high cost care. Of the 346,184 patients, 56,333 were in ICU.	Not well defined. Used University of Pittsburgh IRB.
Methods/study appraisal/ synthesis methods	Used ACUITY registered patient population, timed PCI < 24 hours compared to >24 hours for outcomes.	Statistical review of transfer patterns, cost, use of transport, admission practices, discharge locations based upon previously collected data sets.	Used a decision tree, placing cases into one arm or another of the decision tree. Used case data. Used one way sensitivity analysis to find the treatment time and compare it to RR values. Also used probability sensitive analysis.
Primary outcome measures and results	,8 hours 2197pts, 8-24 hours 2,740 pts., >24 hours 2812 hours. Delays >24 hours associated with increased 30 day and one year mortality	CAH ICU patients 5.9% of census, Rural hospital 9.8% and urban hospitals 17.6% with highest mortality rates in CAH (3.2% compared to 2.6). Medical patients were less likely to transfer, surgical patients more likely. Transport of ICU patients increased mortality rates.	Chest Pain (CP) to PCI 188 minutes (41-447 min range) with 91.5-95.3% survival. Fibrinolytics 118 minutes (51-267 minutes) with 87-94% 30 survival.

Author conclusions/ implications of key findings	Timing of PCI for NSTEMI had not been established prior to this study. Strong association of mortality and adverse clinical outcomes with PCI > 24 hours.	Unable to link charge data to quality of care provided. CAH and rural hospitals do not follow the suggested IHI patterns (intensivists in ICU, local patterns for admission criteria). Less resources are available for rural and CAH ICUs.	Favored preferred transport for PCI instead of fibrinolytic therapy.
Strengths/ limitations	Precise reasons for delay were not gathered, some baseline difference between the randomized groups. This study was post hoc analysis	One state evaluated, one year reviewed, used data collected with different foci than the items studied	Assumed all paramedic gave same care, had 12 lead, excluded all patients who could not receive fibrinolytics, facilitated PCI or failed fibrinolytic therapy
Funding source	Not stated		Not stated
Comments	Urgent PCI for this population would require greater hospital resource use, personnel and costs.	Limited work in the area of study. Not a strong study. Format poor in the journal.	Assumptions were staggering. Defined STEMI treatment time as onset of symptoms to drug or open vessel. Population and methods are not clarified.

American Heart Association/American College of Cardiology Levels of Evidence

Classification of Recommendations:

Class I: Conditions for which there is evidence and/or general agreement that a given procedure or treatment is useful and effective

Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment.
IIa. Weight of evidence /opinion is in favor of usefulness/efficacy
IIb. Usefulness/efficacy is less well established

Class III: Conditions for which there is evidence and /or general agreement that the procedure/treatment is not useful/effective, and in some cases may be harmful.

Level of Evidence

Level A: Data derived from multiple randomized clinical trails

Level B: Data derived from a single randomized trial or a non-randomized trial

Level C: Expert opinion consensus

Adopted from Kushner F.G. (et al.) 2009. 2009 Focused Updates: ACC/AHA Guidelines for the management of patients with STEMI (Updating the 2004 guidelines and 2007 focused update) and ACC/AHA/SCAI guidelines on PCI. A report of the American College of Cardiology Foundation/American Heart association task force on practice guidelines. *Circulation 54,* 2205-2241. doi:10.1016/j.jacc.2009.10.015

Appendix B

Budget and Resources

Balance Sheet for Rural Heart Attack Care Project(s)

Assets	
Current Assets	
• Cash (self-donated)	$500
• Net accounts receivable	$0
• Prepaid Expenses	$0
Total Current Assets	$500
Net Property & equipment (computer, phones)	$1500
Total Assets	**$2000**
Liabilities and Equity	
• Accounts payable	$0
• Withheld taxes	$0
• Employee Benefits withheld	$0
• Accrued salaries and wages	$0
Total Current Liabilities	**$0**
Equity	
• Contributed capitol	$2000
• Retained earnings	$0
Total Equity	$2000
Total Liabilities and Equity	**$2000**

Variable Fixed & Direct Costs	***Billed per project event***	***Projected variable Costs***
• Labor	$50/hour	$50 x 80 hours = $4000
• Office supplies	$15/project	$15
• Training Materials (STEMI Certification Book)	$300 for ten copies	$300
• Commute/gas	$.65/mile	$.65 x 500 miles = $325
• Phones/communications	$150/month	$150 x 3 months = $450
• Membership	$200/professional membership	$200
Total Variable Fixed & Direct Costs		**$5290**

Balance Sheet is adapted from Cleverley, W.O., Song, S.H., & Cleverley, J.O. (2011). Health Plans. In W.O., Cleverley, S.H. Song, and J.O. Cleverley (Eds.) *Essentials of health care finance* (p. 276). Sudbury MA: Jones and Bartlett Learning.

