QUALITY IMPROVEMENT PROJECT FOR DOOR-TO-EKG TIME FOR EMERGENCY ROOM

by

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Abstract

The American Heart Association recommends the initiation of an EKG with interpretation in less than 10 minutes upon presentation to the emergency room for patients presenting with acute coronary symptoms. Treatment delay factors of identifying the importance and impact of triage within the initial contact for patients in the ER influenced to the implementation of an EKG-triage-RN intervention within the triage area. The EKG-triage-RN intervention redirected the flow of ACS patients as they enter the ER, in order to be evaluated and assessed faster for the potential of an immediate EKG. A quality improvement project was completed based on the concept of LEAN Six Sigma asking the following question: For nurses in the ER, will implementation of an EKG-triage-RN approach, compared to current practice, improve door to EKG time to meet the benchmark goal of 10 minutes or less, within a 10-week timeframe? Prior to the project, the average door-to-EKG time of 24 minutes, a compliance rate of EKG's verified by the ER physician at 37.5% and first medical device time for walk-in ER patients of 96 minutes. Post implementation of an EKG-triage-RN data demonstrated a door-to-EKG time of 13 minutes, a compliance rate of 72.3% and first medical device time for walk-in ER patients of 85 minutes. Limitations in this project included were poor recognition of stated symptoms from patients walking into the ER thereby not allowing the EKG-triage-RN to recognize the need for an EKG. The project results were significant to the facility as a method to meeting benchmark standard goals.

Key words: rapid triage nurse approach, improving door-to-EKG time, door-to balloon time, door-to-first medical device time, nurse triage in an ER, recovering arrival EKG from nursing triage.

Quality Improvement Project for Door-To-EKG Time for Emergency Room

In the United States, someone has a heart attack every 40 seconds, and each minute one person dies from a heart disease-related event (Center for Disease Control, 2015). The American Heart Association (AHA) Acute Coronary Treatment and Intervention Outcomes Network- Get with the Guidelines (ACTION- GWTG) set the national goal and standard mark for each facility of regulations and processes for the initial acquisition of an EKG on arrival are set for 10 minutes or less and first medical device (FMD) time of 90 minutes or less for patients presenting with acute coronary symptoms (ACS) (AHA, 2016). These ACS symptoms consist of chest pain or tightness, pain radiating from the chest to the shoulders, arms, upper abdomen, back, neck or jaw, nausea or vomiting, indigestion, dyspnea, diaphoresis, dizziness, unexplained fatigue or feelings of restless or apprehension. A delay in the initiation of an EKG during ACS may yield poor outcomes such as increased mortality rate and irreversible damage to the cardiac muscle (Shin, Hwang, Jeong &Lee, 2013). The intervention of an EKG-triage-RN in the registration and triage area encompassed the concept of the 30-30-30 rule which consisted of 30 minutes or less for emergency medical services (EMS) to deliver the patient to ER from the field, 30 minutes or less for ER to assess, interpret and diagnose the need for cardiac catheterization lab (CCL) and 30 minutes or less to activate FMD (AHA, 2016).

The organization that participated in this project was an acute care medical/surgical hospital in the Northeastern US. The organization's door-to-EKG average time was 24 minutes, with only 37.5% of EKGs performed under the benchmark of 10 minutes and the FMD time for walk-in ER patients of 97 minutes. With these results, an EKG-triage-RN role was implemented within the triage and registration department to address the PICOT question: For nurses in the emergency room (P), how will implementation of a rapid EKG RN approach (I), compared to

current practice (C), improve door-to-EKG time (O), within a 10-week timeframe (T)? This project consisted of intense training of current triage staff, aided in the achievement of meeting benchmark goals of door-to-EKG times of 10 minutes or less from arrival to the emergency room, and FMD time of 90 minutes or less by utilizing the standards of the 30-30-30 rule.

This project was relevant within the nursing field by providing the most optimal outcomes for ACS patients. Failure to identify candidates for an initial EKG during emergency room intake processes subject patients to potential diagnostic and treatment delays (Yiadom et al., 2017). The impact on these patients is a higher incidence of mortality rates when cardiac events are delayed, and an increase in the extent of irreversible cardiac damage that may occur (Yiadom et al., 2017). The EKG-triage-RN process was implemented to act as the first-line nurse for early ACS symptom recognition. This process implemented a dedicated cardiac triage RN within the registration area to specifically assess and triage ACS walk in patients. The EKG-triage-RN identified questionable symptoms that were vague or classic symptoms such as chest pain, to determine the need to receive an EKG faster. The role of the EKG-triage-RN was beneficial in expediting the flow of cardiac patients that were required to obtain an EKG and determine the plan of care.

Problem Description

This project leader identified the average amount of time at this facility for door-to-EKG and FMD times was greater than the national standard times of 10 minutes and 90 minutes. The amount of time exceeded the national average and therefore placed patients at a higher risk for increased morbidity and mortality associated with a lack of immediate diagnosis and treatment. At this facility, the first 10 minutes of an emergency room visit typically consisted of intake processes with registration and triage occurring before a physician encounter, which is the most

time-sensitive nature of patient admission. The national average of door-to-EKG time is 12 minutes (AHA, 2016). The AHA (2016) recommends the initiation of an EKG with interpretation in less than 10 minutes upon presentation to the ER for patients presenting with ACS. Failure to identify candidates for an initial EKG during emergency room intake processes subject patients to diagnostic and potential treatment delays (Yiadom, et al., 2017). This treatment delay creates a domino effect by delaying the activation of the CCL and increasing the FMD time (time from arrival to the FMD).

The current practice at this facility was that patients arrive through the ER to the registration area and describe presenting symptoms. The registration clerk entered the chief complaint to the computer system. The data was transferred to the triage screen to the charge nurse in the ER. The charge nurse then reviewed the chief complaint of the patient in the waiting area and escorted them to the triage area according to the prioritized complaints and symptoms. The patient was triaged with receiving an EKG and cardiac workup. The EKG was then interpreted by the ER physician who determined the need for the CCL for an emergency percutaneous coronary intervention (PCI). Data collected over a 10-week period from 08/2019-10/2019 demonstrated the target door-to-EKG time of 10 minutes or less with 24 minutes and a compliance rate of acquiring an EKG in 10 minutes or less of 37.5% and first medical device time for walk-in ER patients was 96 minutes. The goal of the project was be to meet the benchmark standards of that instituted by AHA (2016) for a door-to-EKG time of 10 minutes or less and FMD time of 90 minutes or less. The FMD is defined as the first interventional equipment used to cross the lesion or blockage within the culprit's vessel, causing the cardiac event.

This doctor of nursing practice student served as the project leader and completed an extensive review of literature related to decreasing door-to-EKG time and FMD. Ellahham et al. (2015) implemented a process described from the concepts of Six Sigma to make processes more uniform and precise through the application of statistical methods model of the definition of goals, measuring the process to determine performance, analysis of the cause of defects, process improvement through elimination of errors and controlling future process performance. According to the study by O'Neill et al. (2014), implementation of the EKG-triage-RN nurse triage approach, which encompassed an RN solely used for patients arriving with ACS complaints to be assessed, resulted in a 92% compliance rate for EKG performed 10 minutes or less from arrival, compared to pre-intervention of 32% showing significant statistical improvement. Wang, Lin and Wu (2016) stated that failing door-to-EKG times were based on poorly orchestrated triage assessments, suggesting an integrated approach for a chief-complaint-based EKG process to be implemented by the triage nurse. Based on these findings, the project leader recommended the implementation of an EKG-triage RN within the registration triage area. This EKG-triage-RN approach would encompass a dedicated RN within the registration and triage area to assess walk in ER patients if they are expressing ACS symptoms. With this rapid assessment, the patient would be immediately streamlined for an EKG by the RN. The EKG-triage-RN would follow and document then patient through the registration, triage and ER until their symptoms have been diagnosed or if they result in going to the CCL. Stanfield (2018) performed an intervention of EKG-triage-RN to provide education to the triage RN on ACS, also included the pivotal role of an RN in the lobby acquiring an EKG within 10 minutes of arrival for the patient population and reiterated which presenting symptoms could suggest acute coronary events and require promptly performed EKGs.

