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Improving Door-to-Balloon Times in Adult Patients with ST-Elevation Myocardial Infarction by Utilizing a STEMI-RN

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**Improving Door-to-Balloon Times in Adult Patients with ST-Elevation Myocardial
Infarction by Utilizing a STEMI-RN**

A DNP Project Submitted to the
Graduate Faculty
Of Jacksonville State University
In Partial Fulfillment of the
Requirements for the Degree of
Doctor of Nursing Practice

By

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Jacksonville, Alabama

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Abstract

Background: Heart disease is the leading cause of death in Alabama. The national estimated annual incidence of myocardial infarction (MI) is 605,000 new and 200,000 recurrent attacks, of which approximately 170,000 are silent (Tsao et al., 2022). Roughly every 40 seconds, an American will have an MI (Tsao et al., 2022). An ST-elevation myocardial infarction (STEMI) occurs when one or more of the coronary arteries supplying the heart with blood occlude, leading to myocardial injury (Akbar et al., 2021). Clinical practice guidelines for STEMI recommend Door to Balloon (D2B) intervention in 90 minutes or less (O'Gara et al., 2013), while the European Society of Cardiology STEMI guidelines recommend reperfusion occur within 60 minutes (Ibanez et al., 2017). Early reperfusion is associated with favorable outcomes, including improved morbidity and mortality (Tsao et al., 2022).

Purpose: The Doctor of Nursing Practice (DNP) quality improvement project aims to decrease D2B times to within 60 minutes for patients arriving at the emergency department (ED) with STEMI. The project's goal is to meet the target timeframe at least 90% of the time.

Methods: This single-center quality improvement project was held at a regional hospital in Northeast Alabama, utilizing concurrent secondary data from all STEMI patients who underwent percutaneous coronary intervention (PCI). The project compared baseline data (12 weeks during the same implementation period in the previous year) to post-implementation data (12 weeks after implementation). Variables analyzed include door-to-electrocardiogram (ECG) time, door-to-activation of STEMI code, activation-to-arrival in the catheterization laboratory (cath lab), door-to-balloon (D2B) time, location of the lesion, and intervention received.

Results: After implementing a STEMI-RN, 60% of cases met the D2B goal of fewer than 60 minutes. In the previous year, 33% of patients met the target of 60 minutes or less. Sample sizes

were too small to show statistical significance in the baseline and post-implementation groups.

The metric presenting improvement opportunity includes the activation-to-arrival in the cath lab time. More research is needed to determine the cause of the delay.

Conclusion: Further study is needed to directly correlate the effect of a STEMI-RN on D2B times.

Keywords: acute myocardial infarction (AMI), ST-Elevation Myocardial Infarction (STEMI), Door-to-balloon (D2B), STEMI policies, door-to-balloon time.

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Improving Door-to-Balloon Times in Adult Patients with ST-Elevation Myocardial Infarction by Utilizing a STEMI-RN

ST-segment elevation myocardial infarction (STEMI) patients require prompt treatment to enhance favorable outcomes. Rapid treatment begins with immediate recognition of symptoms, a diagnostic electrocardiogram (ECG) performance, and activation of Code STEMI. Once a Code STEMI occurs, several metrics require completion to reach a door-to-balloon time under 90 minutes, as recommended by the American Heart Association (AHA) (O'Gara et al., 2013). International standards have become more aggressive, as patient outcomes improve when D2B times are less than 60 minutes, as the European Society of Cardiology recommends (Ibanez et al., 2017). US standards are anticipated to become more aggressive as well. A needs assessment at the DNP project site revealed the need for process improvement by implementing a STEMI-RN to reach D2B times less than 60 minutes.

Background

The national estimated annual incidence of myocardial infarction (MI) is 605,000 new and 200,000 recurrent attacks (Tsao et al., 2022). Of these, about 225,000 die (Lee et al., 2019). 8.95 million deaths were due to ischemic heart disease in 2020 (Tsao et al., 2022). The average age at first MI is 65.6 years for males and 72.0 years for females (Tsao et al., 2022). A STEMI occurs when one or more of the coronary arteries supplying the heart with blood occlude, leading to myocardial injury (Akbar et al., 2021).

Clinical practice guidelines for STEMI recommend D2B intervention in 90 minutes or less (O'Gara et al., 2013), while the ESC STEMI guidelines recommend reperfusion occur within 60 minutes (Ibanez et al., 2017). Early reperfusion is associated with favorable patient outcomes, including improved morbidity and mortality (Tsao et al., 2022). Tsao et al. (2022) observed an

increased risk of 6-month to 12-month mortality for less than a 90-minute D2B delay. Therefore, the definitive course of treatment for an acute coronary syndrome (ACS) episode should begin within 60 minutes of symptom onset and include early treatment with reperfusion and medications, including angiotensin-converting enzyme inhibitors, beta-blockers, and aspirin, to help reduce mortality and morbidity.

