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Timeliness of Electrocardiograms within the Emergency Department: A Quality Improvement Project

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Abstract

BACKGROUND: Timeliness in obtaining an electrocardiogram (ECG) is imperative for patients presenting to the emergency department (ED) with signs and symptoms of acute coronary syndrome (ACS). The American Heart Association (AHA) and American College of Cardiology (ACC) recommend performing an ECG within 10 minutes of patient arrival. Delays in door-to-electrocardiogram (DTE) times were evident in the walk-in (WI) patient population who presented to the ED waiting room (WR) where this quality improvement (QI) project took place. The aim of this QI project was to reduce the median DTE time to 10 minutes through improving the point of contact process upon patient arrival to the ED WR. While beginning work on this QI project it was noted that door greeters/screeners were positioned in the front entrance area of the WR as the point of contact staff member and functioned in a non-clinical role.

METHODS: The Define, Measure, Analyze, Improve, Control (DMAIC) framework was used to guide QI interventions in the process of acquiring an ECG. Staff interviews were obtained and concurrently used with the DMAIC framework in attempts to determine the root causes of delays during the arrival process within the ED WR. Median DTE time data and door greeter/screener surveys were obtained for comparison. Literature was reviewed for current evidence.

INTERVENTIONS: A patient education sign was placed in the ED WR entrance area on the common ACS symptoms with a message for patients to alert the nearest staff member for self-advocation of symptoms. The sign was written in English. A reference sheet was left with the WR entrance door greeter/screener on the common symptoms of ACS with a standardized communication message to use to alert ED clinical staff members of an emergent patient.

RESULTS: Data was collected on median DTE times during the intervention which showed a slight improvement from 12.73 (range 7.27-18.2) minutes to 12.33 (range 7.98-16.67) minutes. Many limitations existed in the study including a small sample size of two patient's pre-intervention and two patients post intervention. Data was gathered on adult patients greater than 18 years old with a preferred language of English. Compliance of DTE time within 10 minutes remained unchanged at 50%. The front entrance greeter/screener staff surveys showed improvement in knowledge on communication of emergent patients with ACS symptoms. Qualitative thematical survey responses showed that insufficient staffing and room availability was a large problem contributing to delays.

CONCLUSION: There was a slight improvement in median DTE time, however due to the limited study and timeline constraints there was a small sample size. Further nursing interventions aimed at the point of contact process could prove useful as a future QI project over a longer study period to determine more reliable patterns and statistical significance. Improvements were seen in communication knowledge and survey responses reported staff and room availability as a major cause of delay in obtaining an ECG. Further role expansion in acquisition of timelier ECGs may prove useful in further QI projects as many of staff surveyed had prior medical training but worked in a non-clinical function.

Keywords: door to electrocardiogram, emergency department, point of contact, door greeter, door screener, patient education signage

Contents

Introduction

Patients presenting to the Emergency Department (ED) require rapid triage, assessment, and focused interventions aimed at managing acute illness or injury. For patients presenting to the ED with signs and symptoms of suspected acute coronary syndrome (ACS) performing a rapid electrocardiogram (ECG) is of the utmost importance to determine the presence of ST-segment elevated myocardial infarction (STEMI). A STEMI is when a blockage exists in the coronary artery of the heart, which causes cardiac tissue death. STEMI is the most severe form of ACS and requires immediate treatment to remove or open the blockage to restore cardiac tissue blood flow. Time is muscle in STEMI treatment, meaning the longer the time a patient has a blockage the more damage that is done to cardiac tissue.

The American College of Cardiology (ACC) and American Heart Association (AHA) recommend performing an ECG within 10 minutes of patient arrival to the ED with signs and symptoms of ACS (Maliszewski et al., 2020). Performance of ECG acquisition from arrival will be termed door-to-ECG (DTE) time. The faster an ECG can be performed which indicates a STEMI the quicker a catheterization lab (cath lab) can be activated by the ED provider. The cath lab provides percutaneous coronary intervention (PCI) which is the gold standard of STEMI care. The time it takes for PCI to be performed on a patient experiencing a STEMI is often termed door-to-balloon (DTB) time. Recommendations from the ACC and AHA recommend DTB time be achieved within 90 minutes from patient arrival to the ED. The Joint Commission (JC) on core measures set care benchmarks for patients having a STEMI to receive care that allows for DTB time within 90 minutes of arrival (Maliszewski et al., 2020).

Problem Description

Within the ED, where this quality improvement (QI) project took place, the goal of patient arrival with suspected acute coronary syndrome to ECG was five to eight minutes. The facility goal was set to a higher standard than the DTE time recommendations by the AHA and ACC. Retrospective data was gathered during one full week in April, 2022 on adult patients who arrived through the waiting room (WR) with ACS signs and symptoms who reported chest pain or chest discomfort. The median DTE time was 12 minutes and compliance of DTE time within 10 minutes was less than 50%. The median DTE time for patients arriving via the WR was greater than the AHA and ACC recommended 10 minutes and served as an area for needed QI interventions. Furthermore, data on DTE times for the calendar year 2021 showed an average median-DTE-time of 12.66 minutes. This yearly average is 2.66 minutes beyond ACC and AHA recommendations, which indicated that achieving DTE time within 10 minutes had been a sustained problem at the facility within the ED. Of note was that the 2021 yearly DTE data encompassed patients who arrived by both ambulance and through the WR. Improving timeliness in DTE within the recommended guidelines was an area of importance for this facility, as it was a certified chest pain center with PCI capabilities during this QI project.

Many factors may have contributed to the delays seen in achieving DTE time within 10 minutes. Short staffing, ED overcrowding, miscommunication, equipment failure, symptom recognition, and process flow inadequacies could’ve contributed to delays observed. In surveying different staff members one aspect of delay was suggested as occurring from the front-end point of care process that took place upon patient arrival to the WR.

While observing process flow during the Spring of 2022, door greeters sat at the ED WR entrance and served as the first point of contact for patients entering the facility for ED care.

Some door greeters were clinically trained; however, many greeters were not clinically trained. The role of the door greeter was categorized as a non-clinical function. Door greeters had radios at their desk to alert ED staff of patients arriving to be seen within ED. However, no standardized communication existed for greeters to report time sensitive patients to the ED clinical staff. Communication was stated once by the greeters and at times was difficult to hear or understand on first broadcast. Failure to establish a visit reason or understand signs and symptoms of ACS by the door greeter may result in patients being directed to the kiosk check in and a delay in the frontend process of alerting ED staff of patients presenting with ACS symptoms. In an interview with one staff member a patient coming in with chest pain was, *directed to sit in a chair and waited there for over 5 minutes without being seen by clinical staff.*

No signage existed in the immediate ED entrance to educate patients on the signs and symptoms of ACS and the need to alert staff if they (the patient) presented with ACS symptoms. There were 17 total signs posted between the front entrance and the door greeter's desk, which may contribute to sensory overload for patients presenting to the ED. Non-clinical door greeters were not allowed to ask clinical related questions, but could alert ED staff of what patients stated on arrival to the ED. This occurred if the patient alerted the door greeter of their symptoms. However, the wide range of ACS signs and symptoms may be unrecognized by the non-clinical front end door greeters if alerted by the patient. Typically, only ACS patients with chest pain were communicated urgently to ED staff as a, *need for assistance*, by the door greeter and there was a lack of recognition or training for signs and symptoms of ACS. The lack of standardized communication, awareness of ACS symptoms, and lack of educational signage for patients presenting to the ED to alert staff of ACS symptoms may have been contributing factors to delays observed in DTE time within the front-end. This QI project targeted the aforementioned

factors to improve timeliness of care for patients experiencing ACS. The goal in addressing these problems directly correlated with the mission statement of the facility and contributes to achieving the JC core benchmarks for STEMI care. The DTE time and process flow for patients arriving through the WR as walk-in (WI) patients was explored in this QI project.

Available Knowledge

Search Methods

A systematic search was completed to evaluate available knowledge on DTE time for patients presenting to the ED with signs and symptoms of ACS. Available knowledge on the clinical outcomes associated with timeliness of DTE time was also explored. The search was limited to electronic databases, Medical Literature Analysis and Retrieval System Online (MEDLINE), Cumulative Index to Nursing and Allied Health Literature (CINAHL) Complete, Cochrane Central Register of Controlled Trials, and PubMed. Key search terms included, *door to electrocardiogram* and *emergency department*. Literature was searched for recent studies published between 2017 to 2022 which contained full text in English. In total 87 articles where reviewed, of which 10 were removed due to being duplicates. Inclusion criteria included adult population (greater than 18 years old), occurring in an ED setting, having data on WI patients, data on DTE time metrics. Exclusion criteria included patients who were not adults, not in the ED setting, arrived sole by pre-hospital means, and studies which did not include data on WI patients or DTE time metrics. Of the 77 studies remaining 70 were removed after initial screening due to not meeting inclusion and exclusion criteria. Seven total peer reviewed studies were selected and reviewed in this literature review. One systematic review, one cohort study, and five quality improvement (QI) studies were identified.

Review of Literature

Available research indicated that achieving DTE time within 10 minutes for patients experiencing STEMI was a common problem that causes delays in DTB time. Noguchi et al. (2018) studied delays in DTB time for patient's having a STEMI, concluding DTE time greater than 10 minutes was a modifiable factor which contributed to DTB time greater than 90 minutes. The study was a historical cohort study at a single institution which reviewed 239 patients having a STEMI with a median age of 66 years old and included ED patients (Noguchi et al., 2018). Noguchi et al. (2018) noted the National Cardiovascular Data Registry (NCDR) and Acute Coronary Treatment and Intervention Outcomes Network Registry–Get with the Guidelines (ACTION Registry–GWTG) which revealed that approximately 40% of patients' experiencing STEMI arrived to the ED via WI mode. Of particular interest are the delays seen among the WI population group. The ACTION-GWTG showed that arrival by walk-in had significant delays in DTE time in comparison with arrival by ambulance, median DTE time of eight minutes versus five minutes, respectively ($p < 0.0001$) (Noguchi et al., 2018). Due to the delays in DTE time for WI patients there are implications for QI interventions aimed at front end processes within the ED WR.