Available Knowledge

The project leader conducted a literature review by utilizing an electronic search through university library summon. The summon included resources and databases of ProQuest, PubMed, Science Direct, and Medical databases. The search keywords were of rapid triage nurse approach, improving door-to-EKG time, door-to balloon time, door-to-first medical device time, nurse triage in an ER, and improving arrival EKG from nursing triage. The search was narrowed down to five years or less from publication, peer-reviewed, scholarly journals, and journal articles. From this summons, 1574 articles were found. Inclusion criteria included evidence for door-to-EKG time improvement or implementation of triage RN for development. Exclusion criteria included a lack of stated door-to-EKG flow and door-to-balloon implementation. From the summoned articles, 20 were retained due to the impact and evidence about this specific project of quality improvement (QI) door-to-EKG time. The referenced articles analyzed supporting this intervention, and the authors consisted of emergency medicine physicians, DNP, Doctor of Philosophy, and Master of Science prepared registered nurses from emergency rooms, cardiologists, and medical college faculty.

After a review of the literature, the project manager recognized several themes throughout the research conducted. These themes consisted of: identifying the importance and impact of triage within the initial contact in the ER, treatment delay factors, and time-sensitive target goals for door-to-EKG and door-to-FMD times. Each theme is explained below in detail.

Identifying the Importance of Triage in the Emergency Room

Triage nursing plays a crucial role within the first contact with patients demonstrating ACS. According to the CDC (2015) a patient has a heart attack every 40 seconds, and each minute one person dies from a heart disease-related event in the United States. Stanfield (2018)

performed an intervention to provide education to the RN, also included the pivotal role a nurse in the lobby plays on acquiring an EKG within 10 minutes of arrival for this patient population and reiterated which presenting symptoms could suggest acute coronary events and require promptly performed EKG's. O'Neill et al. (2014) comparatively says nurse-initiated thrombolysis in the accident and emergency department demonstrated significant reductions in the median door-to-needle times for thrombolysis, consistent with national targets. The integrated approach included a chief-complaint-based ECG process initiated by a triage nurse, moving the EKG station to the triage area, and facilitating the conduction of EKG by a triage nurse (Wang, Lin & Wu, 2016).

Most of the patients with myocardial infarction were classified as low care priority, showing triage failure either due to symptom variability or need for a professional qualification in clinical data collection and interpretation (Nonnenmacher et al., 2018). While, triage systems in distinguishing ACS from diseases of mild severity and patients were sorted into the triage systems based on collected data at admission and a systematic 12-lead EKG performed at triage (Dechamps et al., 2017). Weeks, Johnson, and Jones (2017) stated triage nurses require adequate ACS knowledge to perform prompt recognition and medical response, thereby reducing patient mortality and morbidity, seeking to determine if triage nurses know to identify patients at risk for ACS accurately. Sakamoto et al. (2018) studied the chest pain triage (CPT) model for its effectiveness in improving chest pain protocols for patients in the ER, determining the CPT may develop triage protocols for sensitivity and specificity for patients arriving with ACS.

The AHA (2016) recommends the initiation of an EKG with interpretation in less than 10 minutes upon presentation to the ER for patients presenting with ACS. The gap in practice this project leader identified was the amount of time that is required for an ER patient with ACS

symptoms to have an EKG performed. The amount of time exceeded the national average and therefore placed patients at a higher risk for increased morbidity and mortality associated with a lack of immediate diagnosis and treatment. Coyne et al. (2015) instituted a chief-complaint based cardiac triage area for ACS patients with a secondary intervention of an EKG technician in the triage area. Prachanukool et al. (2016) the rapid EKG RN approach was implemented by the use of an acute chest pain fast track (ACPFT). The ACPFT begins with the triage nurse in evaluating the patient to determine if they are exhibiting ACS. The data was drawn from 616 patients that went through as walk-ins in the ER, resulting in 315 (89.5%) receiving an EKG in 10 minutes or less (Prachanukool et al., 2016).

This theme focused on the design and identification of the triage flow or system and incorporated the importance of the identification of the triage area, either broken down to a specific cardiac triage, the determinants of the flow, or the increased knowledge base for staff to effectively direct the flow of patients. Stanfield (2018), O'Neill et al. (2014), Wang, Lin and Wu (2016), and Prachanukool (2016) all compared the utilization of a triage complaint system to classify the direction of care for the patient based on what their chief complaint was stated to be. These references comparatively resulted in similar data of meeting benchmark goals for patients arriving with chest pain symptoms, to direct them to receive an EKG within 10 minutes of arrival. In contrast, Nonnenmacher et al. (2018) and Dechamps (2017) instituted a system that would separate patient stated complaints within triage contrasting a uniform protocol to the triage RN judgment. These stated references developed with the implementation of triage importance to achieve benchmark standards and expedite patient care.

Treatment Delay Factors. Alnsasra et al. (2017) study stated atypical chest pain symptoms were reported to the triage RN revealing that atypical chest pain and daytime

presentation were independently associated with a delay in ECG recording a result of 29.2% of patients. Identifying room for improving timely STEMI identification among primarily screened ED patients (Yiadom et al., 2017). Delays in the treatment of STEMI patients are caused by many hospitals not having the proper conditions including primary resources of personnel, equipment and good logistical planning to achieve the door-in door-out (DIDO) according to the recommended guideline's time of fewer than 30 minutes (de Andrade et al., 2014). Shi et al. (2018) study also collected data on the DIDO time for patients that are transferred to a cardiac catheterization lab equipped with the facility. Median DIDO time was 55 minutes, and 43% of patients with timely DIDO data had a benchmark door to the first medical contact mark. Results included goals not met for DIDO patients, although symptoms to FMD and EKG were strong influences on DIDO data that fit the benchmark times.

Literature has shown that lack of nursing education to identify ACS reported symptoms delay treatment, as well as patient gender, specifically being female, predicted the amount of triage delay significantly. Surprisingly, experienced nurses were associated with longer delays in triage (Sanders, 2017). In a study from Lee et al. (2019) patients with ACS at triage, one-fourth of the patients with ACS were placed in the low-priority group, which was associated with a significant delay in door-to-EKG and FMD resulted from data identifying that atypical symptom, such as shortness of breath, syncope, weakness, and gastrointestinal discomfort, were the primary sources of delay in door-to-EKG times. When ACS was not recognized in the triage stage, the average time to diagnosis was usually more than 30 min, making the FMD time threshold difficult to achieve (Lee et al., 2019).

Time Sensitive Targets and Target Goals. Several variables, including triage score, arrival time, first location, doctor wait time, and cardiac diagnosis, were all significant predictors

of time to EKG (Hughes et al., 2018). The comprehensive EKG-to-device time represents a single aggregate measure and its derivation incorporates individual patient treatment times relative to other ST elevation myocardial infarction (STEMI) patients arriving in primary PCI-capable centers, since delays associated with time-to-treatment for primary PCI have the same clinical meaning regardless of where STEMI is identified, a combination of these times across all patients at a given hospital yield a meaningful, comprehensive statistic that can be used to compare hospital-related network-level performance for all STEMI patients receiving primary PCI (Shavadia et al., 2017). An interdisciplinary team generated a process map and brainstormed the barriers that prevent EKGs from being completed promptly (Keats et al., 2018).