D2B is affected by all previous treatment measures. Other metrics include door-to-electrocardiogram (ECG), door-to-activation of the catheterization (cath) team, and activation-to-arrival in the cath laboratory. From April thru August 2022, the average D2B time for the facility is 73.47 minutes (Richards, 2023). The facility had previously changed its goal to match the recommendations from the ESC. Times during these months range from 38 minutes to 119 minutes. This time does not meet the facility's goal of 60 minutes or less (Richards, 2023).

Needs Analysis

Heart disease is the leading cause of death in Alabama, including Etowah County. In 2019, heart disease accounted for 13,445 deaths in Alabama (Alabama Department of Public Health (ADPH), 2021). In Etowah County, there were 339 deaths attributed to heart disease alone in 2019 (ADPH, 2019). Heart disease is also the leading cause of death nationwide, with 696,962 deaths reported in 2020 (Centers for Disease Control and Prevention (CDC), 2022). More than 800,000 Americans have a heart attack yearly (CDC, 2022), and prompt reperfusion significantly impacts their morbidity and mortality after acute myocardial infarction (AMI) (Amsterdam & Wenger, 2015). The time from arrival to the hospital until reperfusion therapy profoundly affects the morbidity and mortality outcomes of patients with STEMIs (Lee et al., 2019).

While the facility meets the current US standard for most cases, international standards have become more aggressive. The clinical practice guidelines for treating STEMI patients from the American Heart Association (AHA) and the American College of Cardiology (ACC) recommend a D2B time of ≤ 90 minutes for all STEMI patients (O'Gara et al., 2013). Patient outcomes are better when D2B times are less than 60 minutes, as the ESC recommends. US standards will most likely become more aggressive, and the facility has already changed its goal to match the recommendations from the ESC. The hospital has an average D2B time of 73.47 minutes between April and August 2022. Times during these months range from 38 minutes to 119 minutes. These results do not meet the facility's goal of 60 minutes or less (Richards, 2023).

The current process when a patient presents with a STEMI in the emergency department (ED) on their ECG includes ED staff activating a "Code STEMI." A Code STEMI utilizes the hospital paging system to contact the interventional cardiologist and catheterization laboratory (cath lab) team. A Code STEMI also includes the announcement of a Code STEMI on the overhead intercom throughout the facility. The ED provider enters a standardized order set for all chest pain patients within their electronic medical record. As a part of this order set, the ED nurse or technician prepares the patient for entry into the cath lab. The cath labs' staff expectation is to arrive within 30 minutes of receiving the activation page if initiated after 6 pm and on weekends. The cath lab staff retrieves the patient from the ED once all cath lab staff members have reached the cath lab.

Time delays currently prevent the organization from reaching the target for D2B times. One opportunity for delay occurs when ED staff need to obtain consent quickly for the cath lab procedure. Delays happen when ED staff inadequately prepare patients for percutaneous coronary intervention (PCI). PCI requires ED staff to shave the patient's hair from the groin area

before the PCI procedure. Another area of time delay is the Code STEMI activation-to-arrival time in the catheterization time (Richards, 2023). Best practice initiatives to address these gaps in practice include utilizing a registered nurse (RN) trained to respond to the Code STEMI, a STEMI-RN. This RN will provide additional support for completing the chest pain order set in the ED and preparing the patient for PCI. Talley et al. (2019) described a similar intervention for door-to-needle times in "Code Stroke" patients experiencing cerebrovascular accidents and observed a decrease of 36 minutes in the first month of initiation. In addition, the STEMI-RN intervention is sustainable, as the facility continued to see similar figures years later with Stroke-RN patients (Talley et al., 2019). Li & Liu (2018) report shortened D2B times, reduced hospital stays, lowered medical costs, and increased patient satisfaction in patients with STEMI-RN deployment.

Problem Statement

Clinical practice guidelines for STEMI patients recommend D2B intervention in 90 minutes or less (O'Gara et al., 2013), while international standards are more aggressive. The ESC STEMI guidelines recommend that reperfusion occurs within 60 minutes (Ibanez et al., 2017). Standards in the United States (US) will become more aggressive, and early reperfusion is associated with favorable outcomes, including improved patient morbidity and mortality rates (Tsao et al., 2022). A needs assessment within a community hospital in Alabama confirmed the need to implement evidence-based interventions to reduce the D2B times to improve quality measure performance and overall patient outcomes.