A systematic review conducted by Chhabra et al. (2019) reviewed interventions aimed at reducing DTE time, noting that prior studies have indicated only 40% of patients having a STEMI received ECG within 10 minutes of ED arrival. Chhabra et al. (2019) was of the highest quality evidence and identified 11 studies to review out of 1,111 studies evaluated. The 11 studies reviewed had a combined sample size of 15,622 adult patients and were all focused on interventions for patients presenting directly to the ED with no pre-hospital interventions. Only one of the 11 studies reviewed in the systematic review achieved median DTE time within 10

minutes prior to QI interventions, indicating that this problem was prevalent in available literature (Chhabra et al., 2019). Chhabra et al. (2019) reported statically significant improvements for DTE time post-intervention, noting the following most common QI interventions: dedicated equipment and personnel to obtain an ECG in triage, triage education, improved triage disposition, and data feedback. Statistically significant ($p < 0.05$) reductions in DTE time were observed in 10 of 11 studies after bundled QI interventions (Chhabra et al., 2019). However, only seven out of the 10 studies with significant improvement met the recommended median DTE time of 10-minutes post-intervention (Chhabra et al., 2019). The systematic review by Chhabra et al. (2019) showed that bundled QI interventions aimed at reducing DTE time can have significant results for WI patients with ACS signs and symptoms. However, meeting median DTE time within 10 minutes can still present as a major problem even after QI interventions achieved significant improvements. The review indicates that more work is needed in the aspect of front-end ED care to reduce DTE time for patients presenting with ACS signs and symptoms.

Five QI studies were evaluated in this literature review which contained preintervention and postintervention data, all studies were peer reviewed and contained a total sample size of 11,947 patients. Four of the five studies focused on interventions aimed at patients presenting to the ED by non-prehospital mode of arrival. The fifth study by Lee at al. (2019) included data for some pre-hospital patients, but noted geographic constraints limited available pre-hospital services, concluding that interventions were focused on aspects of non-prehospital patients. All five studies completed QI interventions due to the challenges in obtaining an ECG within 10 minutes for patients experiencing ACS signs and symptoms. Two of the five QI studies noted that compliance of DTE time for recommended guidelines was less than 41% prior to

intervention (Maliszewski et al., 2020; Stanfield, 2018). Keats et al. (2018) had an initial compliance of DTE time within 10 minutes of 62.6%. Lee at al. (2019) achieved DTE time within 10 minutes 79.8% of the time before intervention. Su et al. (2021) achieved DTE time within 10 minutes 78.9% of the time prior to intervention. Each of the reviewed studies suggest achieving DTE time within 10 minutes as an area for improvement.

The five studies used bundled QI interventions with patient triage being a common focus in all the studies. Four of the five studies showed statistically significant improvements in DTE time after bundled QI interventions. Significant improvement in DTE time within 10 minutes was greater than 90% in two studies (Lee at al., 2019; Su et al., 2021). Two studies reported improved DTE within 10 minutes to greater than 80% (Keats et al., 2018; Maliszewski et al., 2020). Stanfield (2018) showed no significant improvement after QI interventions aimed at triage, but did note a downward trend in DTE time, indicating triage as an area where continued improvement may be needed over time. The QI studies indicated that achieving DTE within 10 minutes was an area that could be improved upon with bundled QI interventions. However, achieving DTE time within 10 minutes continued to be a large problem as seen by the numerous QI studies reporting on the need to perform QI interventions to improve baseline performance. The QI studies reviewed indicated that there were still areas needed for improvement in obtaining DTE time within 10 minutes.

Evidence Synthesis

Achieving DTE time within 10 minutes was an important problem to address. Evidence existed to support that reducing DTE time has a direct impact on reducing DTB time for patients experiencing a STEMI. Su et al. (2021) reported on DTE time improvements after QI interventions, showing a significant DTB time reduction to 70 minutes from 81minutes after

reducing DTE time ($p < 0.01$). Chhabra et al. (2019) noted DTE time greater than 10 minutes was associated with a delay in DTB time and door-to-fibrinolysis time, resulting in an increased risk of recurrent STEMI and or death. Noguchi et al., (2018) showed in-hospital death was significantly higher in patients with DTB time greater than 90 minutes in comparison to DTB time less than 90 minutes (14.0% versus 4.4%, $p = 0.01$). Maliszewski et al. (2020) noted studies showing DTB time has been associated with 6.3 fewer deaths per 1,000 people for each 15 minutes of improvement. According to Chhabra et al. (2019) delaying DTB time greater than 150 minutes from the AHA recommended 90 minutes resulted in an increased mortality rate by 4.4%.

Implications for Quality Improvement

In review of the available literature, meeting recommended DTE time guidelines for ACS was a relevant problem. The studies in this literature review focused on DTE time and had a primary focus on QI interventions due to the prevalence of the problem. Patients arriving via WI were shown to account for a significant delay in acquiring an ECG within 10 minutes. The problems identified showed that QI interventions can play a role in significantly reducing DTE time and many QI studies used bundled interventions which could be applied to the WI patient population within the ED. However, even with significant improvement, challenges in obtaining median DTE time within recommended guidelines were still evident across three studies from the systematic review and one of the five QI studies reviewed. The sustained problem indicated that continued QI work is needed to improve DTE time which has been shown to improve DTB time for patients experiencing a STEMI. Delays in DTB time have been associated with worsened clinical outcomes and improvement in DTE time was an area which could promote timely care for patients experiencing STEMI. Therefore, after review of the available literature,

evidence existed to support the problem of timeliness in care of acquiring an ECG for WI patients presenting to the ED with ACS signs and symptoms.

Rationale

The goals of this QI project aligned with the AHA and ACC recommendations on timeliness in care for patients experiencing ACS signs and symptoms. The Define, Measure, Analyze, Improve, Control (DMAIC) framework was used to guide improvements in the process of acquiring an ECG. Specifically, the front-end point of contact process was reviewed for patients arriving through the WR who required an ECG within 10 minutes. The DMAIC framework is an approach of Lean Six Sigma, used to improve quality performance (Ahmed, 2019). The DMAIC framework guided recognition of problems during the point of contact process for this QI project and allowed for current measures and knowledge of the front-end process to be gathered. Utilizing the DMAIC framework has helped healthcare services reduce wasteful variation and work imbalances in process performance (Ahmed, 2019). After analyzing the current front-end process and observing problems, the DMAIC framework was used to determine the suspected root causes for delays in DTE times. Improvements in the process flow of the front entrance area were then targeted directly.

Specific Aim

The aim for this QI project was to reduce the DTE time to 10 minutes for patients presenting to the ED WR with ACS signs and symptoms. As a key performance indicator and recommended guideline from the ACC and AHA for ACS care guidelines, a goal of 10 minutes was a desirable and a specific improvement benchmark to promote timeliness in care.

Methods

Context

The setting of this QI project took place in a community hospital ED in southern New Hampshire. The acute care hospital had 86 beds and was a level 3 trauma center, stroke center, and certified chest pain center. The hospital served a community of approximately 170,000 people across 13 towns with six main ambulance services within the catchment area. Approximately 93% of patients admitted to the hospital arrived through the ED. The ED contained 19 main rooms, nine hallway beds, four fast track hallway chairs, one triage room, and a single WR area. The ED had a medium volume of 20,000 to 39,999 patients annually with an average LOS of 130 minutes (Medicare, 2022). The population encompassed patients across the life span of ages and development with varying medical complaints.

Approximately 21% of patients arrived via ambulance, the majority of the remaining 79% of patients were assumed to arrive through the WR. The focus of this quality improvement intervention was on the process of patient arrival via the WR. The standard process of patient arrival via the WR started with patients being briefly screened for COVID symptoms by a door greeter/screener, then patients checked into a kiosk, then patients were direct bedded (if a room was available) and triaged, or patients were triaged in the triage room and returned to the WR to wait until there was an open ED bed. Nurses completed reception of the patient using time from kiosk or time registered if the kiosk was bypassed. Reception time was the documented arrival time for patients presenting to the ED. Once rapid triage was completed a chief complaint was determined which dictated further intervention, care, and priority of the patient. Approximately 35% of all patient chief complaints were cardiac related.

Adult patients (greater than 18 years old) presenting to the ED via the WR with signs and symptoms of ACS required immediate ECG. ECG time was captured and recorded in a cardiology software which was termed MUSE. The time recorded in MUSE was the ECG capture/completed time. If the patient was direct bedded to a room the ECG was performed there. If no room was available the patient's ECG occurred in the triage room. ECGs were completed by ED technicians or nursing staff.

As mentioned, prior, door greeters were the first point of contact for patients arriving to the ED through the WR and some had no clinical background. Door greeters were originally implemented in the ED due to the COVID-19 pandemic to screen patients and visitors for COVID and enforce mask use on arrival. Door greeters had remained within the ED entrance area from that point forward. Patients recognized as requiring ECG on arrival primarily had chest pain or discomfort and sometimes reported their symptoms to the door greeter. Most heart attack symptoms include chest pain or discomfort (Centers for Disease Control and Prevention [CDC], 2021). The door greeter would broadcast back to staff in the ED via radio to alert them of a new patient with chest pain. As stated previously door greeters had no standardized message to broadcast to ED staff. Delays in this point of contact front-end process were evident and were explored in this QI project.