Variable Fixed and Direct Costs is adapted from Cleverley, W.O., Song, S.H., & Cleverley, J.O. (2011). Cost Measurement. In W.O.,

Cleverley, S.H. Song, and J.O. Cleverley (Eds.) *Essentials of health care finance* (pp.324-325). Sudbury MA: Jones and Bartlett Learning.

Appendix C

The Logic Model

Heart Attack Care for Salida Colorado and Heart of the Rockies Regional Medical Center

Resources	Program Activities	Outputs	Outcomes	Impact
911 system for emergency care by Chaffee County EMS	Collect calls, dispatch, arrive, assess, transport to HRRMC	Quick dispatch , Obtain EKG on scene, load and	Dispatch- 3 minutes Scene EKG 5 minutes Load/transport start within 15 minutes	Reduce time for dispatch, on scene arrival, “eyeball to diagnosis”
Communication contact with ED	Report findings, receive orders	Contact when assessment gathered	Phone contact within 10 minutes	Accurate, fluid data reported
HRRMC ED 24/7	Physician services, nursing, radiology, EKG, lab	Admit, Assess, confirm diagnosis	Door to diagnosis <10 minutes	Deuce time allotments for sequenced care
Staff Skill sets: EMS, Physician, Nurses, Support staff	Gather history, assessment, Vital signs, EKG, start IV access, Oxygen delivery, teamwork, timing, priority setting	Skills in 12 Lead EKG, CPR, ACLS, follow treatment algorithm	Accurate testing, algorithm completed,	STEMI certification for RN, RT, EMS
12 Lead EKG	Place leads, obtain tracing, interpretation	Repeat with any clinical change	Every 10 -15 minutes	Increase accuracy of lead placement, reduce timing between repeated studies
Laboratory testing	Troponin, CK, CBC, Chemistry, other, as indicated	From IV access site	Do not perform a second needle stick	Data reported after transport decision
Radiology	Chest x-ray, rule out AAA	After transport called	Completed as ordered	Completed as ordered
Medication Delivery	Oxygen, nitroglycerin, narcotics, heparin electrolytes, aspirin	Medications directed at symptom control, planned transport	Timing, sequencing and doses accurate	Algorithm completed accurately

Resources	Program Activities	Outputs	Outcomes	Impact
FFL Transport	Dispatch, arrive, load, transport to Penrose, monitor	Arrival air/ground at pre-stated times.	Arrive ASAP. 10 minute load to leave time.	Reduce transport times
Penrose Hospital	Assess, cath lab for PCI, ICU post fibrinolytics	Accept STEMI, no divert, if PCI- bypass ED, If fibrinolytics- bypass ED to ICU	Immediate triage and proper algorithm steps followed	Timing of all event shortened, ED bypass if possible
PCI	Angioplasty, intra-coronary thrombectomy, stents, hemostasis, stabilize, support, manage shock & cardiac arrest	Reperfusion of Coronary within 30 minutes of arrival at ED Door	Restore coronary circulation, manage cardiogenic shock or rhythm disturbances	Reduce self-reported angina, improved Ejection Fraction, Restore flow in coronary arteries (post compared to pre)
Fibrinolytics	TNKase bolus and infusion	If timing > 90 minutes to Penrose and open vessel	Door to drug time- 30 minutes maximum	Recue PCI if symptoms continue after full dose
Centura Connect®	Arrange transport, care at Penrose, attending physician, consultants,	Connect facilities seamlessly	EMTLA preserved, facilities ready, no interruptions in care	One call transfer program
Discharge Planners, Penrose Cardiologists	Repatriation back to Salida	Return to PCP, discharge home	Records, medication reconciliation, follow up provided	Compliance with meds and health-care recovery

ED Emergency Department **HRRMC** Heart of the Rockies Regional Medical Center **EKG** Electrocardiogram **EMS** Emergency Medical Services **FFL** Flight for Life Helicopter
CK creatine phosphokinase **CBC** Complete Blood Count **AAA** Abdominal Aortic Aneurysm **IV** Intravenous **PCI** Percutaneous Coronary Intervention **ICU** Intensive Care Unit
PCP Primary Care Provider **CPR** Cardiopulmonary Resuscitation **ACLS** Advanced Cardiac Life Support **STEMI** ST Elevation Myocardial Infarction