This Doctorate of Nursing Practice (DNP) project explores in adult patients with a STEMI receiving immediate PCI (P), what is the impact of utilizing a STEMI-RN (I) compared to current practice (C) on D2B times (O) over 12 weeks (T)?

Aims and Objectives

This quality improvement project aims to decrease the D2B times by utilizing a STEMI-RN. The project goal is to reach a D2B time of fewer than 60 minutes for patients with STEMI who receive a PCI. To improve the metric, nursing staff from the Emergency Department (ED) and house supervisors received training to act as STEMI-RN. The STEMI-RN will serve as the team leader to facilitate the completion of the STEMI pathway through the ED up to PCI. STEMI-RNs expedite the completion of the STEMI pathway checklist, including obtaining consent and preparing the patient for PCI. Data for three months after implementation and three months during the same period during the previous year are compared and analyzed for improvement.

Review of Literature

Completing a literature review utilized the following constructs: 1) reviewing the best practices for improving D2B times for STEMI patients receiving PCI; 2) analysis of benefits of improving D2B times to less than 60 minutes. A discussion of the findings occurs below.

The databases utilized include CINAHL, PubMed, and Cochrane. A search of professional journals such as Cardiology and Stroke also ensued. Key terms utilized within the search include the following: door-to-balloon, ST-elevation myocardial infarction, percutaneous coronary intervention, and clinical pathway. A total of 420 potential sources are available using different keyword combinations. The results were narrowed to publication dates within the last five years, reducing the search results to 90 sources. Additional article elimination occurred, with articles proving irrelevant to the focus of this project.

Literature indicates that decreasing D2B times to less than 90 minutes improves patient outcomes. O'Gara et al.'s (2013) clinical practice guidelines for treating STEMI patients from the

AHA and ACC recommend a D2B time of fewer than 90 minutes. Ibanez et al. (2017) suggest in the ESC guidelines that the maximum time from STEMI diagnosis to the wire crossing the lesion in the coronary artery is less than 60 minutes. Many anticipate that US clinical guidelines will strive for narrowed D2B times as the European policies have already done.

Alhejily (2021) implemented a chest pain pathway that reduced D2B times ($p = 0.001$) and improved door-to-ECG times ($p = 0.0001$). Alhejily's (2021) work utilized "WhatsApp" for communication with hospital staff and timely delivery of feedback after Code STEMI. An exemplary chest pain pathway is included in the work by Alhejily (2021) and inspired the development of the STEMI pathway for this project. In contrast, Krishnan S et al. (2021) studied the various timeframes influencing D2B times in acute STEMI. In the study, Krishnan S (2021) found consent time correlates with the most considerable delay in time with STEMI patients; however, in India, the location of this study, the consent for the procedure also provided consent to obtain payment for services provided. The healthcare facility in the study obtained an average D2B time of fewer than 60 minutes. The strategies Krishnan S (2021) recommended are already in place at the project implementation site.

Lee et al. (2019) investigated if modifying ED triage processes could improve door-to-ECG and D2B times. Lee et al. (2019) implemented a four-step strategy, including setting up criteria for initiating early ECG and performing ECG for patients meeting the requirements. Other steps by Lee et al. (2019) included moving an ECG machine to the ED triage area and the triage nurse preparing the patient for ECG as the technician makes their way to triage. Lee et al. (2019) found significantly higher rates of meeting the door-to-ECG target times in less than 10 minutes after intervention. Lee et al. (2019) found no significant difference in median D2B time

between the control and intervention groups, but the intervention group experienced a higher rate of meeting the D2B goals.

Li and Liu (2018) implemented a clinical nursing pathway (CNP) for PCI and evaluated its effects on multiple clinical outcomes. In this randomized control trial, the control group received standard nursing care, and the CNP group followed the CNP model. With the CNP model, patients receive rapid diagnosis and examination, expedited transport to specialists, emergency medication administration, and vital sign support. After implementing the CNP, Li and Liu (2018) found a statistically significant improvement in D2B times, hospitalization length, cost of hospitalization, decreased complications, and increased patient satisfaction. Results from Li and Liu's (2018) work included a reduction of D2B time by an average of 13 minutes ($p < 0.05$), a decrease in hospitalization length by 3.82 days ($p < 0.05$), and the average daily cost during hospitalization decreased by USD 104.00 ($p < 0.05$). Li and Liu (2018) also found that patient satisfaction increased to 96.7% in the CNP group from 83.9% in the control group ($p < 0.05$). Li and Liu (2018) also saw post-operative complications decrease from 29 out of 56 patients in the control group to 10 out of 62 patients in the CNP group. Implementing a CNP pre- and post-PCI has a positive statistical significance on multiple outcomes.