Cost Analysis

Total cost for project materials included the cost to print and laminate one large sign in the WR for patients and one reference sheet to be used by the door greeters. The total cost for the prints were estimated to total $103.00. Radios existed for staff communication and did not inquire an additional cost. Time to perform the ECG was also a cost, as it costed approximately 3-8 minutes of staff time to setup and perform. Overall new costs of ECG were estimated to be

minimum in that patients with signs and symptoms of ACS required an ECG regardless and there were no additional staff added for this QI project. Prioritization of ECG was the main change for staff away from other functions. Time from key stakeholders was a cost for the project as meetings had been set up involving the chief nursing officer, ED manager, nursing clinical coordinator, cardiology manager, and manager of volunteer staff. This served as time away from their daily roles and respective pay in that role. Training staff on new process intervention would've also been an educational associated cost. Cost of using hospital computer and printer resources were a cost to the facility.

Reducing DTE time might contribute to further reducing DTB time leading to less myocardial infarct size and decreased length of stay (Khot et al., 2009). Decreasing length of stay reduces cost of being admitted. However, Khot et al. (2009) found reducing DTB time led to no net change in hospital income, and financial benefits went to the payer. This implies that patient cost decreased from DTB time less than 90 minutes and hospital income remained unchanged. Therefore, no additional cost in reducing DTB was evident in the study by Khot et al., (2009). Thus, downstream effects of improved DTE time reduction have not been shown to increase hospital cost through improving DTB time, in the aforementioned study.

Interventions

Interventions were planned to consist of: 7-day pre-implementation phase to start June 6th, 2022, an implementation phase for 7 days to start June 13th, 2022, and a post-implementation phase for 7 days to start June 20th, 2022. Three bundled interventions were performed during the implementation phase to improve the point of contact frontend process of DTE time for adult patients presenting with ACS symptoms via the WR. The first intervention was focused on ED WR signage for patients. With permission from facility stakeholders, non-essential signage

within the ED entrance area was planned to be removed to reduce sensory overload upon entering department. There was no front entrance signage on ACS signs and symptoms with instructions for patients to alert staff of symptoms. A large sign was planned to be placed in the front of the ED WR entrance area instructing patients with common signs and symptoms of ACS to alert a staff member that they are having ACS symptoms. The sign was to state: *STOP, If you are having the following symptoms: chest pain or discomfort, light headedness, nausea/vomiting, neck, jaw, or back pain, pain in the shoulder or arms, shortness of breath, alert the nearest hospital staff member*. The sign was written in English only for this intervention. The second intervention was aimed at introducing a single reference sheet of ACS signs and symptoms for the door greeter. The reference sheet of common ACS signs and symptoms was placed at the door greeters' desk and planned to state: *If a patient reports the following signs and symptoms: chest pain or discomfort, light headedness, nausea/vomiting, neck, jaw, or back pain, pain in the shoulder or arms, shortness of breath, alert the ED clinical staff immediately*. The third intervention was focused on improving door greeter communication with the ED staff from the WR entrance. The door greeter was planned to alert staff using standardized verbatim of: *High alert patient in the waiting room, high alert patient in the waiting room.* The communication dialogue was repeated twice to increase staff awareness. Communication was broadcasted to all ED staff members via the single channel radio system that was used by ED staff.

Study of the Interventions

Pre-implementation

Door greeter staff were given the option to complete a questionnaire pertaining to the frontend process and knowledge of ACS with respect to patients who presented with ACS symptoms. The survey was used to gather direct pre-implementation qualitative and quantitative

data (Appendix A). Other data was gathered by performing chart reviews of adult patients (greater than 18 years old) with a primary chief complaint that was cardiac related. Chart reviews indicated that the patient arrived as a WI patient and had chest pain or chest discomfort as a symptom. Arrival time was gathered as the reception time in chart reviews. ECG completed time was the capture time of the ECG within the MUSE software, where ECGs were transmitted electronically. The DTE time data indicated indirect quantitative measures.

Post-implementation

Door greeter staff were given the option to repeat the same questionnaire after implementation of QI interventions to be compare responses (Appendix A). Data was gathered on DTE time for adult patients presenting with chest pain or chest discomfort utilizing the same method from pre-implementation, except data was planned to be collected during the post implementation week. Changes in the survey results were used to measure the impact of the QI project from the perspective of the door greeter/screener staff members. Changes in median DTE time and compliance of DTE within 10 minutes was gathered post intervention as indirect data. Bundled interventions were used making it difficult to distinguish which intervention was responsible for the changes observed. The survey created was pertinent to the interventions, with resulting changes in the survey responses likely to have been a direct indication from the bundled interventions.

Measures

The initial QI work reviewed the current process flow and ACS knowledge of door greeters/screeners. A survey was created by the author of this QI initiative with quantitative and qualitative questions (Appendix A). The survey being used was not a published tool. Questions one through 10 used Likert style questions on a 1-5 scale of: strongly disagree (1), disagree (2),

neither agree nor disagree (3), agree (4), strongly agree (5). The 5-point Likert scale has been shown to have reliability and validity in psychometric testing. The 10 Likert scale questions were used for statistical analysis of direct quantitative data. Question 11-13 gathered baseline information about the individual taking the survey to gather categorical data on their role. Questions 14-18 were interview style questions used to gather statements that were used for qualitative thematic analysis for pre- and post-implementation. Median door to ECG time and compliance percentage of acquiring DTE time with 10 minutes was gathered. This data was used as indirect quantitative data for the quality improvement project and statistically analyzed to see if there were pre- and post-implementation changes.

Analysis

Pre and post implementation surveys were used to compare and measure direct impact from interventions with respect to each individual front end door greeter/screener. This was completed by matching pre-implementation and post-implementations survey responses. Data was used from the surveys to compare each individual response to allow for paired t testing to determine statistical significance. Quantitative measures were performed in questions one through 10 of the survey (Appendix A) with higher score indicating improvement with ACS process and knowledge for patient who presented with chest pain. Indirect quantitative data analysis measured changes in median DTE time and compliance rate of DTE time within 10 minutes. Lower median DTE time and increased compliance rate showed indirect improvement which may have been affected by front end process changes. As mentioned, prior, the aim was to observe median DTE time for WI patients to be reduced to 10 minutes. Survey question 14-18 indicated qualitative thematic changes that occurred from QI interventions. Bundled

interventions obstructed which intervention had the greatest impact, as no single intervention could be isolated for cause and effect of the changes encountered in analysis.

Ethical Considerations

Permission was granted by the facility and clinical education coordinator to analyze retrospective chart data on DTE time metrics. Use of information was granted due to educational implications for QI. No protected health information (PHI) or identifying information was made available in study. Patient identifying information was kept on site while performing chart reviews and patient confidentiality was maintained. Feedback from staff was kept anonymous. Consent was acknowledged by individuals who filled out the process survey (Appendix A) as a disclaimer was noted on the survey. Collection of data and quality interventions were not random and may have some inherent bias involved while reviewing changes throughout the intervention stages. Initial surveying of staff may also account for more awareness on the topic of DTE time that was not present prior and may have cause and effect implications, impacting data collected pre-implementation. No funding was provided for this quality improvement project or work. This proposal was reviewed by the University of New Hampshire Department of Nursing Quality Committee to verify the project as one of QI exempt from full Institutional Review Board (IRB).

Results

Results

Evolution of Interventions

Pre-Implementation. Methods to gather DTE data and survey responses changed with respect to the initially planned timeline. Criteria for data collection was further defined while gathering median DTE time data. Retrospective data collection on DTE time was collected on patients for Monday June 6th, 2022 starting at 11:00 p.m. through Wednesday June 8th, 2022

stopping at 11:00 a.m. Collection was also limited to the hours of 11:00 p.m. to 11:00 a.m. The data was gathered by performing chart reviews of adult patients (greater than 18 years old) with primary chief complaint that was listed as cardiac related in an autogenerated report utilizing the MEDITECH electronic medical record (EMR) software. Each chart was then manually reviewed. Reviews used in DTE time had to indicate that the patient arrived as a WI patient and had chest pain or an anginal equivalent symptom. Due to the intervention signage being in English, the charts reviewed had to indicate that English was a preferred language for inclusion into the data reviewed. However, in the reviewed data no chart was excluded for preferred language, as all charts in the autogenerated report for WI patients with ACS symptoms indicated English as a primary language. Arrival time was gathered as the reception time in chart reviews. ECG time was the captured time of the ECG within the MUSE software, where ECGs were transmitted electronically.

Initial surveys were administered to door greeter/screener staff from June 14th, 2022 to June 17th, 2022 and filled out during staffed times of 11:00 p.m. to 11:00 a.m. After feedback from one stakeholder and course instructor, slight modifications were made to the survey that was planned to be used (Appendix A). The finalized survey that was used (Appendix B) included less questions and differed slightly from what was reported in the measures section. However, the survey responses followed the same reported themes of Likert scale questions, categorical questions, and qualitative thematical responses (Appendix B). Analysis remained the same even with slight modifications to the survey.

A folder with the finalized surveys (Appendix B) was left with instruction for each respondent to write a number on their completed survey and reference the same number in secondary pos-intervention surveys. This allowed for anonymous tracking of pre- and post-

surveys. Numbers were written on the folder, such that if a number was used it was checked off to prevent the same numbers from being used by another staff member. Surveys were then placed back in the folder and were collected all together June 17th, 2022. The planned timeline was to complete the aforementioned data collection of surveys and DTE time data concurrently for seven days starting on June 6th, 2022 and planned to encompass all hours of the day. However, this changed due to delays on communication, course timeline constraints, waiting for approval, and adjustments to staffing of the door greeter/screener position within the ED WR.