Concepts of LEAN management within protocols to achieve target goals and improve protocol compliance. Lean six sigma strategies included the project goal, project scope, analysis of process mapping, improvement of critical processes, and controlling auditing and documentation (Ellahham et al., 2015). The comparison showed time-critical interventions for stroke therapy benefit from protocol-driven initiatives and clear definitions of roles to create parallel processing of tasks (Rai et al., 2016). Implementation within door-to-balloon time management by involving the stakeholders, determining the specific steps in STEMI care, established time goals, and finally analyzed each step to determine processes edits to achieve each step's goal (Abuhejleh et al., 2016). Implementation of changing the process steps allowed us to identify the specific areas of care that needed to be altered to achieve the overall goal.

Summary. This exhaustive literature review demonstrated that there are numerous techniques and trials conducted to achieve the benchmark standards for door-to-FMD and door-to-EKG time. With the implementation of various interventions and education, facilities can decrease their time to come closer to meeting these standards. After this review, it has been

determined that there are many ways for improvement. Each intervention will vary from facility to facility as well as the setting of the facility.

The implementation of an EKG-triage-RN in the ER triage and registration area is relevant within the nursing field due to providing for the most optimal outcomes. Failure to identify candidates for an initial EKG during emergency room intake processes subject patients to diagnostic and potential treatment delays (Yiadom et al., 2017). The impact on these patients is a higher incidence of mortality rates when cardiac events are delayed and an increase in the extent of irreversible cardiac damage that may occur.

With the implementation of an EKG-triage-RN as a first-line nurse for early ACS symptom recognition within this area, questionable symptoms that are vague and classic symptoms such as chest pain will be able to be identified and evaluated to receive an EKG faster. The role of the EKG-triage-RN will be beneficial in expediting the flow of cardiac patients that may require an EKG and determine the plan of care.

Rationale

The theoretical framework model that will be utilized within this project will be the concept of define, measure, analyze, improve, and control (DMAIC), from the Six Sigma improvement model, which specifies the following sequence of steps for understanding and improving a process: 1) defining the project goals and customer (internal and external) requirements; 2) measuring the process to determine current performance; 3) analyzing and determining the root cause(s) of relevant defects; 4) improving the process by eliminating defect root causes, and 5) controlling future process performance (Ellahham et al., 2015). The project goals were connected through DMAIC framework because it identified the current gap in practice for door-to-EKG times, utilized a multi-disciplinary approach for implementation,

incorporated the knowledge, data collection from current stakeholders to develop a change in training with the institution of an EKG-triage-RN within the triage/registration area of the ER. The identification and feedback from stakeholders (the nursing staff (including the EKG-triage-RN), registration staff, the patient care technicians and the physician in the ER), allowed for a practice change with the implementation of a new role to achieve the benchmark goal of an EKG in 10 minutes or less in patients presenting with ACS symptoms.

Study variables. There are specific operational variables involved in this project. The outcome measurement goal for this project will be an EKG in 10 minutes or less. The independent variable will be the implementation of an EKG-triage-RN, and the dependent variable will be the EKG time.

Study assumptions. There are specific study assumptions associated with this project which are the ER registration staff will accurately state the patient's chief complaint correlating with ACS, the EKG-triage-RN will continuously monitor admission tracker board for patient's arriving with ACS and EKG machines will be readily available for immediate use.

Specific Aims

The purpose of the project was to meet the benchmark standards of that instituted by AHA for the door-to-EKG time of 10 minutes or less and to meet the standards of FMD time of 90 minutes or less. The PICOT question presented for this project was: “For nurses in the ER, how will the implementation of an EKG-triage-RN approach, compared to current practice, improve door to EKG time to meet the benchmark goal of 10 minutes or less, within a 10-week timeframe? This PICOT question and project goals are connected through DMAIC framework because it identified the current gap in practice for door-to-EKG times, utilized a multi-disciplinary approach for implementation, incorporated the knowledge. Data was collected from

current stakeholders to develop a change in training with the institution of an EKG-triage-RN within the triage/registration area of the ER. The identification and feedback from stakeholders (the nursing staff including the EKG-triage-RN), registration staff, the patient care technicians and the physician in the ER), allowed for a practice change with the implementation of a new role to achieve the benchmark goal of an EKG in 10 minutes or less in patients presenting with ACS symptoms.

The methodology of this project was based on the concept of LEAN six sigma. Lean involving principles, practices, and plans for designing, improving and managing processes. While Six Sigma aims to make processes more uniform and precise through the application of statistical methods model of the definition of goals, measuring the process to determine performance, analysis of the cause of defects, process improvement through elimination of errors and controlling future process performance (Ellahham et al., 2015).

Project Goal

The goal for this project was that the nurses in the ER would implement the Rapid EKG-triage-RN to improve door-to-EKG time to the benchmark goal of 10 minutes or less, within a 10-week timeframe. The DMAIC model provided the framework as follows:

Define. Nurses in the ER, will implementation of a Rapid EKG-triage-RN, compared to current practice, to improve door to EKG time to meet the benchmark goal of 10 minutes or less, within a 10-week timeframe?.

Measure. The process was measured by time is based on when the patient checks into registration and time of when they receive their first EKG. The two tracked times collected within the ER are the time of patient arrival to the ER and the initiated EKG time. The difference between these two tracked times is what will derive the door-to-EKG time. The next

tracked time is when the patient was then activated to the CCL to FMD time. The last data collection will be from the overall time from arrival to FMD in the CCL.

Analyze. Data collection will be conducted through admission coded symptoms using ICD-10-CM codes and will narrow the selection to patients presenting with ACS symptoms

Improve. An increased number of staff members can perform EKG's. The implemented streamline process for ACS symptoms for rapid assessment in Triage
increase activation and post symptom identification.

Control: Tracking, auditing, and monitoring the two times a week for data collection of times. Availability of an ER Director or on-site Administrator. We conducted bi-weekly meetings to evaluate the door-to-EKG and door-to-FMD process effectiveness. Increase the ability for all staff to perform EKGs and **e**valuate the on-call process for activating CCL.

Methods

Context

The setting for this project occurred in the ER of a community hospital located within a rural context in Upstate New York. The physical and sociocultural makeup is a short-term acute care facility with 257 beds and serves predominately Northeastern English and Spanish speaking residents, varying cultural descents and religious preferences. The facility staffing included 15 triage RNs that are full-time staff at this facility, with a total of two triage RNs per shift, ER technicians, registration clerks, and an administrative leadership team of ER physicians, ER director, and Chief Nursing Officer.

Culture and barriers. The culture of this facility is based on patient safety, quality improvement, and benchmark measures for effective care provided. Many of the practice changes within this facility are based off of evidence-based practice, which are implemented

from specific unit levels all the way up to administration for implementation and change. There were no significant barriers within this project as the facility and stakeholders were in support of the implemented project to assist with achieving benchmark standards. Nursing, registration, and ER technician staff were inquisitive and compliant with the delivery of this project creating the culture of the organization as very welcoming and friendly.

Organizational support and stakeholders. The discussion with the administration and ER physicians consisted of reviewing current protocols implemented within the registration/triage process. Administration and ER physicians were very eager and supportive on this implementation, as EKG time were well off the benchmark goal. Each stakeholder was eager to implement to see effective results. Stakeholders were engaged through open forum discussions, evaluation of prior data collection with the primary concept of developing a change to improve flow within the registration and triage areas. The process of the implementation followed the concepts of six sigma to make processes more uniform and precise through the application of statistical methods model of the definition of goals, measuring the process to determine performance, analysis of the cause of defects, process improvement through elimination of errors and controlling future process performance.