In the study by Namdar et al. (2021), a "STEMI code" response was designed and implemented. Namdar et al. (2021) created a code team utilizing two RNs. These nurses complete the patients' ECGs, obtain vascular access, communicate with the patient and family, ensure early diagnostic tests are conducted and reviewed, obtain patient consent for treatment, complete the STEMI paperwork, and communicate with the catheterization laboratory staff. Within Namdar et al.'s (2021) STEMI code team also includes two patient care technicians who prepare the patient for PCI by shaving the groin area, delivering lab samples, and transporting

the patient to the catheterization laboratory. Namdar et al.'s (2021) staffing roles for their "STEMI code" serve as a model for the staff responsibilities for the STEMI-RN quality improvement project.

Meisel et al. (2021) analyzed the impact of direct admission for patients to the catheterization laboratory versus entry to the ED and its effect on D2B times and patient outcomes. According to Meisel et al. (2021), emergency medical services (EMS) personnel decreased D2B times via direct admission to the catheterization laboratory for patients. Additionally, Meisel et al. (2021) data indicated significant decreases in D2B times, improving short- and long-term mortality. Meisel et al.'s (2021) retrospective study reviewed STEMI patient charts for 12 years.

Talley et al.'s (2019) abstract inspired the intervention of this quality improvement project--a critical care nurse leading the stroke team response. Talley et al. (2019) trained the nurse in the stroke protocol interventions. They developed a "tool kit" for the nurse to utilize during a Code stroke. The tool kit contained any medication or supplies the RN may need and a notebook containing the written protocol and resources. Subsequently, there was a significant decrease in door-to-needle times after implementing the new stroke process by Talley et al. (2019), with an immediate 36-minute reduction during the month of project implementation. The intervention by Talley et al. (2019) was also seen as sustainable for the facility and recommended for consideration in rural community hospitals with fewer resources than larger medical centers.

Tsukui et al. (2017) sought to find determinants of shortened D2B times. The retrospective study by Tsukui et al. (2017) divided the patient population into three groups, the short D2B group, the intermediate D2B group, and the extended D2B group. Specific factors had

an impact on D2B times. Tsukui et al. (2017) found that the prevalence of atypical symptoms was highest in the extended D2B group (42.4%), then the intermediate group (19.8%), and was lowest in the short D2B group (16.7%)($p=0.01$). The prevalence of direct admission by ambulance, according to Tsukui et al. (2017), was highest in the extended D2B group (59.5%) and the lowest in the short D2B group (38.3%). Finally, Tsukui et al. (2017) found that the prevalence of transfer from local hospitals was highest in the short D2B group (21.5%) and lowest in the extended D2B group (15.2%) ($p=0.011$). It is essential to note that this study occurred in Japan, where there was no pre-hospital ECG system within EMS transport.

Winchester et al. (2020) examine the effect of medical center accreditation on the quality of care for chest pain patients. Winchester et al. (2020) conducted a retrospective review of data five years prior of facilities that achieved Chest Pain Center (CPC) accreditation from the AHA and ACC. A discussion of the differences noted takes place here. Winchester et al. (2020) found that urban facilities were more likely to collaborate with EMS on the accuracy of in-field STEMI activation ($p<0.0001$) and to achieve a 10-minute goal for door-to-ECG time ($p=0.012$). Urban facilities were also more likely to have a single catheterization laboratory contact point ($p<0.0001$) to give ED clinicians STEMI activation authority ($p<0.0001$), according to Winchester et al. (2020), and were less likely to provide them with reperfusion authority ($p=0.013$). The lack of data showing that accreditation directly improved clinical outcomes limited the study.

Chen et al. (2017) verified the effect of D2B time under 60 minutes on the prognosis of STEMI patients. Chen et al.'s (2017) study took place in Taiwan within a 3,000-bed facility and compared the outcomes of STEMI patients who received PCI with D2B time of fewer than 60 minutes versus those who received PCI with D2B time between 60 and 90 minutes. When D2B

time reductions occur, Chen et al. (2017) found better blood flow within the infarct-related artery (9.2% fewer patients with thrombolysis in myocardial infarction flow less than 3 seconds, $p=0.019$) and improved 30-day recurrent MI and mortality rates ($p<0.001$).

Foo et al. (2018) conducted a systematic review and meta-analysis to determine the relationship between D2B delay and STEMI outcomes and sought to determine potential modifiers. Foo et al. (2018) included one hundred seventy-two studies to analyze mortality outcomes, including pooling ten studies. Foo et al. (2018) showed that a longer delay of greater than 90 minutes was associated with significantly higher short-term mortality (pooled OR 1.52, 95%CI 1.40 to 1.65, $I^2=16.2\%$) compared to a shorter delay of fewer than 90 minutes. Foo et al. (2018) also noted that longer D2B delay was associated with higher mortality among those presenting early but not those arriving at the ED as delayed; there was a statistically significant difference in the effect estimates between the two groups ($p=0.049$). Finally, Foo et al. (2018) determined that patients with STEMI who experience a delay in D2B times are at a higher risk for short-, medium-, and long-term mortality, significant adverse cardiac effects, and reinfarction.

