Implementation of Accelerated Troponin Testing in the Emergency Department for Chest Pain

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Table of Contents

Abstract

Chest pain is one of the leading complaints for patients in the emergency department (ED) that requires a thorough evaluation. This often results in extended lengths of stay, excessive use of unnecessary resources, and over crowding in the ED. The implementation of an accelerated diagnostic protocol, such as the HEART pathway, with the use of accelerated troponin testing will help to address these issues. Adult patients with chest pain HEART scores were calculated for adults with chest pain and a low risk score between 0-3 determined their eligibility to participate in this project. Two sets of serial troponins were tested with 3 hours between each test. A negative trend in troponins made patients eligible for early discharge. Patients were contacted 30 days from discharge to assess for any risks of major adverse cardiac events (MACE). The results of enrolled patients were entered into a spreadsheet, which was analyzed using the Statistical Package for the Social Science (SPSS), version 23.0. Results of the project will contribute to economic and cost benefits by decreasing the unnecessary use of resources, and by improving wait times in the ED through a decreased length of stay. It will also impact healthcare quality by providing a rapid, safe, and effective tool in the evaluation of patients with chest pain.

Keywords: accelerated troponin, chest pain, HEART pathway, emergency department

Introduction

The implementation of an accelerated diagnostic protocol with the introduction of accelerated troponin testing as part of the treatment plan for patients presenting to the emergency department (ED) with complaints of chest pain is the objective of this project. The focus of this project is to establish a protocol that will aid physicians in improving emergency department (ED) throughput by identifying patients who are at low-risk for adverse cardiovascular events and are suitable for early discharge, as well as identifying patients who are at high-risk and provide an early disposition for placement on observation status, or inpatient admission into the hospital for further testing and monitoring. Currently, contemporary protocols are used that require troponins to be drawn at time of presentation to the ED, repeated at six hours after presentation, and then again at twelve hours after presentation. The contemporary protocol requires longer lengths of stay for patients, which further results in ED overcrowding and unnecessary use of resources for patients who are at low risk. The implementation of an accelerated troponin testing protocol, with troponins drawn at the time of presentation to the emergency department and then three hours after, accompanied by the assessment of electrocardiograms (ECGs) and clinical judgment using tools such as the Heart Score or Thrombolysis Myocardial Infarct Score (TIMI) may result in less ED overcrowding, reduced use of resources, and improved patient safety and outcomes. The accelerated protocol that is chosen to implement this project is the HEART Pathway (Appendix D).

The HEART Pathway was implemented to differentiate patients who are at low risk of ACS and patients who are at high risk for ACS. Based on the result, they were identified as suitable for early discharge, placed in observation status, or admitted to inpatient status for further treatment. Accelerated serial troponin testing was performed on patients who were

identified as low risk. Patients were followed and contacted to monitor their 30-day risk of major adverse cardiac events (MACE). The project results explained the rationale and benefits for implementing this protocol in the ED.

Background and Significance

Patients present to the emergency department with a wide variety of complaints and symptoms. One of the most frequent presenting symptoms is chest pain (Cervellin, Mattiuzzi, Bovo, & Lippi, 2016). More than 5.5 million people present to emergency departments yearly, and only 13% receive an actual diagnosis of acute coronary syndrome (ACS) (Greenslade et al., 2017). When patients receive a diagnosis of ACS, further testing and/or intervention is needed. Over $10 billion is spent on evaluating patients with chest pain in the US, which yields to only 10% of a diagnosis of ACS (Mahler et al., 2016). Because of the financial burden that has risen from the unnecessary use of resources, the need for differentiating patients at high risk who require further testing and treatment from those at low risk who do not require further testing and treatment is a significant concern.

Diagnostic tests are performed to identify patients who require further testing from those who do not with complaints of chest pain with a risk of ACS. One of the tests performed is the use of troponin assays. Troponins are proteins that are released from cardiac tissue in response to myocardial ischemia or necrosis (Fox & Diercks, 2016). The presence of troponins in the bloodstream warrant close attention and decisions are necessary to determine if the patients will require more aggressive interventions in order to prevent further damage to the heart (p. 2). Troponin measurements become elevated after an ischemic event and remain elevated for 4-9 hours after myocardial injury, peaking in 12-24 hours. Because troponin elevation is not seen until 4-9 hours after myocardial injury, it is important to know the time of onset of symptoms.