Quality Improvement-Implementation. The three-day implementation phase, which included patient education signage (Appendix C), a reference sheet for door greeters (Appendix D), and instruction with a standardized communication broadcast (Appendix D), occurred from Monday June 20th, 2022 11:00 p.m. to Wednesday June 22nd, 2022 11:00 a.m. The three QI interventions were restricted to the hours of 11:00 p.m. to 11:00 a.m. while a single door greeter staffed the ED WR entrance area. The door greeter role was only staffed from 11:00 p.m. to 11:00 a.m. at the time of this QI intervention. Slight modifications were made to the patient signage wording and reference sheet wording from the methods intervention section after additional feedback was gathered. The finalized signs used can be seen in the Appendix (Appendix C, Appendix D). Final approval to reduce additional signage in the ED WR room was not approved at the time of this QI project.

Prior to each of the QI implementation shifts, at 11:00 pm, the door greeter staff member working was verbally educated on the purpose of the patient signage, refence sheet, and the new standardized communication radio broadcast to be used. Written instructions for utilizing the patient sign, reference sheet, and new broadcast were left at the front desk for door greeter staff to review. Instructions included how to reference the sign, what the new standardized radio

broadcast was, and how it should be used. Each full shift included two individuals divided between the shift. One individual worked from 11:00 p.m. to 7:00 a.m. A second individual worked 7:00 a.m. to 11:00 a.m. The staff members who received initial verbal instruction at the start of 11:00 p.m., for each shift, were further instructed on communicating the QI interventions to the oncoming 7:00 am staff and letting the new staff member know of the written instructions at the desk.

Surveys were left at the door greeters' desk, in a folder, to allow for filling out post-implementation surveys (Appendix B) at the conclusion of their shift during which QI interventions occurred. Instruction for how and when to fill out the surveys were left on the outside folder which contained all the surveys. Each person who filled out a survey used a self-assigned number which was used in prior pre-implementation surveys. Once filled out, surveys were placed back in the folder face down and collected at the conclusion of the intervention to keep them anonymous.

Information on the new standardized broadcast was subsequently discussed with each 11:00 p.m. nurse and overnight ED Technician, for each night of the QI implementation. This was done to prevent any confusion on the new communication which they may hear broadcasted over the radio for emergent patients as *High Alert Triage, High Alert Triage,* followed by the patients' stated, *complaint,* by the door greeter/screener. The charge nurse was then instructed to carry the information of the new broadcast over to the morning ED staff at change of shift in morning huddle. A small written reference sheet was also handed out to overnight staff members about the new broadcast to prevent confusion due to the changed verbatim of the radio broadcasts. Copies of the small written reference sheet were also left with the charge nurse to hand out to morning ED staff.

The original QI intervention timeline was proposed to be implemented for all hours of the day for one full week from June 13th, 2022 to June 19th, 2022 (implementation phase). However, this changed due to delays in approval, communication, staffing adjustments, course deadlines, and uncertainty of the role of the door greeter within the ED WR. The timeline for post-surveys were also adjusted to occur at the conclusion of each of the two shifts with QI interventions. This was due to the limited timeframe of intervention. The surveys from door greeter staff were originally planned to be collected during the post-implementation phase from June 20th, 2022 to June 26th, 2022. However, this longer term postimplementation phase did not occur and was adjusted to the implementation timeline.

Post-Implementation. Data was collected June 22nd, 2022, after conclusion of the QI implementation. DTE data was gathered for the time frame of the QI intervention and final surveys were rounded up. The timeframe to collect surveys and data was originally planned for June 20th, 2022 to June 26th, 2022. The timeline change occurred due to the same aforementioned reasons in the prior section.

Measurements and Outcomes

ECG Times Data. Data was gathered on median DTE time and compliance of ECGs completed in less than 10 minutes. Retrospective data was gathered for the pre-implementation period (prior to QI) and after QI implementation (post-implementation). Due to timeline constraints DTE time data consisted of two shifts pre-implementation and two shifts during implementation, corresponding with the same days of the week and timeframe of 11:00 p.m. to 11:00 a.m. as previously discussed in the pre-implementation section. Table 1 shows the median DTE time comparison for pre-implementation and post-implementation time. As can be seen there was a small improvement in DTE time with QI implementation by 0.4 minutes (24

seconds), but compliance percentage of ECG within 10 minutes was the same. However, sample size was limited in this gathered data which was affected by the limited hours and days in which the QI interventions occurred. The overnight timeframe also limited sample size as less patients typically present to the ED WR at overnight hours, in comparison to full daytime hours. The limited sample size prevented analysis of statistical significance by nonparametric data testing.

Table 1

Comparison Median DTE Time and Compliance of ECG within 10 minutes

Study	Median Door to ECG Time (Minutes)	Standard Deviation	Range (Minutes)	ECG Compliance within 10 Minutes (Percentage)
Pre-Implementation	12.73	7.73	7.27-18.2	50%
Post-Implementation	12.33	6.13	7.98-16.67	50%

Note. Sample size of two for pre-implementation and sample size of two for post-implementation.

The door greeter hours were changed during the originally planned implementation of this QI project which created a small sample size of survey respondents. Four pre-implementation surveys were gathered and three post-intervention surveys were gathered. The three gathered post-intervention surveys corresponded with the same individuals with self-assigned numbers from the pre-implementation surveys. Three total comparison surveys from before and immediately after QI implementation were obtained. Originally a paired-t test was planned for statistical analysis, but that was not completed due to limited data sample size for measurement. Surveys were compared as aggregate data for before and after QI interventions for comparison.

Survey Likert Scale Items. Questions one through eight contained Likert scale questions from an untested instrument (Appendix B). There were four surveys collected for data analysis prior to implementation and three surveys gathered after intervention. The data collected and reported shows frequency of responses in accordance with a 5-point Likert scale, with respect to each question. The Likert question on a 1-5 scale represented: strongly disagree (1), disagree (2), neither agree nor disagree (3), agree (4), strongly agree (5). Figure 1 shows pre-implementation data, while figure 2 shows survey responses gathered at the end of each QI intervention. Note that the sample size is one less for the post QI intervention due to missing data for one survey response during the QI implementation period. One respondent also noted no change in pre-and-post-QI implementation survey response, which may be due to the limited use of the QI interventions during the two overnight implementation shifts.