Tsukui et al. (2020) investigated the correlation between D2B and mid-term all-cause death in STEMI patients. A total of 309 patients met the inclusion criteria and were exempt from the exclusion criteria. Tsukui et al. (2020) divided this group of 309 patients into subgroups based on the D2B times: short D2B, intermediate D2B, and extended D2B groups. Retrospective observation by Tsukui et al. (2020) revealed that the prevalence of atypical symptoms was highest among the extended D2B group (37.6%), followed by the intermediate D2B group (20.7%) and the minimal D2B group (11.7%) ($p=0.004$). Tsukui et al. (2020) acknowledged that triple vessel disease prevalence was highest among the extended D2B group (34.4%) and the

intermediate D2B group (20.7%), while triple vessel disease was lowest in the short D2B group (8.7%) ($p=0.008$). Observation of all-cause death occurred most frequently in the extended D2B group, according to Tsukui et al. (2020), followed by the intermediate group, and least frequently in the short D2B group ($p<0.001$). Tsukui et al.'s (2020) study concluded that D2B was a significant indicator of mid-term all-cause death, and hospitals should try to decrease the D2B metric.

Key findings from the literature review support using a critical care nurse as a STEMI-RN to facilitate a STEMI pathway for patients receiving PCI after presentation with STEMI. The literature review also supports improving D2B times to less than 60 minutes. Improvement of patient outcomes occurs with shorted D2B times and decreased mortality. A clinical pathway and a STEMI-RN to complete the clinical pathway with ED patients will assist with reducing D2B times to the goals of this quality improvement project.

Theoretical Model

The theory used to guide this quality improvement project is Rogers' Diffusion of Innovation Theory. Rogers' theory helps determine clinical areas where additional effort concerning the behaviors and diffusion of change is necessary (Sanson-Fisher, 2004). Dearing and Cox (2018) describe diffusion as a response to learning about innovative ways to improve healthcare that occurs among a group of people. The five components of the Diffusion of Innovation theory include innovation, the adopter, the social system, the individual adoption process, and the diffusion system (LaMorte, 2022).

Additionally, this quality improvement project aims to decrease D2B times by utilizing RN staff members in an innovative, evidence-based way to facilitate the patient's pathway through the ED to the catheterization laboratory. Using Rogers' theory, early adopters of the

intervention may also serve as advocates for protocol implementation within the facility. The outcomes used to evaluate the effectiveness of the project's intervention include monitoring D2B times for all STEMI patients. The project aims to decrease D2B times to less than 60 minutes for all STEMI patients.

This quality improvement project aims to decrease the D2B times by utilizing a STEMI-RN. To improve the metric, nursing staff from the Emergency Department (ED) and RNs within the house supervisor role will receive training to act as the STEMI-RN. The STEMI-RN will serve as the team leader to facilitate the completion of the STEMI pathway through the ED up to PCI. Training STEMI-RNs to expedite completing the STEMI order set checklist includes obtaining consent and preparing the patient for PCI. After three months of project implementation utilizing the STEMI-RN, a comparison of data from 2021 during the same twelve calendar weeks without project activation will occur. The project goal is to obtain a significant D2B time reduction for patients experiencing a STEMI who receive PCI when utilizing the STEMI-RN.

Quantitative, secondary data will be collected concurrently. The data collected includes the following: the time of patient arrival to the ED, the time of ECG in the ED, the time of ED ECG interpretation, the time of Code STEMI activation, the time of patient arrival to the catheterization lab, the time of vascular access achieved in the catheterization lab, the time of catheterization lab balloon deployment, the intervention received, and the lesion identified. Manual data collection is utilized and verified for this project. Data remains on a biometric-protected computer in an Excel spreadsheet.

The outcome measurement for this quality improvement project will compare D2B times with the STEMI-RN for 12 weeks in 2023 compared to the same calendar weeks in 2022 without

the STEMI-RN. Collected data will be analyzed concurrently and communicated with the stakeholders. Collecting data pre- and post-implementation allows for accurately comparing the data pre- and post-project. In addition, deviations during the project will have a root-cause analysis performed.

Methodology

Setting

The setting of this project is a community hospital in northeast Alabama. The interventions associated with the project will occur within the ED. After STEMI-RN intervention completion in the ED, transportation of patients to the catheterization lab for PCI completion occurs.