Appendix D

CITI Training Certificate

CITI Collaborative Institutional Training Initiative

Human Research Curriculum Completion Report
Printed on 6/11/2011

Learner: Julie Benz (username: jbenz@regis.edu)
Institution: Regis University
Contact Information 3315 Crystal Peak drive
Parker, CO 80138 USA
Department: Nursing
Phone: 303 841 7426
Email: jbenz@regis.edu

Biomedical Research Investigators and Key Personnel:

Stage 2. Refresher Course Passed on 06/11/11 (Ref # 6163829)

Required Modules	Date Completed	
Refresher Course 101 Introduction	06/11/11	no quiz
History and Ethical Principles.	06/11/11	no quiz
Regulations and Process, Part 1	06/11/11	1/1 (100%)
Regulations and Process, Part 2	06/11/11	1/1 (100%)
Informed Consent.	06/11/11	1/1 (100%)
Social & Behavioral Research (SBR)	06/11/11	2/2 (100%)
Genetics Research, Part 1	06/11/11	1/1 (100%)

Genetics Research, Part 2	06/11/11	1/1 (100%)
Records-Based Research, Part 1	06/11/11	1/1 (100%)
Records-Based Research, Part 2	06/11/11	1/1 (100%)
Records-Based Research, Part 3	06/11/11	1/1 (100%)
Research with Protected Populations - Vulnerable Subjects: A Definition.	06/11/11	1/1 (100%)
Vulnerable Subjects - Prisoners, Part 1	06/11/11	0/1 (0%)
Vulnerable Subjects - Prisoners, Part 2	06/11/11	1/1 (100%)
Studies With Minors, Part 1	06/11/11	1/1 (100%)
Studies With Minors, Part 2	06/11/11	1/1 (100%)
Studies With Minors, Part 3	06/11/11	0/1 (0%)
Studies with Pregnant Women and Fetuses, Part 1	06/11/11	0/1 (0%)
Studies with Pregnant Women and Fetuses, Part 2	06/11/11	0/1 (0%)
Group Harms: Research with Culturally or Medically Vulnerable Groups.	06/11/11	2/3 (67%)
FDA-Regulated Research, Part 1	06/11/11	1/1 (100%)
FDA-Regulated Research, Part 2	06/11/11	2/2 (100%)
Human Subjects Protections at	06/1	1/1

the VA, Part 1	1/11	(100%)
Human Subjects Protections at the VA, Part 2	06/11/11	1/1 (100%)
HIPAA and Human Subjects Research.	06/11/11	2/2 (100%)
Conflicts of Interest in Research Involving Human Subjects.	06/11/11	2/2 (100%)
How to Complete the CITI Refresher Course and Receive a Completion Report	06/11/11	no quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator

Appendix E

NIH Training Certificate

Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Julie Benz** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 08/22/2011

Certification Number: 729792

Appendix F
Regis University Internal Review Board Letter

REGIS UNIVERSITY

Academic Affairs
Academic Grants

3333 Regis Boulevard, H-4
Denver, Colorado 80221-1C

303-458-4206
303-964-3647 FAX
www.regis.edu

IRB – REGIS UNIVERSITY

October 13, 2011

Julie Benz
3315 Crystal Peak Drive
Parker, CO 80138

RE: IRB #: 11-254

Dear Julie:

Your application to the Regis IRB for your project "Rural Heart Attack Health Care" was approved as exempt on October 12, 2011.

The designation of "exempt," means no further IRB review of this project, as it is currently designed, is needed.

If changes are made in the research plan that significantly alter the involvement of human subjects from that which was approved in the named application, the new research plan must be resubmitted to the Regis IRB for approval.

Sincerely,

Daniel Roysden, Ph.D.
Chair, Institutional Review Board

cc: Pat Mullen, Ph.D.

Appendix G

Penrose Hospital Internal Review Board Letter

Penrose-St. Francis Health Services
Centura Health
2222 North Nevada Ave.
Colorado Springs, CO 80907
719.776.2514

DATE: November 2, 2011

TO: Julie Benz, RN BSN MS CCRN CNS-BC
FROM: Penrose-St. Francis Institutional Review Board

STUDY TITLE: [266116-1] Rural Heart Attack Helath Care
SUBMISSION TYPE: New Project

ACTION: APPROVED
APPROVAL DATE: October 31, 2011
EXPIRATION DATE: October 30, 2012

REVIEW CATEGORY: Expedited review

Thank you for your submission of the materials for this research study. Penrose-St. Francis Institutional Review Board has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable Federal regulation.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All FDA and sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.