The second discussion was with the triage RN's and ER technicians. The conversation with this group was the review of the evaluation of new protocols for identifying ACS presenting symptoms from walk-in patients and the implementation of an ACS dedicated RN within registration and triage. This role was explained on solely dedicating their attention to identification and assessment of ACS presenting patients, with the assistance of the ER technician for EKG performance. This group also reviewed on an EKG performance and increasing the educational knowledge for an EKG performance.

The benefit to the organization. Since the role of the triage nurse has already been established within the daily assignments, there will not be any additional costs involved with the realignment. The intervention changed the concept and utilization of the triage nurse and transforming the role into the EKG-triage-RN within the designated cardiac triage area. Patient care technicians, registration, and registered nurses were adequately trained and educated on the performance of EKG stakeholders consist of administrators in the facility and interdisciplinary team members of the ER directors, interventional cardiologists, ccl team, and triage RN. Stakeholders were actively involved in the implementation of this intervention. Based on the benefit of the facility, achieving the benchmark goal of door-to-EKG in 10 minutes or less will allow maintaining compliance with accreditation with AHA.

Interventions

Project design and setting. The setting for this project occurred in the ER of a community hospital located within a rural context in Upstate New York. The primary target population was patients with an age range of 30 years old to 85 years of age, male or female-walk-in patients to the ER with chief complaints of ACS. This is including but not limited to chest pain or tightness, pain radiating from the chest to the shoulders, arms, upper abdomen, back, neck or jaw, nausea or vomiting, indigestion, dyspnea, diaphoresis, dizziness, unexplained fatigue or feelings of restless or apprehension.

The project was a quality improvement, which collected quantitative data for 10 weeks before the implementation of the intervention. The data collection was then compared to determine the validity of the intervention. This quality improvement project instituted the implementation of an EKG-triage-RN as a first-line nurse for early ACS symptom recognition within the area of triage. Questionable symptoms that are vague and classic symptoms such as

chest pain were identified and evaluated to receive an EKG faster. The role of the EKG-triage-RN and designated cardiac triage area will be beneficial in expediting the flow of cardiac patients that may require an EKG and determine the plan of care.

The DNP learner implemented through a hands-on interdisciplinary communication approach which was expanded to the ER and CCL to ensure that patient presenting with ACS symptoms were adequately moved through the proper channels to achieve the designated benchmark goals achieved by utilizing the concepts of Lean six sigma. Lean involves principles, practices, and methods for designing, improving and managing processes, while Six Sigma aims to make processes more uniform and precise through the application of statistical methods model of the definition of goals, measuring the process to determine performance, analysis of the cause of defects, process improvement through elimination of defects and controlling future process performance (Ellahham et al., 2015). The goal of the project was to meet the benchmark standards of that instituted by AHA for a door-to-EKG time of 10 minutes or less and to meet the standards of FMA time of 90 mins or less. The steps of door-to-EKG analyzed for potential delays and inconsistencies, then with the implementation of Lean, the processes were altered to decrease time and meet benchmark standards. The timing measured each phase of the patient's arrival, ER stays, and the entry to the CCL. Data were then analyzed for defects of timing and cause in delays. With the implementation of a cardiac triage area and EKG-triage-RN improvement of time was seen as well as controlling the potential of future defects in time delays through auditing data with multi-disciplinary teams. This intervention also applied to door-to-FMD time, Lean concepts were able to determine the process and the flow to achieve the desired outcomes.

Inclusion and exclusion criteria. The inclusion criteria of this sample are the population of all the ER triage RN's within this facility and patients of all races and sexes walking in the ER within the age range of 30 years old to 85 years of age. Exclusion criteria are patients that are brought in via ambulance or already admitted patients. Each patient involved in this study was protected by the Health Insurance Portability and Accountability Act of 1996.

Practice recommendations and interventions. According to the AHA Acute Coronary Treatment and Intervention Outcomes Network- Get with the Guidelines (ACTION- GWTG), the national goal and standard mark for each facility of regulations and processes for the initial acquisition of an EKG on arrival are set for 10 minutes or less and FMD time of 90 minutes or less (AHA, 2016). This intervention encompassed the concept of the 30-30-30 rule which consisted of 30 minutes or less for EMS to deliver the patient to ER from the field, 30 minutes or less for ER to assess, interpreted and diagnosed a need for CCL and 30 minutes or less for CCL to activate FMD (AHA, 2016). This rule incorporated the relevance of the data collected and did not affect the study based on EMS transmission of the patient to the ER, said timing did not have an impact on the door-to-EKG data. Increased time for EKG initiation in practice has become a prevalent issue nationally delaying first medical device times and has had standards placed from the AHA for guidelines of 10 minutes or less for door-to-EKG times.

EKG-triage-RN. The intervention implemented an EKG-triage-RN and a designated cardiac triage area within the triage and registration department. The first action of this intervention was based on the intervention operational logistics concept map (see Appendix A), the registration staff checking the patient into the ER, and having the patient state their chief complaint. The role of the EKG-triage-RN was to be the first medical staff to assess the patient who presented with chief complaints of ACS symptoms when arriving in the registration area

and to divert to a designated cardiac triage area for rapid assessment. These stated ACS complaints were then evaluated by the EKG-triage-RN to determine if the patient required an immediate intervention of an EKG. The EKG-triage-RN and patient care technician then assisted in performing an EKG after the patient is assessed. This rapid EKG performance is pertinent to achieve the benchmark goal of 10 minutes or less from arrival time. After the EKG was performed, the ER physician was then alerted that an EKG would need to be interpreted to determine the plan of care for the patient if activation of the CCL team is necessary.

DNP learner's role. The project leader's position was observing the flow of the process aiding areas that may need improvement, offering guidance or education to the team members involved to achieve the projected goal and assist facilitation between interdisciplinary teams. The project leader communicated with the director of the ER and explained the implemented change of utilizing an EKG-triage-RN role in the cardiac triage/registration area. The project leader was then available to provide assistance and educational needs to nursing and patient care technician staff about the importance of implementing these changes and the purpose of the intended project via the concept map. The project leader educated the team on the importance of symptom recognition to achieve a faster diagnosis, to decrease cardiac muscle compromise. Education encompassed complications and risks associated with acute cardiac syndrome.

Teamwork. The individuals on this team were the nursing staff (including the EKG-triage-RN), registration staff, the patient care technicians, the physician in the ER, interventional cardiologist, and the cardiac catheterization team. Education was implemented to the individuals on the team, including the nursing staff (including the EKG-triage-RN), registration staff, the patient care technicians, and the physician in the ER. The registration staff was educated on what chief symptoms to observe and assess for in ACS patients. The project leader

communicated with the director of the ER and explain the implemented change of utilizing an EKG-triage-RN role in the triage and registration area. The project leader educated the staff on the importance of symptom recognition to achieve a faster diagnosis. These stakeholders were met multiple times throughout the weekly implementation and held biweekly meetings with the administration for the progression of the project.

Study of the Interventions

Assessment of impact. The project facility was interested in implementing this project due to the currently the compliance rate of 37.5% for EKG's performed in 10 minutes or less upon patient arrival to the ER. After the 10-week implementation period, the project goal was to have a compliance rate of 80% or higher and a goal of FMD of 90 minutes or less, which resulted in 72.3% compliance of door-to-EKG and FMD time of 85 minutes.