Population

The population of interest is adult patients presenting with STEMI on ECG during their presentation to the ED for symptoms. The population of the ED unit fluctuates frequently. The nurses trained as the STEMI-RNs include house supervisors of the hospital facility. STEMI-RN education took place during a staff meeting for house supervisors in December. Education for the ED staff occurs via staff meetings, computerized modules, and education via unit educators and the Chest Pain Coordinator.

Inclusion/Exclusion Criteria for Patients

The inclusion criteria for this DNP project include adult patients who present to the ED with STEMI on ECG and are candidates to receive PCI. Patients excluded from the project are those who experience cardiac arrest and any STEMI patients who are not candidates for PCI.

Recruitment

The RNs who serve as house supervisors for the facility were recruited to act as STEMI-RNs during Code STEMI for the facility and experienced RNs in the ED. Response to Code STEMI to facilitate timely completion of the pathway and transportation to the cath laboratory were added to the house supervisors' duties by the facility.

Consent

The facility added the STEMI-RN duties to the responsibilities of the house supervisors and ED staff; therefore, the Jacksonville State University (JSU) Internal Review Board permitted the project to commence without requiring consent for this quality improvement project.

Design

STEMI occurs when an ST-segment elevation occurs on an ECG during MI (Namdar et al., 2021). Current clinical practice guidelines in the US recommend PCI to occur within 90 minutes of arrival at the hospital (O'Gara et al., 2013). The quality improvement project aims to decrease the D2B times of the target facility by utilizing a STEMI response nurse, or STEMI-RN. D2B is the interval between the patient's arrival at the ED until balloon inflation occurs within the affected coronary artery during PCI (Namdar et al., 2021). Project goals include a D2B time of fewer than 60 minutes for ED patients with STEMI who receive PCI. Experienced hospital nursing staff trained as STEMI-RN will serve as the team leader, facilitating the completion of the STEMI pathway through the ED until PCI. STEMI-RN responsibilities include the completion of the STEMI pathway checklist by obtaining patient consent, preparing the patient for the PCI, and communicating with the patient, their family, and medical providers.

Data Review Process

Quantitative data for each step in the STEMI pathway will be collected concurrently throughout the project. The data to be collected includes the time of patient arrival to the ED, the time of ECG completion, the time of ECG interpretation, and the time of Code STEMI activation. Other data to be collected include the time of arrival to the catheterization lab, time of vascular access, time of balloon deployment, type of intervention, and area of the identified lesion. In addition, manual data collection is utilized and verified for this project.

Data storage is on a biometric-protected computer in an Excel spreadsheet. Data collected will be secondary and will not include individual patient identifiers. Project outcomes are measured by comparing D2B times for 12 weeks of the project versus the same 12 weeks without the project interventions in the prior calendar year. Collected data will be analyzed concurrently and communicated with the stakeholders. Collecting data pre-and post-implementation of the project allows for accurate data comparison. Deviations will have a root-cause analysis performed.

Risks and Benefits

No risks are associated with this project, as the project will add a staff member to the patient's care team within the ED until the PCI is underway in the cardiac catheterization lab.

Compensation

No participant received compensation for their participation in this project. The facility compensated staff members at their standard hourly rates for time worked.

Timeline

In June 2022, a preceptor and project site was obtained, and a needs analysis was completed. The PICOT question was formulated, and a project proposal draft was completed by

July 2022. Stakeholder meetings were held in July, September, October, November, and December 2022, January, February, and March 2023 (Appendix A). Extensive training for conducting research was completed in September 2022 through Collaborative Institutional Training Institute (CITI) (Appendix B). A letter of approval was obtained from the facility in September 2022 (Appendix C). The institutional review board approved the proposed project in November 2022 (Appendix D). House supervisors began responding to Code STEMI in January 2023 after being educated on STEMI responses in their December meeting. Data is to be collected for 12 weeks post-implementation. The collection of data will take place from January 2023 thru March 2023. Charts of patients failing to meet the benchmark for the door-to-PCI time of 60 minutes or less will be reviewed routinely for root-cause analysis. Results will then be disseminated to the facility following project completion and presented during JSU dissemination day.

Budget and Resources

The facility will provide a three-ring binder for the STEMI-RN to utilize during the Code STEMI. Additionally, this binder will contain copies of the STEMI pathway checklist for the STEMI-RN to use and reference during a Code STEMI. The facility will provide copier paper and ink to print the STEMI-RN list.