Figure 1

Pre-implementation Survey Results Question 1-8

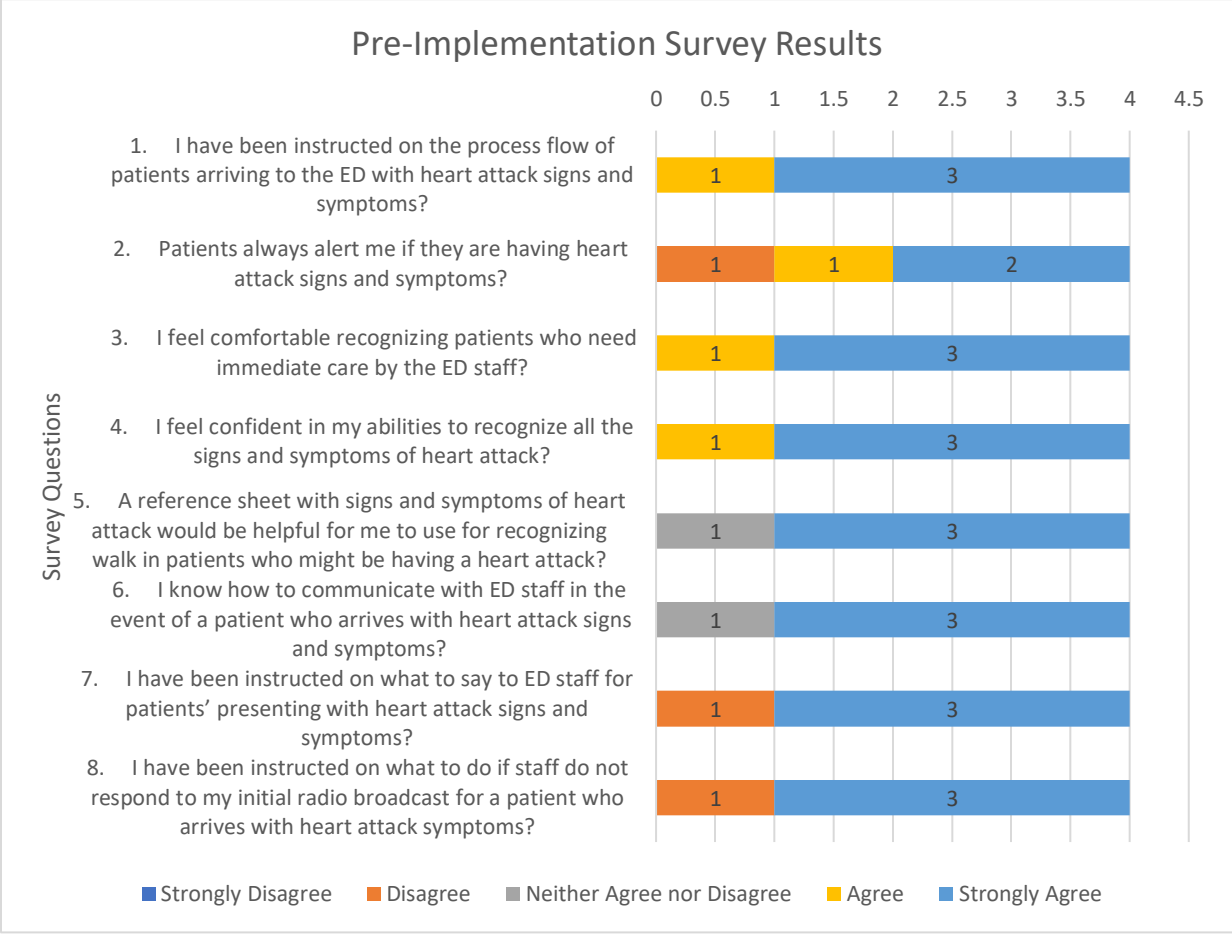


Figure 2

QI implementation Survey Results Question 1-8

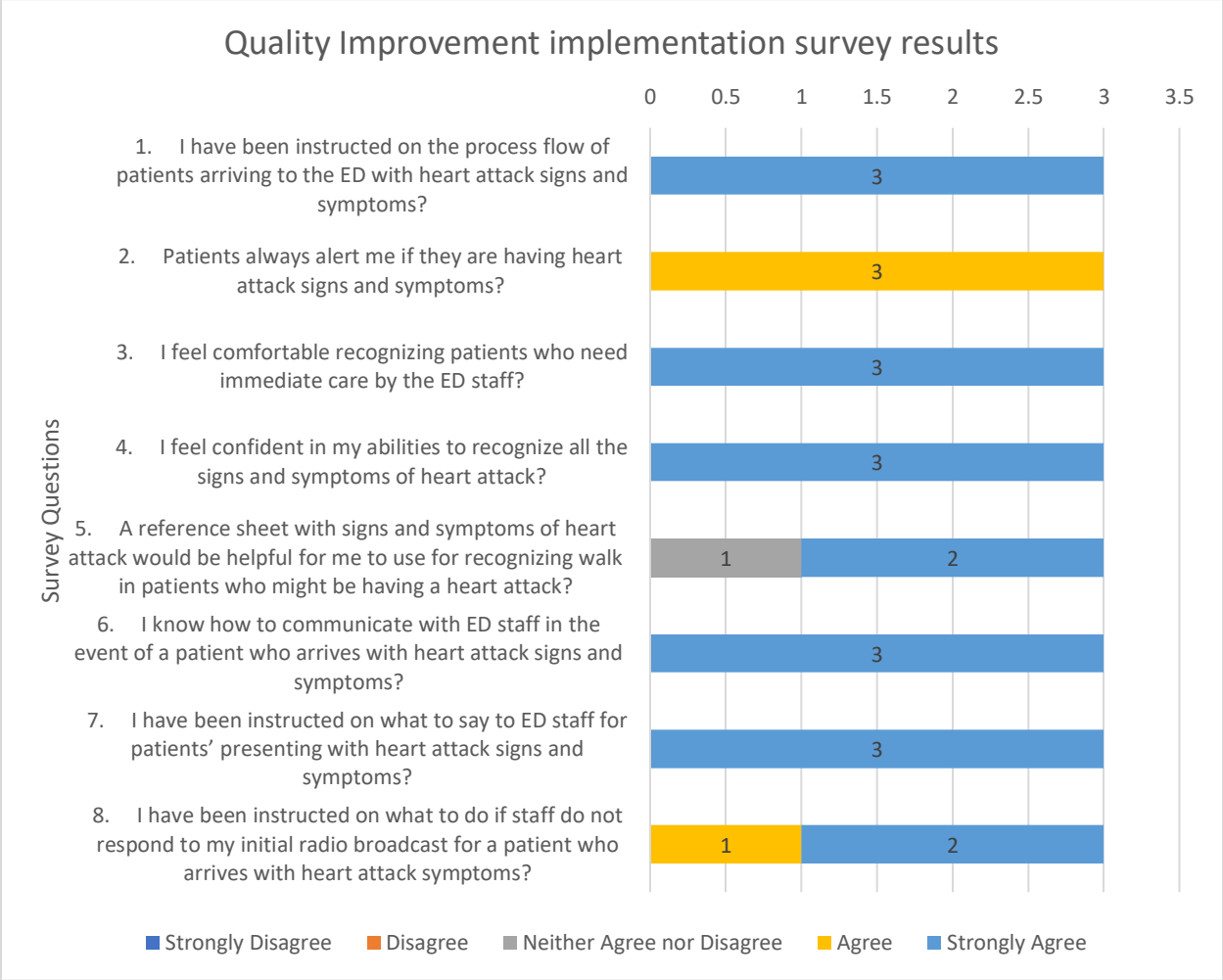


Table 2, below, shows the survey response mean, standard deviation, and range for Likert scale questions during the pre-implementation period. Table 3, below, shows the survey responses of mean, standard deviation, and range for Likert scale questions during the post-implementation period. The higher the mean was to five, the more the question responses correlated with strongly agree.

Table 2

Pre-Implementation Survey Responses Question One Through Eight Likert Scale Data

Question	Mean	Standard Deviation	Range
1. I have been instructed on the process flow of patients arriving to the ED with heart attack signs and symptoms?	4.75	0.5	4- 5
2. Patients always alert me if they are having heart attack signs and symptoms?	4	1.41	2-5
3. I feel comfortable recognizing patients who need immediate care by the ED staff?	4.75	0.5	4-5
4. I feel confident in my abilities to recognize all the signs and symptoms of heart attack?	4.75	0.5	4-5
5. A reference sheet with signs and symptoms of heart attack would be helpful for me to use for recognizing walk in patients who might be having a heart attack?	4.5	1	3-5
6. I know how to communicate with ED staff in the event of a patient who arrives with heart attack signs and symptoms?	4.5	1	3-5
7. I have been instructed on what to say to ED staff for patients' presenting with heart attack signs and symptoms?	4.25	1.5	2-5
8. I have been instructed on what to do if staff do not respond to my initial radio broadcast for a patient who arrives with heart attack symptoms?	4.25	1.5	2-5

Note. Sample size of four and scale one through five, one is strongly disagree and five is strongly agree (Appendix B).

Table 3

Post-Implementation Survey Responses Question One Through Eight Likert Scale Data

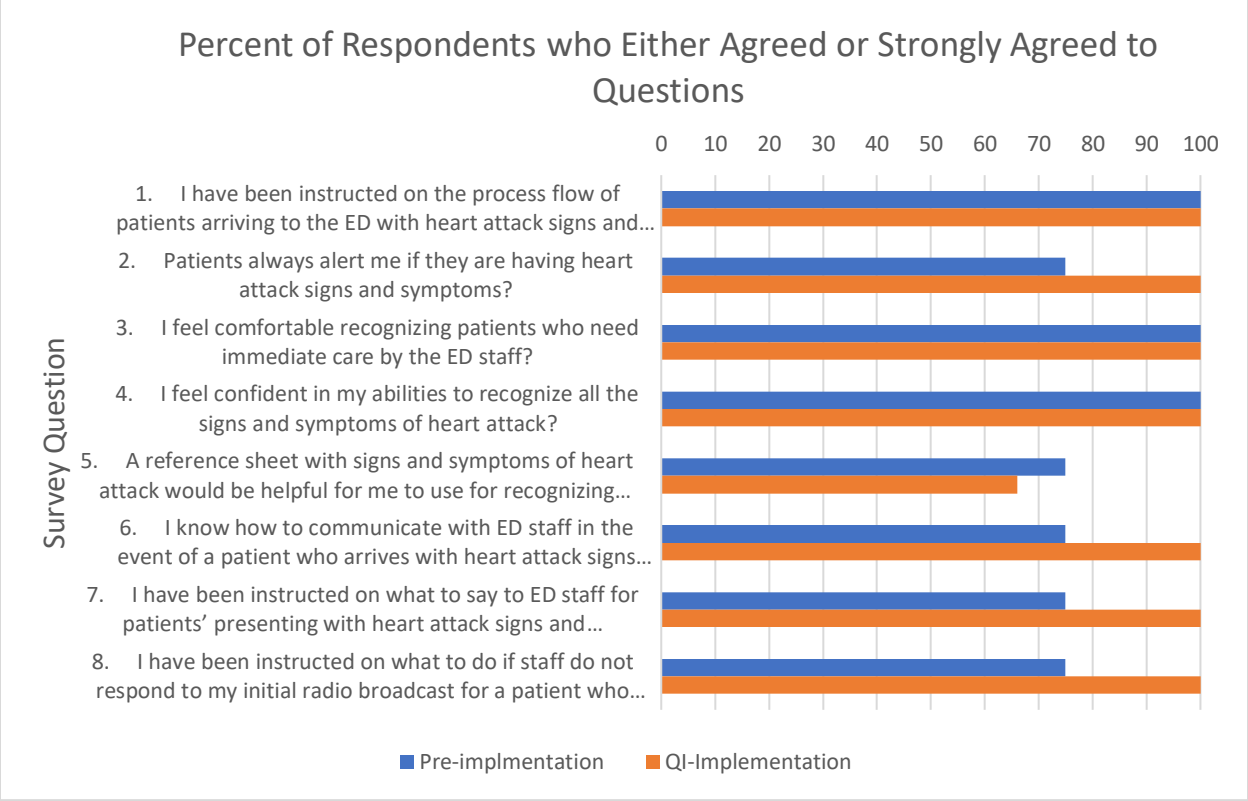
Question	Mean	Standard Deviation	Range
1. I have been instructed on the process flow of patients arriving to the ED with heart attack signs and symptoms?	5	0	5-5
2. Patients always alert me if they are having heart attack signs and symptoms?	4	0	4-4
3. I feel comfortable recognizing patients who need immediate care by the ED staff?	5	0	5-5
4. I feel confident in my abilities to recognize all the signs and symptoms of heart attack?	5	0	5-5
5. A reference sheet with signs and symptoms of heart attack would be helpful for me to use for recognizing walk in patients who might be having a heart attack?	4.33	1.15	3-5
6. I know how to communicate with ED staff in the event of a patient who arrives with heart attack signs and symptoms?	5	0	5-5
7. I have been instructed on what to say to ED staff for patients' presenting with heart attack signs and symptoms?	5	0	5-5
8. I have been instructed on what to do if staff do not respond to my initial radio broadcast for a patient who arrives with heart attack symptoms?	4.66	0.57	4-5

Note. Sample size of three and scale one through five, one is strongly disagree and five is strongly agree (Appendix B).