Evaluation plan and reflection. Data collection was conducted through admission coded symptoms using ICD-10-CM codes and narrowed the selection to patients presenting with ACS symptoms. This project collected quantitative data for 10 weeks before the implementation of the intervention and data collection for 10 weeks after the implementation of the intervention and then compare it to determine the validity of the intervention. The implementation was then measured by time is based on when the patient checked into registration and time of when they received their first EKG. The two tracked times collected within the ER are the time of patient arrival to the ER and the initiated EKG time. The difference between these two tracked times is what derived the door-to-EKG time. The next tracked time was when the patient was activated to the CCL to FMD time. The last data collection will be from the overall time from arrival to FMD in the CCL. The areas of error were incorrect data input from military and standard time, inaccurate data entry, and failed initial EKG's input.

Impact of change. This project's facility stakeholders were pleased with the results of the interventions after the 10 weeks. The administration opted to continue the use of the EKG-triage-RN role in the triage and registration area to comply with the AHA ACTION- GWTG national goal and standard mark for the initial acquisition of an EKG on the arrival of 10 minutes or less and FMD time of 90 minutes or less (AHA, 2016).

Observed outcomes related to the intervention. The observed outcomes related to the interventions included change in the flow of patient registration and admission to the ER. It was involving the implementation of a cardiac triage with an EKG-triage-RN. This project leader observed a gradual decline in door-to-EKG times over the 10 weeks of implementation. Bi-weekly meetings with administration and ER physicians were held evaluating compliance and evaluating the effectiveness of the EKG-triage-RN. Quality data collections were conducted each week, comparing the declining time trends. Overall, this DNP leader determined the observed outcomes positively affected the facility with the implementation of the EKG-triage-RN intervention.

Evaluative measures. The evaluative criteria for this project were evaluating each data input involving the time initiated of an EKG, time input within the medical record system, and time of activation of the CCL. If times were greater than 10 mins from door-to-EKG, the chart was reviewed for time entry errors and possible treatment delay factors. If there was an error with input, it was documented with error rationale.

Measures

Project design and data measures. This project followed the design of a pretest posttest test, identifying the critical gap in practice, determined the outcome and goals, identifying the variables within the project and collected quantitative data for 10 weeks before the

implementation of the intervention and data collection for 10 weeks after the implementation of the intervention and then compared to determine the validity of the intervention. This project evaluated the interventions after implementation for the effectiveness of time less than 10 minutes for door-to-EKG initiation and to have improved compliance rates regarding how many EKG's are verified by the ER physician and compliance with FMD time of 90 minutes or less. This project also evaluated the compliance of the 30-30-30 rule, which is imposed of 30 minutes or less for EMS to deliver a patient to ER from the field, 30 minutes or less for ER to assess, interpret and diagnose the need for CCL and 30 minutes or less for CCL to activate FMD (AHA, 2016).

This DNP project leader utilized the concept of LEAN six sigma. LEAN involves principles, practices, and methods for designing, improving and managing processes, while Six Sigma aims to make processes more uniform and precise through the application of statistical methods model of the definition of goals, measuring the process to determine performance, analysis of the cause of defects, process improvement through elimination of defects and controlling future process performance (DMAIC) (Ellahham et al., 2015).

Analysis

Data. Data collection included summative case counts obtained from the ER hospital electronic medical record (EMR) system and data admission coded symptoms using ICD-10-CM codes and narrowed the selection to patients presenting with ACS symptoms. This data was collected biweekly for the 10 weeks on the implementation project. This data tracked two timestamps collected within the ER, which were the time of patient arrival to the ER and the initiated EKG time. The difference between these two tracked times derived the door-to-EKG time. The second tracked time was when the patient was activated to the CCL to FMD time. The

last data collection was from the overall time from arrival to FMD in the CCL. After the data was collected, tracked times of patient arrival and EKG times were then compared and contrasted for compliance of benchmark door-to-EKG time of 10 minutes or less. The benchmarking EKG time was based on when the patient checks into registration and time of when they receive their first EKG.

Data collection identified areas of error consistent with time input error from military to standard time lost EKG's, second EKG time input, or unidentified symptoms related to ACS. For this project, a designated cardiac triage area was implemented within the triage/registration department and is designed with the use of an EKG-triage-RN. A flow pattern policy of patient admission was utilized to designate staff roles and expedition of care for the patient's arrival (see Appendix B). Mandatory bi-week meetings with administration and ER physicians were held to evaluate compliance, as well as meeting with staff to assess compliance and effectiveness. For this project, this DNP learner audited biweekly ICD coded patients over a 10-week period, for a total of 453 patients.

This DNP learner researched each patient's time that was greater than 10 minutes, for treatment delays, data input error, or lost EKG. Door-to-EKG mean times and door-to FMD were compared before and after intervention using a 2-sample t-test. The second collection of data will be compared to the prior pre-intervention data.

Ethical Considerations

Human subject protection was protected through the ethical and regulatory responsibilities of the Health Insurance Portability and Accountability Act (HIPPA). Patient name and identifiers were not utilized within this study due to the data collection being limited to timestamp data collection. The Institutional Review Board evaluated this quality improvement

project for the protection and welfare of the human subjects that were evaluated at this facility. The Institutional Review Board evaluated the proposed protocol and gained approval for this project stating the study did not meet federal regulations definition of human subject research. Therefore, IRB review and oversight were not needed.

Results

The main goal of the project was to meet the benchmark standards of that instituted by AHA for a door-to-EKG time of 10 minutes or less and to meet the standards of FMD time of 90 minutes or less. A flow pattern policy of patient admission was utilized to designate staff roles and expedition of care for the patient arrival, which implemented a designated cardiac triage area with an EKG-triage-RN. This role of the EKG-triage-RN will be the first medical staff to assess the patient who presents with chief complaints of ACS symptoms when arriving at the registration area. The previously stated ACS complaints are then evaluated to determine if the patient requires the immediate intervention of an EKG. The EKG-triage-RN will then assist in the performance of an EKG, to ensure the benchmark goal of 10 minutes or less from arrival to the ER. All 15 triage RN's participated in designating one RN each shift to take the EKG-triage-RN role. The EKG-triage-RN appointed was the primary RN for each patient that arrived with ACS symptoms and implemented the flow to expedite the execution of an EKG with the data input correctly into the data system, alerted the ER physician for diagnosis and the activation of the CCL if necessary.

Based on the results of data collection, the recommendation for further research should be focused on the process flow of sensitive time collection and data input. Since the flow process has many avenues to achieve the same outcome, the precedence of priority to input EKG times must be impressed to meet the benchmark standards of the AHA.

Door-to-EKG mean times and door-to FMD were compared before and after intervention using a 2-sample t-test. After 10 weeks of post-implementation period (10/2019-12/2019), data was collected for a total of 453 patients which demonstrated a door-to-EKG time of 13 minutes and a compliance rate of acquiring an EKG in 10 minutes or less of 72.3% and first medical device time for walk-in ER patients of 85 minutes. The data collection and trend were calculated (see chart in Figure 1). Two independent-sample t-tests were conducted to compare pre and post implementation of EKG-triage-RN on door-to-EKG time and FMD time. This implemented project overall was demonstrated significantly positive results (M=13, SD= 1.30); t(142)= +1.31 p = 0.020. Pre-intervention results were compared to post-intervention results, showing a 34.8% improvement in door-to-EKG time with an 11-minute improvement, respectively, in both door-to-EKG and FMD times (see Figure 2). The FMD time demonstrates significant improvement (M=86, SD= 1.30); t(67)= +0.89 p = 0.020.