Results

The baseline data from 2022 consisted of ten STEMI patients who underwent PCI, two in January, six in February, and two in March. For January, one of two patients met the goal of D2B in less than 60 minutes. The average D2B during that month was 55.5 minutes. Of the six patients in February, one case met exclusion criteria due to cardiac arrest in the ED. Out of the remaining five STEMI codes, the D2B was less than 60 minutes in one case, with an average

D2B of 68.2 minutes from arrival. One of the two cases met the target D2B in March 2022; the median D2B was 60.5 minutes. Therefore, during the first three months of 2022, 33.3% of cases met the target D2B of 60 minutes or less, with an overall average D2B time of 63.6 minutes. In contrast, 60% of patients met the metric in 2023, a 27.6% improvement from the previous year.

In the post-intervention time data from 2023, eleven patients underwent PCI after presenting with STEMI, one in January, eight in February, and four in March. The single case in January exceeded the D2B target with a D2B time of 95 minutes. The door-to-activation time during this case was 25 minutes and did not meet the facility goal of 15 minutes from arrival. In this case, the delay was due to a new staff member awaiting the ECG to be reviewed by cardiology before activating the Code STEMI protocol. Staff education occurred at that time. In February 2023, eight patients presented with STEMI, seven of whom received PCI. Cancellation of the STEMI code occurred due to the patient leaving against medical advice in one case. Two of the remaining seven that received PCI did not require intervention during the procedure. One patient presented with shortness of breath with an unremarkable initial ECG, and the subsequent ECG indicated STEMI. The ECG-to-balloon time was measured for this patient and met the goal of fewer than 60 minutes from the time STEMI presented on ECG. The remaining four cases met the target D2B of less than 60 minutes; the average D2B (along with ECG-to-balloon) was 49.6 minutes from arrival. During March 2023, four patients presenting with STEMI underwent PCI. One patient presented with a normal ECG, and STEMI presented on a subsequent ECG. Measurement of ECG-to-balloon, which met the target of fewer than 60 minutes, occurred in this case. The other three patient cases did not meet the target due to difficulty passing the guidewire through the lesion as there was an acute lesion on a chronic lesion. Out of ten patients for the project's first three months, four did not meet the target D2B time of fewer than 60 minutes.

In January 2023, one case had a D2B time of 95 minutes. The average D2B time in February 2023 was 49.6 minutes, and the average from March 2023 was 77.5 minutes. The median D2B for the 12 weeks post-implementation was 65.3 minutes.

The facility has goals for each of the discussed metrics, and these goals are as follows: a door-to-ECG goal within 10 minutes of ED arrival, a door-to-activation goal within 15 minutes of ED arrival, and an activation-to-arrival in the catheterization lab within 30 minutes. In January 2022, the hospital was 100% in meeting the goals for door-to-ECG and door-to-activation, and the activation-to-arrival in the catheterization lab goal 50% of the time. During February 2022, the facility met the target door-to-ECG and door-to-activation goals 80% of the time and the activation-to-arrival in the laboratory and D2B goals 20% of the time. For March 2022, the hospital met the door-to-ECG and door-to-activation goals 75% of the time, the activation-to-arrival in the cath lab goal, and D2B targets 25% of the time.

In January 2023, the institution met the door-to-ECG goal 100% of the time; however, the door-to-activation, activation-to-arrival in the laboratory, and D2B goals were not achieved during the first month of the project. In February 2023, the facility met the door-to-ECG, door-to-activation, and D2B goals 100% of the time and the target activation-to-arrival in the cath lab 60% of the time. During March 2023, the hospital met the door-to-ECG and door-to-activation goals 75% of the time, the D2B goals, and the target activation-to-arrival in the cath lab 25% of patient cases.

Discussion

The baseline and post-implementation sample sizes were too small to show statistically significant levels of change post-implementation. Noted improvement in overall D2B times can likely be attributed to implementing a STEMI-RN. A considerable delay occurred in the

activation-to-arrival in the cath lab metric. 67% of cases from 2023 met the metric, and 33% of patients from 2022 met it. The project saw improvement in achieving the goal for each metric, although not statistically significant given the sample sizes.

Implications for Clinical Practice

The results of this quality improvement project suggest several implications for clinical practice. First, it would be essential to expand data collection to include discharge disposition and length of stay to provide helpful insight regarding improved D2B times and decreased length of stay. Including the time of the cath lab team's arrival would also prove beneficial in further determining causes of delay during the activation-to-arrival in laboratory metric.

Implications for Quality/Safety

The institution where this project took place included STEMI-RN duties in the job duties of the house supervisors at implementation. Future quality improvement could involve developing a STEMI toolkit with all the supplies needed during a Code STEMI, such as medications, intravenous catheter supplies, and intravenous fluids. Utilizing an additional RN with no other duties beyond serving as STEMI-RN is not feasible for this facility currently, but it could prove beneficial for STEMI response. Talley et al. (2019) utilized a rapid-response RN that responded to Code Stroke patients and saw marked improvement in door-to-needle times. An RN leading the response and expediting the completion of protocols could prove valuable in more clinical circumstances.