Some patients present to the ED immediately after symptom onset and practitioners test troponins upon arrival. This early presentation to the ED often results in a negative initial troponin. As a result, many practitioners will place patients in an observation status for repeat testing of troponin assays, especially those patients who do not have any ECG changes, such as ST-segment elevation and have a negative initial troponin (p. 2). Because of the expected timing of troponin elevations in patients presenting with a suspected myocardial infarction (MI), repeated testing results in longer hospital stays, requiring patients to be admitted to inpatient status or placed on observation, which results in ED overcrowding, delayed disposition, and the unnecessary use of resources, especially for patients who are identified as low risk.

Distinguishing between patients who are at low risk and high risk is important to the ED because it may reduce overcrowding, reduce unnecessary use of resources by patients who are at low risk, and provide a rapid diagnosis for patients who are at high risk who require inpatient admission or ED observation for further testing and treatment.

Needs Assessment

Management of patients who present with chest pain to the ED is a topic that is constantly being assessed. This is partially because chest pain is one of the most frequent symptoms that patients present to the ED and the causes of chest pain range from being harmless to life-threatening (Cervellin, Mattiuzzi, Bovo, & Lippi, 2016). Consequently, the wide spectrum of possible causes of chest pain has resulted in over testing in many patients, which has contributed to the over expenditure of resources in the US healthcare system. This is a prevalent issue in most EDs. According to the Community Health Needs Survey (CHNS) of 2016, one of the top key health issues for the community [redacted] serves is heart disease. This contributes to

the large number of ED visits related to cardiac complaints ("Community Needs Assessment," 2016).

[redacted] has the longest ED wait times among all of the six [redacted] County Hospitals. The ED wait time is reported to be four hours and twenty-seven minutes, which is twice as long as the other [redacted] County hospital EDs ("ER Wait Times in [redacted] County Hospitals," 2014). Patients requiring serial troponins in the ED contribute to this wait time because patients are occupying treatment rooms in the ED, preventing evaluation of waiting ED patients because of the lack of bed availability. One way to resolve this problem is with the implementation of accelerated troponin testing because patients can be reevaluated in 2-4 hours compared to the contemporary 12-24 hours. Between April 2016 and April 2017, the average time patients spent in [redacted] ED before being admitted to the hospital is approximately 30% longer (208 minutes) than the New Jersey average (143 minutes) and approximately 50% greater than the national average (97 minutes). Consequently, [redacted]'s percentage of patients who leave the ED without being seen by a doctor (4%) is 50% greater than the state (2%) and national average (2%) ("ER Wait Watcher," n.d.).

Problem Statement

The large number of ED presentations for chest pain results in over crowding, excess use of unnecessary resources for patients at low risk of ACS, and a delay in diagnosis for patients at high risk who require immediate or high intervention. This can be prevented with the use of an accelerated diagnostic protocol that consists of accelerated troponin testing.

Clinical Question

In adult patients 18-75 years of age presenting to the [redacted] Emergency Department with complaints of chest pain, would the use of an accelerated diagnostic

protocol that consists of accelerated troponin assays compared to the contemporary protocol, improve ED throughput by better and quickly identifying those at low risk who are suitable for early discharge and those at high risk who require further treatment and testing?

Aims and Objectives

The aim of this project was to evaluate the effectiveness of an accelerated diagnostic protocol consisting of the use of accelerated troponin assays in the management of ED patients presenting with chest pain.

The objective of this project was to:

1. Decrease length of stay for ED patients who present with a complaint of chest pain
2. Decrease overcrowding in the ED
3. Identify patients who are at low risk of ACS and can be safely discharged

Review of Literature

In searching for literature to support this project, the database at Rutgers University library was used. Key words in the "Quicksearch" "accelerated troponin" and "chest pain in the emergency department" were used. Furthermore, access to databases such as CINAHL, PubMed, and EBSCO was used to search for supporting resources using the same keywords. Multiple articles were derived from the Annals of Emergency Medicine and the Journal of the American College of Cardiology. The table of evidence (Appendix A) includes the key points of the supporting articles for this project.