The project outcomes were not achieved with the anticipated goals of 80% compliance rate and 10 minutes or less for door-to-EKG time. Although the weekly data collection showed a significant reduction in times over the 10-week period. Over time, the outcome of the intervention would have been met based on the trending decline in tracked time. During weeks one and two, there was the highest average of door-to-EKG time of 16.4 minutes, which negatively impacted the trended times for the remainder of the project.

Observed associations between outcomes, interventions, and contextual elements demonstrated a positive impact. Once all staff and stakeholders have trained adequately on the implemented flow, tracked times began to decrease. During the initiation of the intervention, the staff was hesitant to change due to the lack of understanding of the implemented flow plan. Once

the team became understanding and accepting of the intervention, the results began to demonstrate a positive change towards the anticipated outcomes.

There were some unintended consequences throughout the first two weeks on the implementation phase. These consequences were due to staff failing to comply with the newly implemented flow pattern when stakeholders or this project leader were not on site. Although this was addressed and corrected within the weekly meetings with staff. Some data that was missing throughout the project were lost EKG's that were not transmitted or submitted into the ICD coded system. This lost data flagged for the wrong time in the data collection and needed to be backtracked for accurate timing. The critical facilitators to meeting the outcomes included registration staff, triage RN's, administration, and the stakeholders who were significantly involved with the implemented intervention of change. The barrier to meeting the anticipated outcome was the length of the study of 10 weeks. After reviewing the trending data collection, a gradual decline in door-to-EKG time was significant, suggesting that if the project was extended over a longer-term, the outcome might have been met.

The sustainability of this project post-intervention will be with the policy of practice change for patient flow from admission to the ER. The facility has identified the areas of improvement with the implementation of cardiac triage and an EKG-triage-RN. This recommended change and the facility is on target to meet the benchmark standards that are implied from the AHA to maintain compliance due to determining the means of identifying a patient with ACS to expedite their care faster. With a plan of flow in place, the facility will now be able to focus on the minor limitations that may be causing a delay in identification, now that the grand scheme layout has been adopted and implemented.

Discussion

Summary

The key findings associated with this project included the implementation of a designated cardiac triage in the registration area of the ER with the utilization of a cardiac-specific EKG-triage-RN with the direct impact of decreasing the time of ACS recognition with the need for an EKG. The areas that were measured were the time of the patient arrival, acquisition of an EKG, and activation of the CCL if necessary. The flow of patients from admission through the triage area was monitored for specific times. The critical findings that this project encompassed the project rationale and particular aims with the measurement of pre-implementation data to post-implementation conclusions.

Project strengths. The strengths of this project included a more organized flow pattern for specific patients with time-sensitive needs for care. With the implementation of an EKG-triage-RN as a first-line nurse for early ACS symptom recognition within this area, questionable symptoms that were vague and classic symptoms such as chest pain, were able to be identified and evaluated to receive an EKG faster. This role of the EKG-triage-RN was beneficial in expediting the flow of cardiac patients that may require an EKG to determine the plan of care, therefore not only improving door-to-EKG time but FMD as well.

Interpretation

The association between the intervention and the outcomes with this project included the implementation of a designated cardiac triage in the registration area of the ER with the utilization of a cardiac-specific EKG-triage-RN with the direct impact of decreasing the time of ACS recognition with the need for an EKG. Literature has supported these results. Wang, Lin and Wu (2016) stated that failing door-to-EKG times were based on poorly orchestrated triage

assessments, suggesting an integrated approach for a chief-complaint-based EKG process to be implemented by the triage nurse. Sakamoto et al. (2018) studied the chest pain triage (CPT) model, for its effectiveness in improving chest pain protocols for patients in the ER. This study included a total of 797 patients from a hospital in Singapore, and the CPT model was implemented to create the triage model to improve vital signs and EKG parameters. Vital signs and EKG were guided to be performed within the triage area. The implementation of the CPT model resulted in the determinant of triaging patients more accurately than compared to non-CPT tracts. Most of the patients with myocardial infarction were classified as low care priority, showing triage failure either due to symptom variability or need for a professional qualification in clinical data collection and interpretation (Nonnenmacher et al., 2018). While, triage systems in distinguishing acute coronary syndromes (ACS) from diseases of mild severity and patients were sorted into the triage systems based on collected data at admission and a systematic 12-lead ECG performed at triage (Dechamps et al., 2017). Ellahham et al. (2015) utilized methods of six sigma methodology to increase quality improvement to patients suffering from myocardial infarctions. After three months of data collection from September-November 2011, 73% of STEMI patients had door-to-balloon times of less than 90 minutes. Lean six sigma allowed for more efficiency with minimal variables to align with policy priorities to meet door-to-balloon time compliance.

Even though the primary outcome was not achieved, data collected from pre-intervention and post-intervention display a significant improvement. Before the implementation of the cardiac triage area and EKG-triage-RN, door-to-EKG times were more than double the benchmark standards instituted by the AHA. Post-intervention displayed a significant reduction in time, which is parallel to current literature practices. According to the research performed by

Nonnenmacher et al. (2018) a Rapid EKG RN was implemented with the use of the Manchester Triage system was applied to educate triage nurses on symptom recognition for treatment. Results were from 217 patients placed into a high priority zone (29.5%). Their door-to-EKG time was 21 minutes, although not at the benchmark rate but improved from 36 minutes. Research from Prachanukool et al. (2016) displayed that the Rapid EKG RN approach implemented the use of an acute chest pain fast track. This began with the triage nurse in evaluating the patient to determine if they are exhibiting ACS. The data was drawn from 616 patients that went through as walk-ins in the ER, resulting in 315 (89.5%) receiving an EKG in 10 minutes or less (Prachanukool et Al., 2016). This DNP learner's findings were similar to these studies.

Impact on people and systems. The desired state for this door-to-EKG project was to have EKG's obtained in 10 minutes or less from the time the patient arrives in the ER within three months after implementing interventions. For this desired state of a less than 10-minute initiation of an EKG to be achieved and door-to-FMD to be less than 90 minutes, the flow of registration needs the modified and improved changes to maximize efficiency in the process of recognizing early ACS symptoms and intervening effectively to prevent complications. This DNP learner anticipated a decreased door-to-EKG time and FMD time. The impact of the change of an EKG-triage-RN as a first-line nurse for early ACS symptom recognition within this area was able to question symptoms that are vague and classic symptoms such as chest pain, to identify the need for an EKG and for care to be expedited faster. With the recognition of improvement on time, stakeholders and administration want to implement this project's quality improvement plan to maintain on target for benchmark standards of the AHA.

The variation between anticipated and observed outcomes. Anticipated findings from data collection are that pre-intervention data will show an increased door-to-EKG time of greater

than 10 minutes, and post-intervention data will show an improvement in time with the goal of 10 minutes or less. The primary difference between these outcomes is that the anticipated goal was not met, although the observed outcomes demonstrated a significant decrease in time and improvement due to the staff and stakeholder's role in implementing the ER flow change.

Costs. Since the role of the triage nurse has already been established within the daily assignments, there were no additional costs involved with the realignment of this project.

Limitations

The limitations in this project included were poor recognition from registration staff of the stated symptoms from patients walking into the ER therefore not allowing the EKG-triage-RN to recognize the need for an EKG. Other limitations were when the chief complaint from the patient was vague from ACS symptom recognition and when administration was not present during the off shift, the EKG-triage-RN role was not implemented. Efforts were implemented to minimize limitations by meeting with staff numerous times throughout the week and on various shifts and bi-weekly meetings with administration and stakeholders to evaluate compliance and effectiveness. Despite the limitations listed, the implemented intervention demonstrated a positive impact on decreased door-to-EKG and FMD times.