Limitations

This quality improvement project had several limitations. The project occurred at a single center, limiting the sample size. Data collection occurred over a short period of time, further

restricting the sample size. The small sample size limits the ability to find the statistical significance of the intervention.

Dissemination

The project results will be disseminated to the stakeholders at a meeting in June. The information will be presented in a poster presentation for the facility. JSU dissemination will be held on July 13, 2023. The results of the project will be presented to classmates and faculty on that day.

Sustainability

The intervention implemented in this project is sustainable. The house supervisor responded to all codes at this facility before implementing the STEMI-RN. By implementing the STEMI-RN, the role of the house supervisor during Code STEMIs changed slightly. The house supervisor became the team leader and had clear responsibilities to ensure completion. Larger facilities can utilize a similar process with their rapid response team to ensure rapid D2B. The facility plans to continue the STEMI-RN response for the foreseeable future.

Conclusions

Recommended D2B times for patients with STEMI who receive PCI are within 90 minutes according to US guidelines and 60 minutes per the ESC. Definitive diagnosis and treatment should occur rapidly for the best outcomes. Local policies will become more aggressive as well.

This project aimed to determine if implementing a STEMI-RN could improve D2B times in STEMI patients receiving PCI. While the study saw an improvement in D2B times compared to the same time in the previous year, the sample size is too small to determine statistical

significance. Further study is needed to directly correlate the effect of a STEMI-RN on D2B times.

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Appendix A

Timeline

Activity/Date	May 22	Jun. 22	Jul. 22	Aug. 22	Sep. 22	Oct. 22	Nov. 22	Dec. 22	Jan. 23	Feb. 23	Mar. 23	Apr. 23	May 23	Jun. 23	Jul. 23	Aug. 23
Obtained Project Preceptor		✓														
Gap Analysis		✓														
Develop PICOT Question			✓													
Project Proposal			✓													
Meet with Stakeholders			✓	✓	✓	✓	✓	✓	✓	✓	✓					
Receive Approval of Project from Stakeholders					✓											
Receive IRB Approval							✓									
Intervention Implementation									✓							
Data collection and analysis									✓	✓	✓					
Disseminate Findings to Agency															✓	
Present at JSU Dissemination Day															✓	
Graduation																✓

Appendix B

CITI Training Certificate

		Completion Date 30-Sep-2022 Expiration Date 29-Sep-2025 Record ID 51246350
This is to certify that:		
Amanda Hunter		
Has completed the following CITI Program course:		Not valid for renewal of certification through CME.
Social and Behavioral Responsible Conduct of Research (Curriculum Group)		
Social and Behavioral Responsible Conduct of Research (Course Learner Group)		
1 - RCR (Stage)		
Under requirements set by:		
Jacksonville State University		
		
Verify at www.citiprogram.org/verify/?w44f67ba2-fbd6-4081-a998-710ed6e676e1-51246350		

Appendix C

Agency Support Letter

Friday, September 30, 2022

Dear Sir or Madam,

This letter confirms my support for Jacksonville State University graduate nursing student Mrs. Amanda Hunter. Mrs. Hunter has received our approval to focus on "Improving Door-to-Balloon Times in Adult Patients with ST-Elevation Myocardial Infarction by Utilizing a STEMI-RN" over the coming year.

We are excited to support her as she works toward improving patient care delivery in our facility.

Please let me know if I can assist in any way.

Sincerely,

A handwritten signature in blue ink that reads "Sherry Fryman". The signature is written in a cursive, flowing style.

Sherry Fryman, MSN, RN

Chief Nursing Officer

Appendix D
JSU IRB Approval Letter



Institutional Review Board for the Protection of Human Subjects in Research
249 Angle Hall
700 Pelham Road North
Jacksonville, AL 36265-1602

November 18, 2022

Amanda Hunter
700 Pelham Rd. North
Jacksonville, AL 36265

Dear Amanda:

Your project "Improving Door-to-Balloon Times in Adult Patients with ST-Elevation Myocardial Infarction by Utilizing a STEMI-RN" 11182022 has been granted exemption by the JSU Institutional Review Board for the Protection of Human Subjects in Research (IRB). If your research deviates from that listed in the protocol, please notify me immediately. One year from the date of this approval letter, please send me a progress report of your research project.

Best wishes for a successful research project.

Sincerely,

A handwritten signature in black ink, appearing to read 'Lynn Garner', written in a cursive style.

Lynn Garner
Associate Human Protections Administrator, Institutional Review Board