Figure 3, below, shows the percentage of responses which were filled out as either agree or strongly agree for the survey questions one through eight, and compares pre-implementation and QI implementation responses. Note that the sample sizes were different for each, but there is indication of a higher percentage of agree or strongly agree occurred post implementation for the survey responses.

Figure 3

Percentage of Respondents who Agree or Strongly Agreed Comparing Interventions



Note. Sample size is four for Pre-Implementation and sample size is three for QI-Implementation

Survey Categorical Data. The categorical data sought to determine how many staff members in the door greeter/screener role were paid, medically trained on heart attack symptoms, or certified in Basic Life Support (BLS), and gathered written responses on what

medically trained personnel were certified as. Table 4 shows the responses for the initial 4 survey respondents, which remained unchanged through the study for all pre- and post-implementation survey results. As can be seen staff members in the door greeter role were paid staff and three out of the four staff members were medically trained and BLS certified. Of the three medically trained personnel two were licensed nursing assistants (LNA) and one was an Advanced Emergency Medical Technician (AEMT). A portion of the door greeter/screener role was volunteer members who served as screeners during the pandemic during daytime hours. As a result of the positional staffing changes no volunteers were recorded in the survey responses. Much of the QI implementation was planned around staff members in the role who were not medically trained or volunteers with a limited medical background. Some of this information may correlate to the high markings obtained for survey questions one through eight in both the pre-implementation and post-implementation responses.

Table 4

Surveyed Staff Categorical Data

Survey Question	Yes	No
9. Are you a volunteer?	0	4
10. Do you have medical training on heart attack signs and symptoms?	3	1
11. Are you currently certified in basic life support (BLS)?	3	1

Survey Qualitative Thematical Analysis. Questions 12 through 15 on the survey were open responses to perform qualitative thematical analysis (Appendix B). Three staff members filled this section out prior to implementation and the same three respondents responded post-

implementation to this section. One of the respondents indicated no change for post-implementation survey results, and indicated that they did not use the new broadcast during their shift. The lack of use during the overnight shift can be seen in the limited changes for one of the survey responses. Figure 4 shows the comparison of the common coded survey themes for the process of patients who come to the ED with signs and symptoms of heart attack. Prior to implementation all surveyed staff members would radio broadcast to ED staff to alert them of a *triage patient*. However, there was no standard communication instructed to screeners/greeters, which this QI project intended to improve. After intervention two of the three respondents indicated they used the new broadcast response of *High Alert Triage High Alert Triage.* One respondent did not use the broadcast which was evident in the survey response. Additional reporting of symptoms in initial broadcast were intended, but reported less in question 12 post-implementation.

Figure 4

Surveyed Process for Patients Presenting to the ED WR with Heart Attack Symptoms

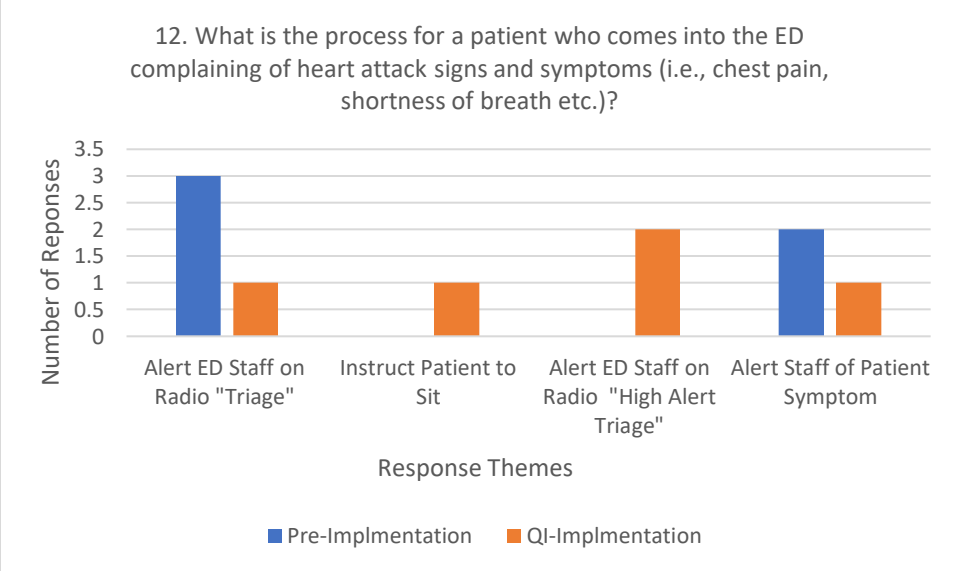


Figure 5, below, shows a survey comparison of what is radio broadcasted to ED staff for a patient who presents to the ED WR with heart attack symptom. As can be seen different communication wording was used pre-implementation, and verbatim was more standardized post-implementation to, *High Alert Triage High Alert Triage Chest Pain*. One respondent did not used the new standardized communication.

Figure 5

Surveyed Response of Communication with ED Staff for Patients with Symptoms of Heart Attack

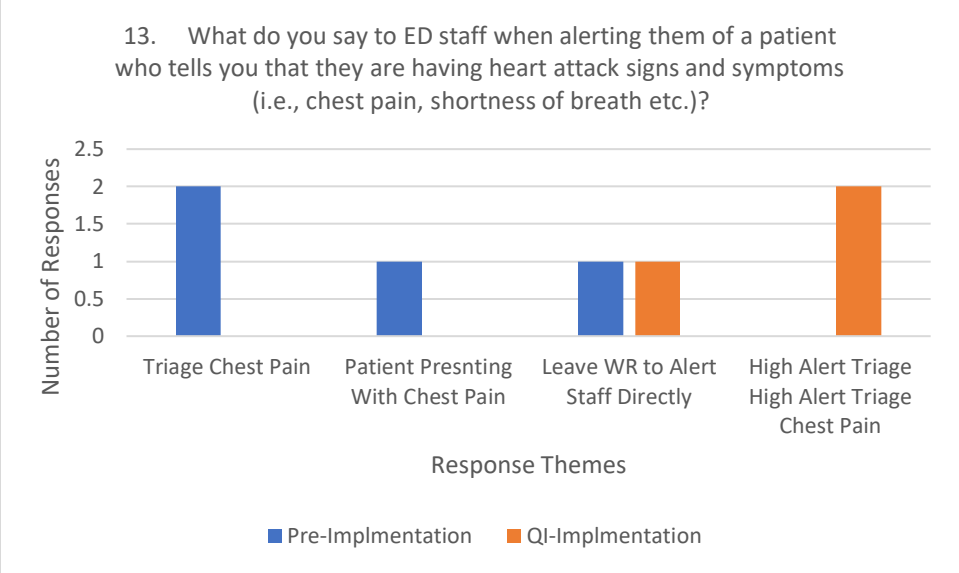


Figure 6, showed no changes in how patients were directed in the point of care process from prior to and during QI implementation.

Figure 6

Surveyed Staff Directions to Patient Upon Arrival with Heart Attack Symptoms

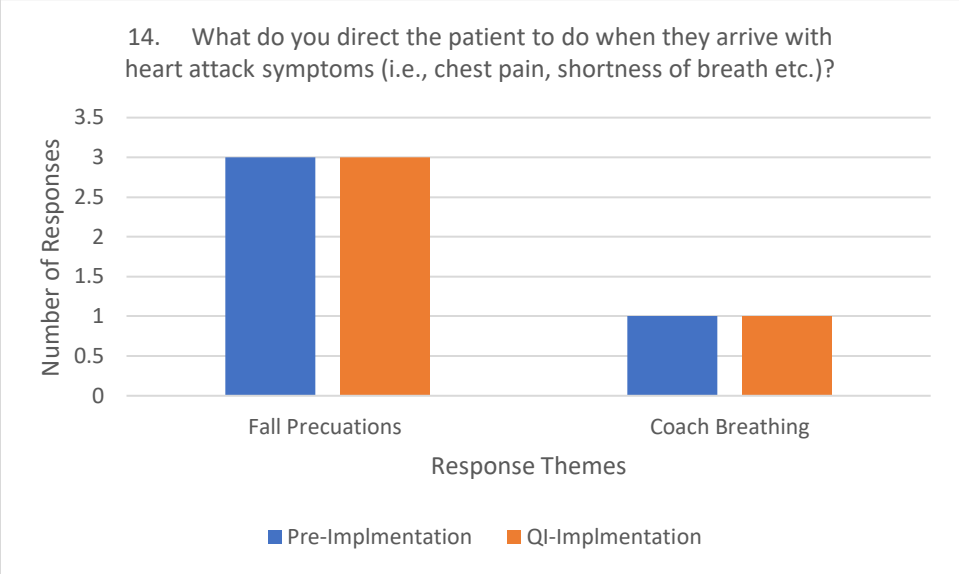


Figure 7

Surveyed Staff Delays in Front End Process

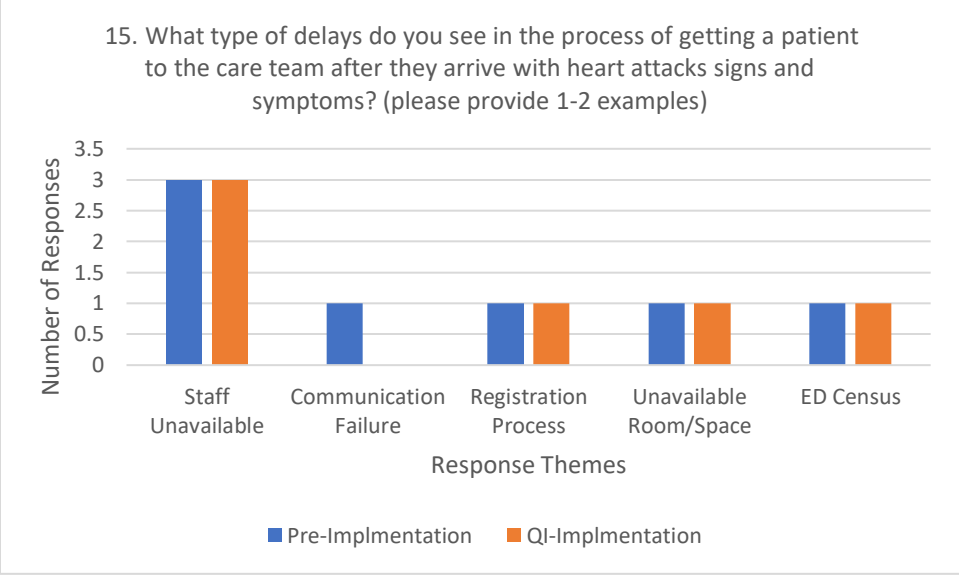


Figure 7, showed minimal changes and reported on the processes in which each member believed delays were seen in getting a patient who presented with heart symptoms to the care of ED staff. Common themes were evident among staffing, communication failure, registration

process, limited space, and overall, ED census. There was however a single response improvement noted in communication failure being improved post-implementation.