Limited internal validity may have been present with the different RN’s on each shift interpreting differences between ACS stated symptoms from the patient. The interpretation of EKG findings with the ER physician and what the patient presented with. Efforts to minimize this included collaboration of the stakeholders with emphasis on education of identifying symptoms.

Conclusions

This project has demonstrated the ability to implement a positive change for identifying patients with ACS symptoms that walk into the ER. This project focused on achieving a designated cardiac triage area, with the use of an EKG-triage-RN for earlier recognition and identification of symptoms to expedite treatment. After 10 weeks of implementation, data demonstrated a significant improvement in decreasing more than half the pre-implementation time in door-to-EKG times and FMD. This change in flow is sustainable and will be permanently implemented within this project's facility. This project can be extended into other time-sensitive areas in need of benchmarked standards. For example, this project's facility will be implementing the same concept flow plan for patients arriving with stroke-like symptoms for early recognition and treatment.

Future study and recommended next steps. Areas that are time-sensitive for treatment, this practice change can be tapered to the specific need and implemented for time improvements. With these particular implemented flow plans, early symptom recognition will increase, and compliance with benchmarking standards can be met. Overall improving the quality of care provided, as well as potentially enhancing the future quality of life for the patient.

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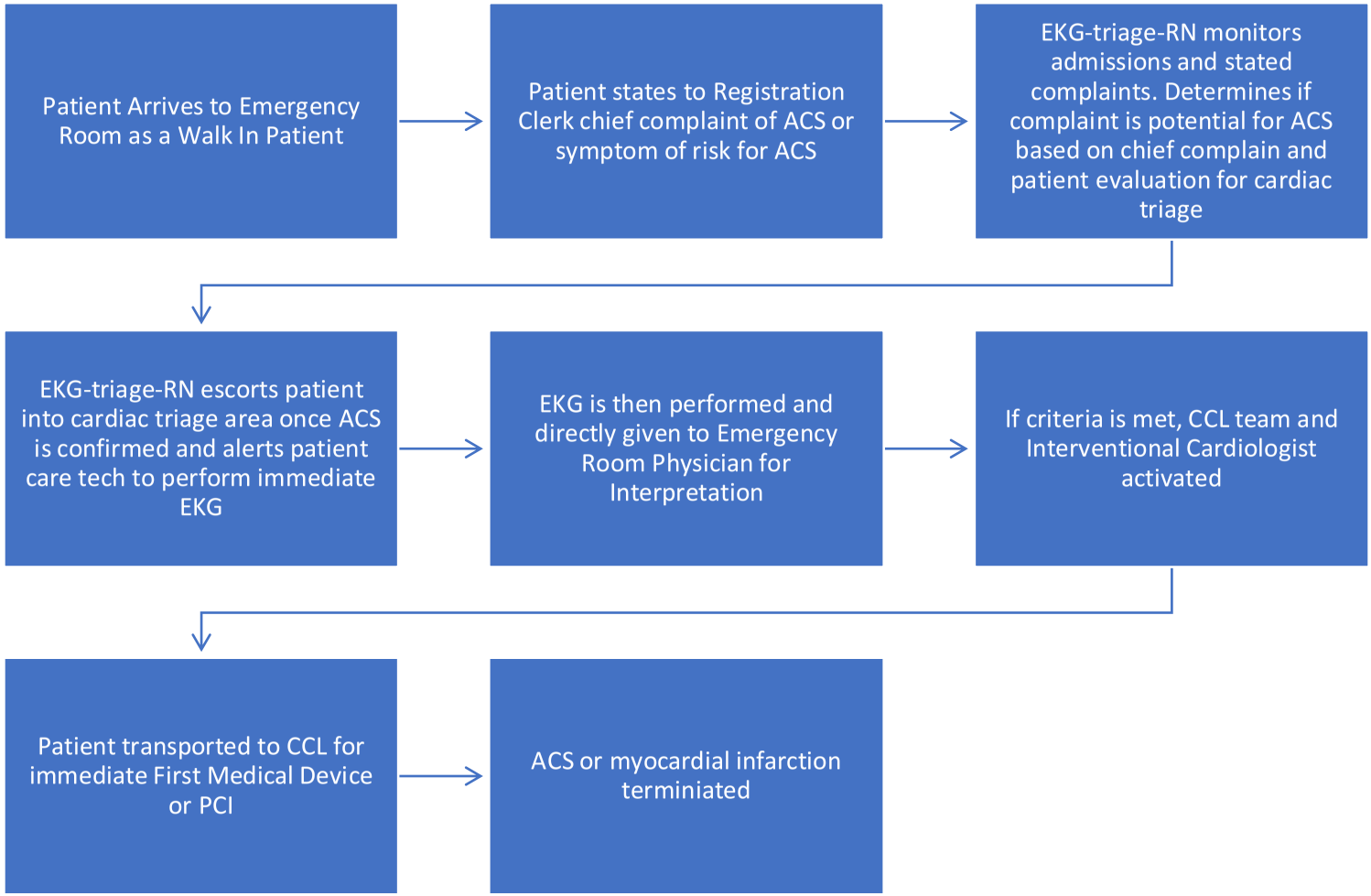
Appendix A

Intervention operational logistics: Concept Map



Appendix B

WALK IN ACS/STEMI FLOWSHEET

Patient Walk In to Registration with ACS/STEMI Symptoms

Chest Pain or Tightness
Pain Radiating from the Chest to the Shoulders, Arms, Upper Abdomen, Back, Neck or Jaw Chest Pain with Nausea or Vomiting, Indigestion
Shortness of Breath
Dizziness

→

If patient POSITIVE for Symptoms:

Registration Alerts

Cardiac Triage RN on Vocera

Cardiac Triage RN assesses Patient at Registration Window

→

Cardiac Triage RN

12 Lead EKG Performed

GOAL:

Door-to-EKG

10 minutes or less

↓

EKG delivered to ER MD for Interpretation

Cardiac Triage RN or Designated Staff Documents

EKG Performance Time

and Read Time.

→

ER MD Determines ACS/STEMI

IF Yes:

ER IA Alerts CCL

If Positive ACS/STEMI:
Cardiac Triage RN transports to Main side ER bed.