Based on the risks, this project requires Continuing Review by this office on an annual basis. Please use the appropriate renewal forms for this procedure.

If you have any questions, please contact the IRB Coordinator at (719) 776-2514 or cynthiawinemiller@centura.org. Please include your study title and reference number in all correspondence with this office.

Jerome B. Myers, MD, PhD
Chair, Penrose-St. Francis Institutional Review Board

Appendix H
Penrose Hospital Letter of Support

Penrose-St. Francis Health Services
Centura Health

Interdisciplinary Research Study
Nursing Letter of Support

Title of Study: "Rural Heart Attack Health Care". PI: J Julie Benz, RN CNS-BC CCRN MS

Comments: This study has been reviewed and approved by members of the Nursing Evidence Based Practice (EBP) and Research Council and PSFHS Nursing Directors/Leadership.

Chair Nursing EBP/Research Council: Rochelle Salmore / Deb Mundstock 8-22-2011
Rochelle Salmore MSN, RN, NE-BC Date of Approval

Chief Nursing Officer: Kate McCord 8/22/2011
Kate McCord MSN, RN, NEA-BC Date

A copy of this approval letter must be delivered to the IRB prior to their review.

Appendix I

Measurement Tool

STEMI Data Collection Tool (Adopted from Excel Spread Sheet Format)

General Date	Case Number	Gender	Age	Walk in or POV or clinic	Home town	EMS DATA First Medical Contact Time (FMC)	12 Lead EKG Minutes from FMC	Call to base Time, Minutes from FMC	Depart scene Minutes from FMC

Labs with IV start Y/N	Total EMS Time	Mileage Pt to HRRMC	HRRMC Data Arrive HRRMC	Positive EKG Time	Call cardiac alert	Call for transport time	Centura Connect®? Y/N	Time TNKase	Time ASA

Time Plavix	2nd EKG	Use of written checklist	TIME TRANSFER	HRRMC Time total	Penrose Data	Arrival to Penrose	Direct admit	ED admit

Appendix J
Salida STEMI Only Data 2010, 2011

Demographic Data

General Date	Case Number	Gender	Age	Walk in or POV EMS clinic	Home town
8/26/2010	4	M	67	POV	Buena Vista
6/29/2010	7	M	66	EMS	Buena Vista
8/27/2010	8	M	48	POV	Buena Vista
3/26/2011	1	M	48	POV	Salida
5/20/2011	2	M	75	POV	Salida
5/20/2011	3	M	60	EMS	West Bend WI
6/20/2011	4	M	62	EMS	Salida
6/26/2011	5	M	74	EMS	Nathrop
9/28/2011	6	M	71	EMS	Salida
11/5/2011	7	F	77	POV	Salida

EMS Data

Case Number	EMS DATA First Medical Contact Time	12 Lead EKG Minutes from FMC	Depart scene Minutes from FMC	Total EMS Time	Mileage Pt to HRRMC
7	2207	10	5	28	23
3	1300	42	9	35	30
4	1445	11	12	21	21
5	1000	9	11	26	14.9
6	23:50	8	22	48	38.8