Observed Association in QI Implementation

During the intended implementation phase coordination among key stakeholders proved challenging. Meetings were missed due to competing priorities, some of which were due to a critical ED census. Coordination had to occur between several key stakeholders as the door greeter role was managed by a stakeholder not based within the ED functions. Communication also contributed to unintended delays in the intervention. The intended project was planned around the door greeter role, which was significantly reduced in the ED during the week of the initially planned QI implementation period. This led to a delay in the implementation timeline and contributed to small sample sizes of data collected. The door greeter role was also reported as being a non-clinical role which prevented medical education on ACS signs and symptoms for QI. However, after gathering survey responses a majority in the role of the door greeter position during the QI implementation were medically trained and BLS certified. This may have led to survey responses not expected, in that it was intended to survey non-clinical staff with a limited medical background. This may have helped with some of the data collection and responses but may also contribute to minimal changes as a result of QI project due to prior clinical knowledge on recognizing ACS symptoms without the need for reference material. Another observation was the total cost for implementing this QI interventions. A smaller 8.5-inch by 11-inch patient sign was used, as agreed upon by one of the key stakeholders. This reduced estimated cost which was originally $103.00 to $10.97.

Discussion

Summary

The purpose of this QI project was to use bundled interventions to reduce the median DTE time for patients presenting to the ED WR with ACS signs and symptoms. Timeliness of acquiring an ECG within 10 minutes of patient arrival was the specific aim of the project. The DMAIC framework was used in the planning of the interventions to address several potential root causes for delays seen in the point of contact process. Improvement bundles were geared toward improving the point of care process by providing patient education signage on alerting staff of their suspected ACS symptoms, a reference sheet on ACS symptoms for the point of contact door greeter/screener staff member, and improved standardized communication for alerting ED staff of a new emergent patient requiring an ECG. The goal of achieving a DTE time within 10 minutes aligned with the AHA and ACC recommendations for ACS care. Available evidence on the subject suggests that achieving DTE time within 10 minutes is a continued problem in many healthcare systems and WI patients have more delay than those who arrive via pre-hospital medical services.

The goal of achieving DTE time within 10 minutes was not achieved during the two shifts with implementation of this QI project. During the QI intervention the median DTE time was 12.33 (range 7.98- 16.67, standard deviation (STD) = 7.31) minutes, and had a small sample size of two. However, prior to QI implementation the median DTE time was 12.73 (range 7.27-18.2, STD = 6.14) minutes, showing that the interventions had a 24 second improvement. The pre-implementation data collection also had a small sample size of two. The compliance percentage of ECGs completed within 10 minutes was 50% for both pre- and post-implementation. Significance could not be obtained by non-parametric means, due to the small

sample sizes, which significantly limits whether or not QI interventions made any significant difference on the point of contact process within the ED WR. Survey responses were also limited and indicates more data is needed to determine patterns from QI interventions that were not obtained in this QI study. However, with the marginal decrease in DTE time, there may be further nursing implications to provide QI interventions aimed at the point of contact process for patients who present with ACS signs and symptoms. Time constraints were a major limiting factor in this QI project and further interventions over a longer period of time may prove useful in determining significance of similar QI interventions.

In surveying staff members, who worked in the door greeter/screener role, within the ED WR (before and after intervention) surveys reported strongly on unavailable staffing being a large problem in delays observed in acquiring an ECG within 10 minutes from the WR. While this project did not have any interventions aimed at staffing, further QI implications of efficiency in staffing and effectiveness in front end staffing may be further areas for QI interventions. The surveys also determined that a majority of the individuals in the door greeter/screener role were medically trained but functioned in a non-clinical role. This could be an area in which optimizing role and ability to perform ECG could contribute to a potential reduction in DTE time.

Additionally, survey responses after the QI intervention showed an increase in standardized communication in reporting an emergent patient from the point of contact area to the ED staff. There was also an improvement in staff surveys of both *agree* or *strongly agree* for question number two on, *patients always alert staff of potential heart attack symptoms*, from 75 percent to 100 percent among survey responses. While limited in its use, the respondents indicated more understanding on what to say to alert staff of a patient arriving with ACS symptoms. Post intervention surveys were also limited to three total surveys and a larger

population of staff surveyed may be useful in degerming long term patterns. Overall, many factors contribute to delays seen among DTE time, making it very difficult to determine which factors contribute to delays or improvements in median DTE time.

The QI interventions were initially planned using the DMAIC framework, taking into account the non-clinical function of the door greeter/screener role and the fact that many within this role were volunteers and had minimal medical training. However, after surveying the staff, three out of the four survey responses had medical training and BLS certification, indicating that different interventions more clinically based may have been more applicable. However, the door greeter/screener role came about due to the large waves of COVID patient influx and at the time of max use this role consisted of many non-medically trained personnel to screen patients for COVID and assist visitors under hospital protocols. Due to the continuously changing spread of COVID variants it is likely that if another big COVID wave presents, the door greeter/screener role may be re-implemented on a larger scale and contain many more volunteers and non-clinical staff. As such, the planned bundled QI interventions may serve a role in areas where non-medically trained screeners are utilized during waves of COVID to improve care at the point of contact process with patients presenting with emergent conditions such as ACS.

Interpretation

The three bundled interventions within the ED WR showed a median DTE time improvement of 24 seconds, however there were many limitations, discussed in the next section. The patient reference sign (Appendix C) was implemented to increase patient awareness of common ACS symptoms and increase patient self-advocacy of alerting staff of their ACS symptoms. Data was reviewed in the staff surveys which indicated improvement of agree or strongly agree question number two of, *patients always alert me if they are having heart attack*

signs and symptoms. This improvement may correlate with the patient signage, but further data collection is needed to determine long-term patterns. The question two mean score remained unchanged from pre- and post-intervention, remaining at an overall mean of four on the one to five Likert scale.

The door greeter/screener reference sheet was reported as helpful in the pre-implementation survey, but showed less helpfulness among survey responses post implementation for agree or strongly agree. The overall mean score decreased from 4.5 to 4.33 for the reference sign helpfulness. The post-implementation survey of QI interventions showed an improvement among having instructions on what to say when communicating to ED staff of the arrival of a patient presenting with ACS symptoms. Improved communication knowledge on the process of reporting a patient with ACS symptoms was evident in the survey responses of agree or strongly agree. This indicates that the aspect of standardizing communication and instructing members on the communication process in alerting ED staff of patients with ACS as an improvement in the QI interventions.

With the three bundled interventions the overall goal of achieving median DTE time within 10 minutes was not achieved. Compliance of DTE time within 10 minutes remained unchanged at 50 percent from pre- and post-intervention. In the previous section of available knowledge, previous literature suggest DTE time within 10 minutes is a common problem among patients presenting with ACS signs and symptoms. Many of the studies that were reviewed focused on QI interventions in a bundled approach and did report significant improvements in DTE time overall. Among the literature reviewed, even with significant improvements, there were still challenges in obtaining median DTE time within recommended guidelines. This was also evident in this QI project as median DTE time was not achieved even

with bundle interventions aimed at the point of contact process. This indicates that more work is needed in addressing the many causative factors for delays in DTE time. There were many factors that contributed to delays seen in median DTE time during this project, making it difficult to distinguish if this QI intervention was directly responsible for any observed changes. All respondents surveyed indicated that unavailable staff and unavailable rooms were key factors of delays seen among acquiring an ECG within 10 minutes. While QI interventions did not address the factor of staffing, there is implications for further studies on interventions aimed at trying to acquire additional staff to help with the care of suspected ACS patients or increase roles and training among designated non-clinical staff. A majority of the respondents in the door greeter/screener role were medically trained and were BLS certified but did not function in a designated clinical role which could have obtained ECG on patients. Overall cost associated with implementing the QI project were minimal and further studies on opportunity cost for downstream impacts of improved DTE time may be useful in further QI studies. Due to the short timeframe for this QI study further long-term studies are implicated for determining statistical significance and long-term impacts of using bundled QI interventions aimed at improving the point of contact process for reducing DTE time. Further QI studies may be indicated during COVID surges when non-clinically designated roles are used in the immediate ED entrance area to screen patients for COVID as the point of contact personnel.