↓

Interventional Cardiologist arrives

Pt transported to CCL

Hand off Report to CCL RN

Figure 1

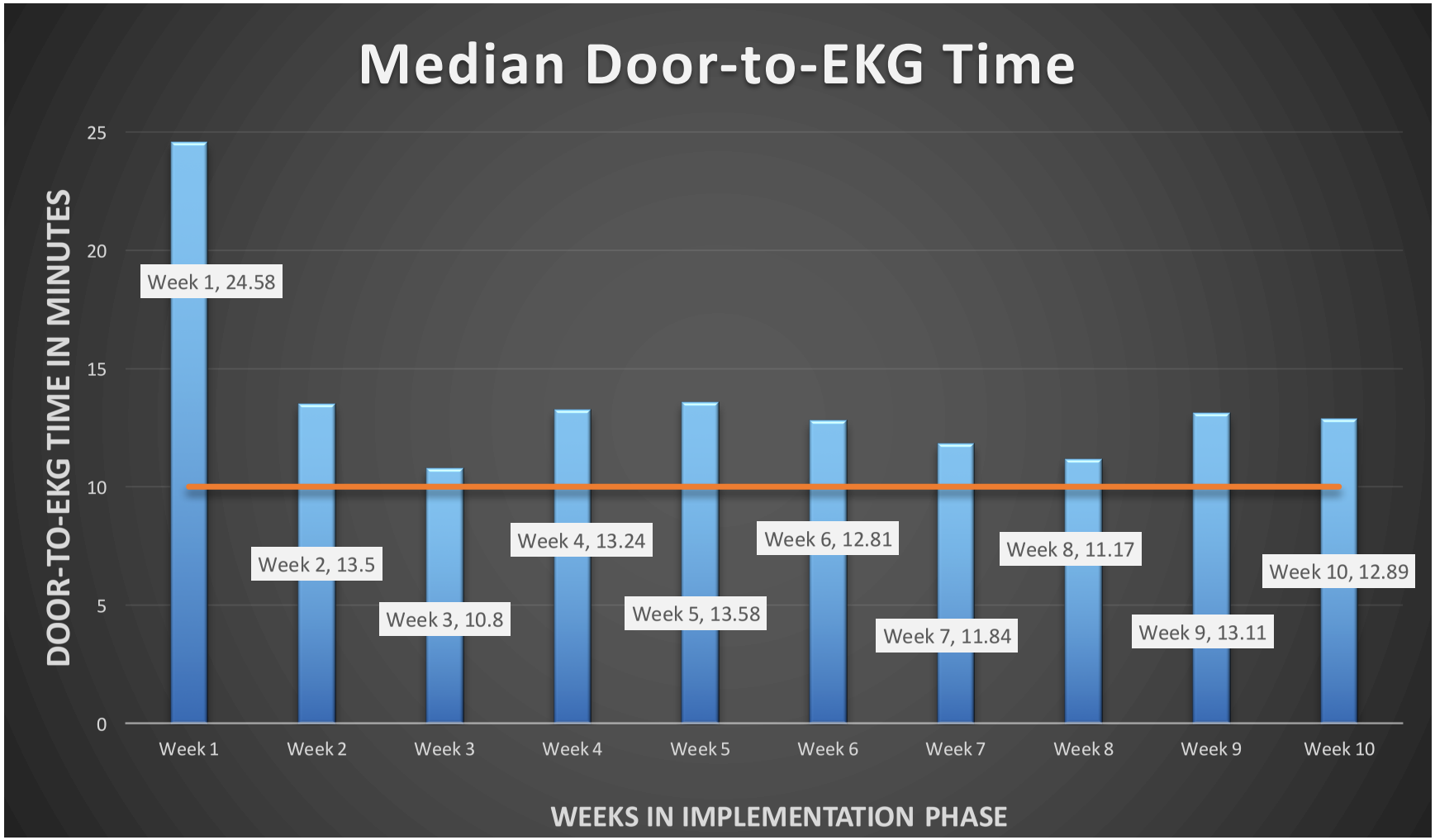
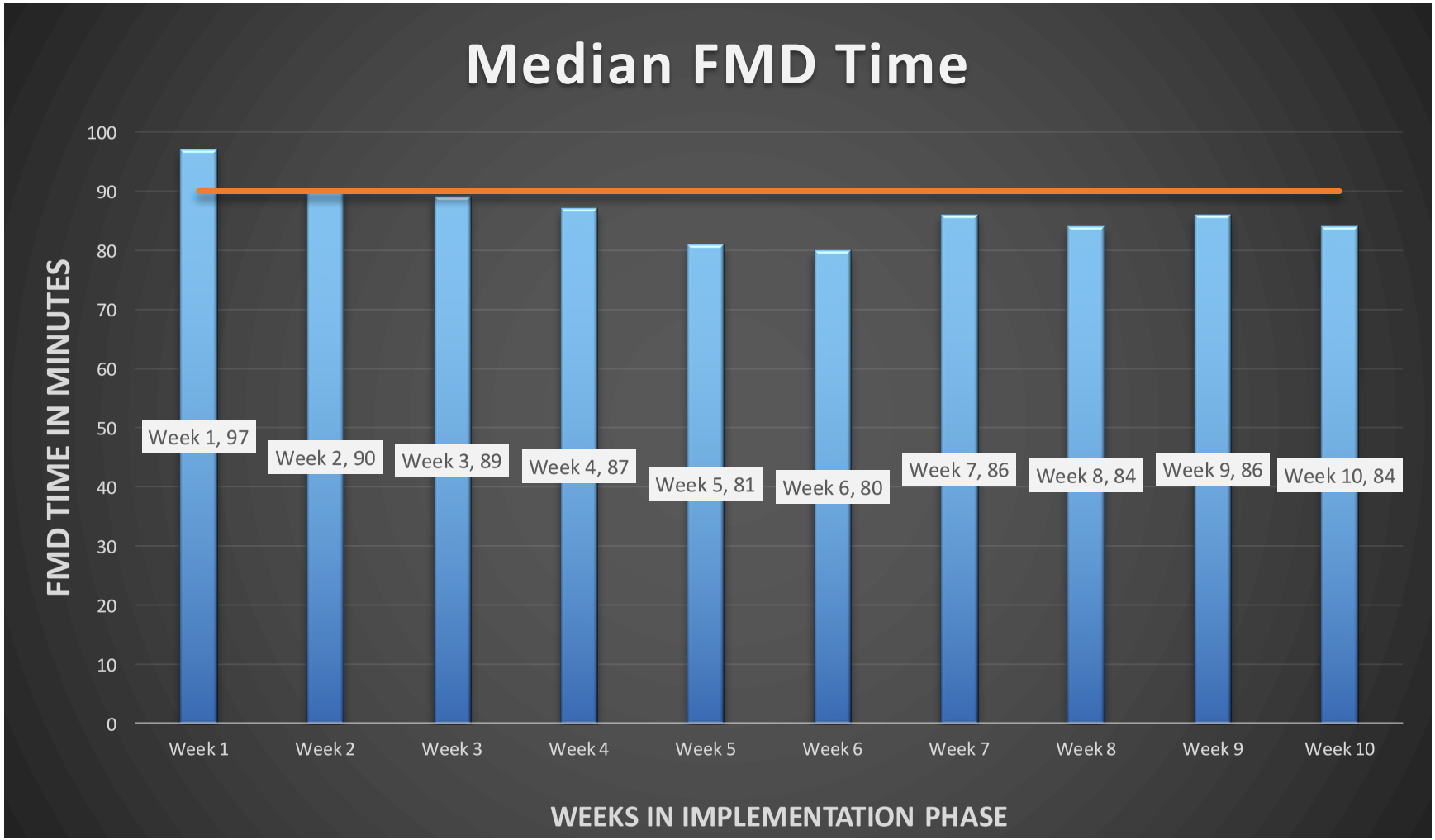

Median Door-to-EKG Time
DOOR-TO-EKG TIME IN MINUTES
25
20
15
10
5
0
Week 1, 24.58
Week 2, 13.5
Week 3, 10.8
Week 4, 13.24
Week 5, 13.58
Week 6, 12.81
Week 7, 11.84
Week 8, 11.17
Week 9, 13.11
Week 10, 12.89
Week 1
Week 2
Week 3
Week 4
Week 5
Week 6
Week 7
Week 8
Week 9
Week 10
WEEKS IN IMPLEMENTATION PHASE

Figure 2


Median FMD Time
FMD TIME IN MINUTES
100
90
80
70
60
50
40
30
20
10
0
Week 1, 97
Week 2, 90
Week 3, 89
Week 4, 87
Week 5, 81
Week 6, 80
Week 7, 86
Week 8, 84
Week 9, 86
Week 10, 84
Week 1
Week 2
Week 3
Week 4
Week 5
Week 6
Week 7
Week 8
Week 9
Week 10
WEEKS IN IMPLEMENTATION PHASE