Appendix J, Continued
Salida STEMI Only Data 2010, 2011

Heart of the Rockies Regional Medical Center Data

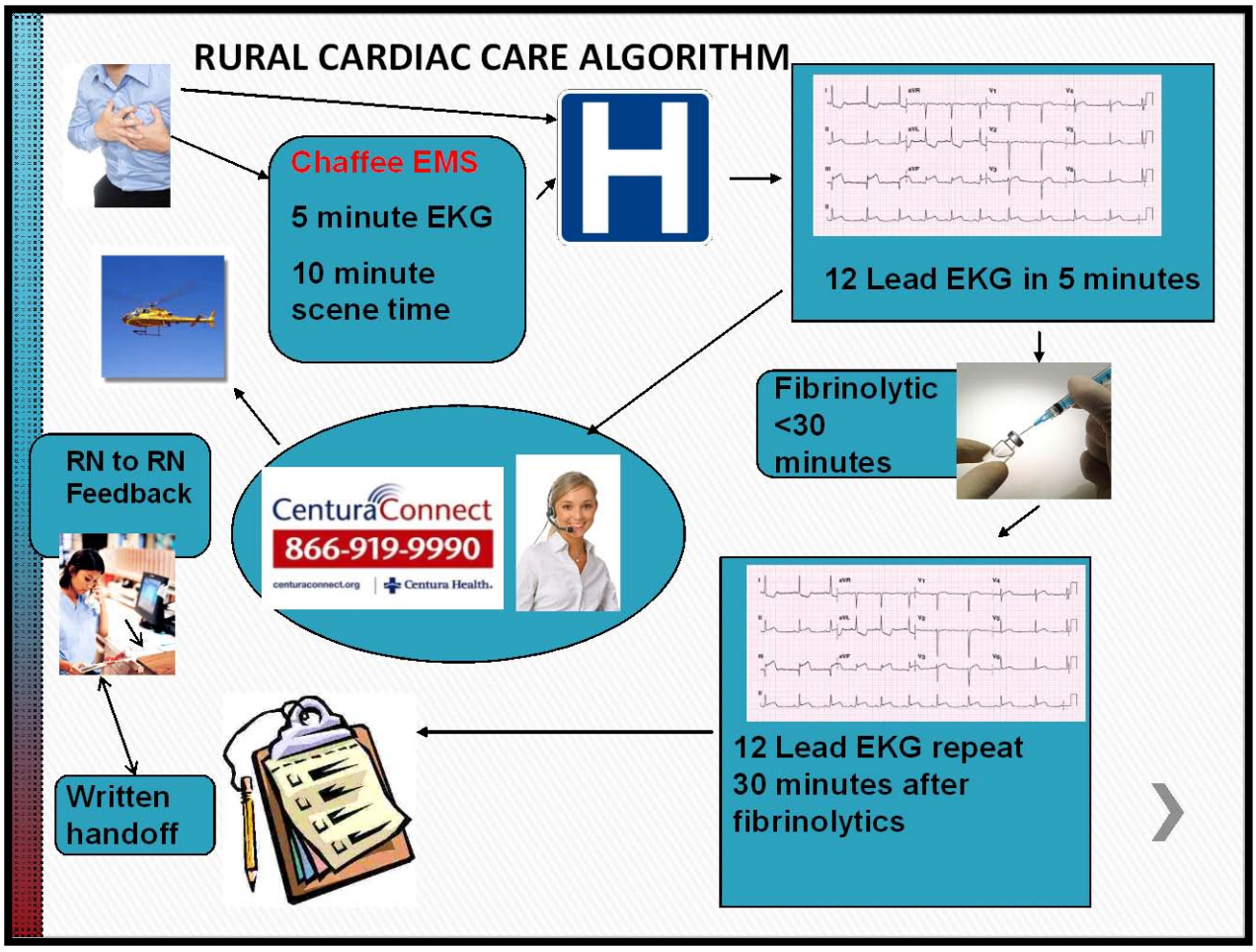
General Date	HRRMC Data Arrive HRRMC	Positive EKG Time	Call cardiac alert	Call for transport time	Centura Connect ®? Y/N	Time TNKase	TIME TRANSFER	Use of written check list	HRRMC Time total
8/26/2010	720	728	728		no	746	900		100
6/29/2010	2230	2245		adm, tx	no		820		590
8/27/2010	940	950	1005			1010	1110		90
3/26/2011	1931	1935			no	1950	2043	no	72
5/20/2011	1109	1119			no	no	1350	yes	161
5/20/2011	1333	1342			no	1341	1450	yes	137
6/20/2011	1500	1507			no	1511	1646	yes	106
6/26/2011	1026	1033			no	no	1120	no	54
9/28/2011	0:10	40			yes	48	230	yes	140
11/5/2011	1225	1236			yes	1248	1500	yes	155

Penrose Data

General Date	Penrose Data	Arrival to Penrose	Direct admit	ED admit Diagnosis	other
8/26/2010	8/26	10:30	CVL	STEMI	8/26 PCI
6/29/2010	6/29	10:00	ICU	STEMI	6/29 PCI
8/27/2010	8/27		CVL	STEMI	
3/26/2011	3/26	2125	ICU	STEMI	
5/20/2011	5/20	1836	CVL	STEMI	PCI
5/20/2011	5/20	1611	CVL	STEMI	PCI 1611 failed lytics
6/20/2011	6/20	1728	CVL	STEMI	HC, no stent,failed lytic
6/26/2011	6/26	1225	CVL	STEMI	PCI, direct to Cath lab
9/28/2011	9/28	329	CVL	STEMI	PCI 0351
11/5/2011	11/5	1655	ICU	STEMI	PCI 11/6 1311