Limitations

The QI project was very small with no randomization. Due to the small sample size, there was limited generalizability in review of the collected data. During the planned implementation phase of the project the door greeter/screener role of the ED that was covered 24 hours per day seven days per week was reduced by 50 percent. The role of door greeter was changed to be

available during the overnight hours of 11:00 p.m. to 11:00 a.m., with no greeter/screener in the ED WR to assist patients or visitors from 11:00 a.m. to 11:00 p.m. Due to this occurrence the sample size of survey respondence decreased and the DTE time data collected was targeted for the hours of 11:00 p.m. to 11:00 a.m. The targeted daily timeframe created a very small sample size in statistical analysis of median DTE time and compliance percentage of DTE time within 10 minutes. A change was made to correlate with data collection during times at which the door greeter/screener was working to maintain consistency in the impact of QI implementation and comparison data. The project timeline was delayed and shortened due to the position changes and time constraints among the QI project and school semester deadlines. This led to a small QI implementation period of two shifts and changes in originally planned timeline of project. Delays existed in communication of approving project implementation among key stakeholders. Pre-planning was difficult due to competing stakeholder priorities and changes in ED census. This led to a key meeting being missed by key stakeholders, and less stakeholder involvement. Internal staffing challenges were evident and at the time of QI implementation there were significant ED staffing shortages during the overnight hours. Many other factors contributed to the median DTE time data observed which cannot be excluded. Collection of data was limited to two shifts and limited time created data that may not be representable to long term studies of these QI interventions. Other limiting factors may have occurred due to having to educate all staff on the communication changes and inherent Hawthorne effect may have influenced some of the study results. Statistical significance was not determined due to the small sample sizes of collected data and survey responses. Convenience study was performed while observing front-end process which may have introduced some bias in reported process flow problems. Interviews in process flow problems varied during initial planning, with much input from stakeholders

which may have some bias. Signage used for patients was limited to English language, however no data reviewed was excluded due to this constraint upon reviewing preferred language. The majority of survey respondence had a medical background, training, and certification which may have affected the survey response results. The survey used was an untested instrument which may have limited validity. Due to the short timeframe of intervention and secondary survey responses there may be limited changes observed in responses. Further long-term studies may prove useful in determining long-term changes from bundled QI interventions aimed at the front-end point of contact process.

Conclusions

Achieving DTE time within the ACC and AHA recommended 10 minutes is a common challenge among EDs'. Many QI studies reviewed indicated significant improvements can be made but there is still difficulty in reaching recommended DTE time goals. This QI project attempted to improve a small part in the process of acquiring an ECG within 10 minutes by looking at the point of contact process. Bundled interventions aimed at improving patient education to alert staff of common ACS symptoms, a reference sheet for staff, and improved communication instruction were the primary QI interventions. While there was a slight decrease in median DTE time, the study was very short and had to adapt to timeline changes and position changes making consistency in the project plan difficult. There was improvement in survey responses on aspects of point of contact communication with ED staff, indicating a potential area in which this QI project can be applied to improve the communication process. However, there were many limitations in this project and implications for further studies over a longer period of time may prove useful in further nursing QI studies aimed at the point of contact process to determine long term impacts.

Patient education signage in the entrance area of the WR was not present prior to QI interventions on common ACS symptoms with instruction to report symptoms to staff. Further long-term studies in this area may be useful determining if there was significant increases in patient frequency of following sign instruction for self-advocacy of symptoms to staff members.

The project interventions were primarily aimed at individuals working in a non-clinical function as door greeters/screeners and provided a reference sheet on ACS symptoms and communication. While communication knowledge was reported as improved the reference sheet was not reported as helpful as it had been pre-implementation. However, the reference sheet was aimed to be used by non-medically trained staff, but a majority of staff surveyed had medical training, certification, and knowledge on BLS.

The primary role of the door greeter/screener was introduced in the ED to assist with screening patients and visitors presenting to the ED who may have COVID. The role was intended as a non-clinical function. During this QI intervention the door greeter/screener role was being reduced from this ED setting. The role had consisted of volunteers and non-medically trained individuals which was not represented in the surveyed staff responses during this QI project. As the role of door greeters/screeners may be utilized in ED settings during waves of COVID further QI interventions aimed at this point of contact role may be implicated to assist in recognition and communication to clinical staff of emergent patients.

Other reported problems in acquiring ECG within 10 minutes were staffing shortages and unavailable beds. A majority of the individuals surveyed in the role of door greeter/screener were medically trained and functioning in a non-clinical role. Further changes in defining roles based on clinical background, knowledge, and certification may be indicated to help in acquiring ECG within 10 minutes as further nursing QI projects aimed at door screeners/greeter.

Funding

This QI project was primarily self-funded with incurred cost being associated with printing of survey materials, patient signage, reference sheet signage/instruction, and a stand to hold patient signage and door greeter/screener reference sheet. Some of the paper surveys used were printed on site utilizing a facility printer. Facility computer was used in acquiring data and interpretation utilizing facility Microsoft Office products excel and word. Unless otherwise aforementioned, no direct funding contributions were received from any organization or individual within public, private, or non-profit sectors for this QI project.

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Appendix A

[Quality Improvement Survey ED]

(Please circle the number that best corresponds with your agreement on the question)

(This survey will not identify you, and will remain anonymous, by filling out this survey you acknowledge consent in your responses being used for a quality improvement project)

Question:	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. I have been instructed on the process flow of patients arriving to the ED with chest pain?	1	2	3	4	5
2. Chest pain is a time sensitive medical concern?	1	2	3	4	5
3. Patients always alert me if they are having chest pain?	1	2	3	4	5
4. I feel comfortable asking a patient what has brought them in?	1	2	3	4	5
5. I feel comfortable recognizing patients who need immediate care by the ED staff?	1	2	3	4	5
6. I feel confident in my abilities to recognize all the signs and symptoms of heart attack?	1	2	3	4	5
7. A sheet with signs and symptoms of heart attack would be helpful for me to use for recognizing the signs and symptoms of heart attack?	1	2	3	4	5
8. I know how to alert ED staff in the event of a patient who arrived with chest pain?	1	2	3	4	5
9. I have been instructed on what to say to ED staff for patients' presenting with chest pain?	1	2	3	4	5
10. Nurses respond quickly to the waiting room when I broadcast "triage patient with chest pain?"	1	2	3	4	5

(please circle yes or no)

11. Are you a volunteer?
    Yes/no

12. Do you have clinical training on heart attack signs and symptoms?
    Yes/no

13. Are you CPR certified?
    Yes/no

14. What is the process for a patient who comes into the ED complaining of chest pain?

15. What do you say to ED staff when alerting them of a patient who tells you that they are having chest pain?

16. What do you direct the patient to do when they arrive with chest pain?

17. How many minutes would you estimate it takes a patient to check into the kiosk?

18. What type of delays do you see in the process of getting a patient to the care team after they arrive? (please provide 1-2 examples)

Appendix B

[Quality Improvement Survey Patients Presenting with Heart Attack Symptoms]

(This survey will not identify you and will remain anonymous, by filling out this survey you acknowledge consent in your responses being used for a quality improvement project on the point of care process for patients arriving to the ED with signs and symptoms of heart attack. Before and after surveys will be handed out corresponding with a quality improvement project change, your participation in this survey is voluntary and greatly appreciated, thank you)

Number: _____

(Please circle the number on a scale from 1-5)

Question	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. I have been instructed on the process flow of patients arriving to the ED with heart attack signs and symptoms?	1	2	3	4	5
2. Patients always alert me if they are having heart attack signs and symptoms?	1	2	3	4	5
3. I feel comfortable recognizing patients who need immediate care by the ED staff?	1	2	3	4	5
4. I feel confident in my abilities to recognize all the signs and symptoms of heart attack?	1	2	3	4	5
5. A reference sheet with signs and symptoms of heart attack would be helpful for me to use for recognizing walk in patients who might be having a heart attack?	1	2	3	4	5
6. I know how to communicate with ED staff in the event of a patient who arrives with heart attack signs and symptoms?	1	2	3	4	5
7. I have been instructed on what to say to ED staff for patients' presenting with heart attack signs and symptoms?	1	2	3	4	5
8. I have been instructed on what to do if staff do not respond to my initial radio broadcast for a patient who arrives with heart attack symptoms?	1	2	3	4	5

(please circle yes or no)

9. Are you a volunteer?
   Yes/no

10. Do you have medical training on heart attack signs and symptoms?
    Yes/no

    If Yes, what training? _____

11. Are you currently certified in basic life support (BLS)?
    Yes/no

(please freely respond to the following questions)

12. What is the process for a patient who comes into the ED complaining of heart attack signs and symptoms (i.e., chest pain, shortness of breath etc.)?

13. What do you say to ED staff when alerting them of a patient who tells you that they are having heart attack signs and symptoms (i.e., chest pain, shortness of breath etc.)?

14. What do you direct the patient to do when they arrive with heart attack symptoms (i.e., chest pain, shortness of breath etc.)?

15. What type of delays do you see in the process of getting a patient to the care team after they arrive with heart attacks signs and symptoms? (please provide 1-2 examples)

Appendix C

STOP

If you are having the following common heart attack symptoms:

- Chest: Pain, Discomfort, Pressure, Tightness
- Shortness of Breath
- Nausea, Vomiting, Weakness
- Left Arm or Shoulder Pain – not from an injury
- Unusual Fatigue or Tiredness
- Pain Between Shoulder Blades – not from an injury
- Lightheadedness or Dizziness
- Heart “Fluttering or Racing” – Palpitations

Alert the Nearest Staff Member

Appendix D

If an Adult patient reports the following common Heart Attack Symptoms

- Chest: Pain, Discomfort, Pressure, Tightness
- Shortness of Breath
- Nausea, Vomiting, Weakness
- Left Arm or Shoulder Pain – not from an injury
- Unusual Fatigue or Tiredness
- Pain Between Shoulder Blades – not from an injury
- Lightheadedness or Dizziness
- Heart "Fluttering or Racing" – Palpitations

Alert the ED Staff via Radio and State the Following:

"High Alert Triage, High Alert Triage"

****You may then state what the patient said for symptom****