Appendix K

Rural Cardiac Care Algorithm



Appendix L

Timeline

DNP Capstone Timeline

NR706_BenzJu_CapstoneTimeline, Adapted from April 17 2011 Version

Process Step	Key details	Resources	Anticipated Barriers	Comments
Problem recognition	Identify need, PICO statement, Systematic review of the Literature	PICO development continues with Dr Pappas. SRL skills with Jan Turner	Time, PICO seems to change over time- Three versions created.	
Needs Assessment	Identify Population, Identify sponsor and stakeholders, organizational assessment, assess resources, identify desired outcomes, team selection, cost/benefit analysis, define scope of project	Population paper for NR 704 identifies the population. Working with Scott Campbell to identify sponsor and key stakeholders. Physician sponsor- Jack Sharon, Penrose ED. Administrative sponsor- Kate Mixdorf, Meeting with HRRMC staff 4/19. Outcomes identified from clinical practice guidelines. Defined algorithm, model for care delivery and interventions in October 2011	It has taken some effort to identify sending facility and the EMS service line. FFL data made that decision work. First meeting is 4/19/2011 Did not complete cost benefit analysis since time was donated and team supportive of project. That was an error. Formal SWOT done for Capstone Paper November 2011	Population identification- done. May 2011
Goals, Objectives and Mission statement	Goals Process Outcome objectives Develop Mission statement	DNP Mentor, HRRMC Leadership, Capstone Chair, Faculty	Difficult to refine and reduce length. Needs to be guiding direction and inclusive. Questioned on slide show by faculty in November and reviewed in January 2012.	May 2011

Process Step	Key details	Resources	Anticipated Barriers	Comments
Theoretical Underpinnings	Theory of change Theory to support project framework	Roger Diffusion of Innovation Benner's Novice to Expert theory for practice of health care and nursing	Finding research,- older theory, have the text book 4th edition 2006 Need applied studies, researched or supportive data	Summer 2011, actually completed in July 2011
Work Planning	Project Proposal Project management tools: Milestones Timeline Budget	Began work with HRRMC in February 2011, as tool developed, met monthly with resources at HRRMC monthly until June 2011 (waiting on IRB) Realistic budget was $0.	Timeline completed in April 2011 and updated in February 2012 for final edition of paper. Developed revised budget for project February 22 2012 for inclusion in final paper.	May/June 2011
Planning for Evaluation	Development evaluation plan Logic Model Plan	Planned to use chart review with back up ACTION® data from American College of Cardiology Developed Logic model from Kellogg Model	Data review delayed by IRB issues. Collection began in January 2012	Summer 2011- Data finally evaluated in later February 2012 due to extended time allowed for IRB submission.

Process Step	Key details	Resources	Anticipated Barriers	Comments
Implementation	IRB Approval Threats and barriers Monitoring implementation phase Project closure	Used Penrose IRB, with CNO Kate McCord, IRB director beginning in late May 2011, approval in October 2011 IRB at Regis, with Mentor assistance, Capstone Chair-submitted and approved in July 2011 Data collected in late January from HRRMC, ACTION® registry data collected in February 2012. At end of February the EMS data is just being offered.	Never anticipated the number of barriers faced: Poor direction given by Penrose for IRB 9separate from Nursing Research Committee), needed CITI and NIH competencies completed. Submission to Penrose IRB was protracted due to their process timing. Anticipated weeks for process and it was five months. EMS was not active partner. Involved medical director in 2/2012 and within days all data reported and included.	Summer 2011 Summer 2011 Late summer 2011 Need adequate sample-unsure of timeline
Giving Meaning to the data	Qualitative data Quantitative data	Data review, cleaned data, verified dates and times of data in February.	Still in process 2/22/2012. Data is coming in later than hoped. Conflicts in data resolved with very strong source.	Winter 2012
Utilizing and Reporting Results	Written dissemination Oral dissemination Electronic dissemination Submit for publication	Writing final Capstone Project from January – March 2012. Schedule for April 18, 2012. ASAP May not be worthy of publication due to low volume of patients.	Missing elements needed to be generated for the paper-project finding, limitation, implications etc. Discussed with mentor, but few cases make the work less publishable.	Spring 2012 Spring 2012 Spring 2012 Spring 2012

Appendix M

Colorado Model of Rural Access for Emergent Cardiac Care