A clinical practice guideline on evaluation of ED patients with chest pain was developed by Hollander, Than, & Mueller (2016). These guidelines allow ED providers to evaluate high

and low risk patients and improve throughput in the ED. One of the limitations of this study was related to inaccurate analysis of ECGs.

Fox & Diercks (2016) conducted a literature review regarding assay use in the emergency department for management of patients with potential acute coronary syndrome: current use and future directions. The study results concluded that with appropriate risk-stratification, troponin at 0 and 2 hours resulted in a decreased disposition time without MACE.

A prospective cohort, quasi-experimental study was done by Mahler, Burke, Duncan, Case, Herrington, et al (2016) regarding the use of the HEART Pathway Accelerated Diagnostic Protocol Implementation used a prospective pre-post interrupted times series design and methods. This study consisted of 10,000 adult patients who were 21 years of age or older with a complaint of acute chest pain. The result of this study concluded that the HEART Pathway caused a 21% decrease in hospitalization rate and a decreased length of stay with a reduction of 12 hours.

A randomized parallel-group trial was conducted by Than, Aldous, Lord, Goodacre, Frampton, Troughton, et al (2014) using a randomized parallel-group trial. A 2-hour diagnostic protocol for chest pain in the ED was used. A significant trend that was identified was that multiple studies currently exist and have used accelerated diagnostic protocols with the use of accelerated troponin assays to evaluate patients in the ED with chest pain. Some hospitals in the United States have used these protocols and have improved their ED throughput. Topics such as risk of major adverse cardiac events (MACE), suitability for early discharge, and accelerated diagnostic pathways were discussed.

Early Discharge

Research studies have described how the use of an accelerated diagnostic protocol have been effective in identifying patients who are at low risk and suitable for early discharge. This is an effective way to improve ED throughput. Misinterpretation of ECG can hinder the diagnosis of AMI, with false-positive interpretations in at least 11% to 14% of presumed STEMI cases. High sensitivity troponin (hs-cTn) use has not yet been approved for use in the United States.

In a study by Than et al. (2016), 558 adult patients with chest pain were evaluated using accelerated diagnostic pathways. 279 of the participants were evaluated using a 2-hour accelerated diagnostic pathway consisting of Thrombolysis in Myocardial Infarction score (TIMI) and troponin measurements. The other 279 patients were evaluated using the Emergency Department Assessment of Chest Pain Score (EDACS-ADP) and 2-hour troponin measurements. No difference was noted with the use of either pathway. The implementation of these pathways in this study resulted in an increased rate of early discharges.

A second study by Than et al. (2014) was performed in an academic and tertiary hospital emergency department. This randomized parallel-group trial used an accelerated diagnostic protocol consisting of a TIMI score, ECG, and a 0- and 2-hour troponin test. The outcome of this study was to discharge patients within 6 hours of ED presentation without a risk of major adverse cardiac events occurring within 30 days post discharge. 52 of 270 patients were in the experimental group and discharged within 6 hours. 30 of 270 patients were in the control group and discharged within 20 hours. 35 patients were added to the experimental group and were admitted within 6 hours. The results of the study showed that use of the accelerated diagnostic protocol identified almost double the amount of patients who were discharged early. Physicians were able to discharge 1 out of 5 patients with chest pain within 6 hours.

HEART Pathway

The implementation of an accelerated diagnostic protocol when evaluating patients in the ED who complain of chest pain has shown to be effective in improving ED throughput throughout multiple hospitals. One of the accelerated diagnostic protocols that has been implemented in studies is the HEART Pathway (Appendix D).

In a study by Mahler et al. (2016), the use of an accelerated diagnostic protocol in Wake Forest Baptist Medical Center in North Carolina was observed. Participants that were recruited were adults greater than 21-years old who presented to the ED with symptoms of ACS. The HEART pathway used the HEART score (Appendix E) was helped to risk-stratify patients. The HEART pathway consists of history, ECG, age, risk factors, and troponin. With application of the HEART pathway, 141 patients with symptoms of possible ACS were enrolled and randomized. Patients of low risk were identified to be suitable for early discharge. Follow up was then provided at 30 days to assess for possible major adverse cardiac events (MACE). With all patients that were suitable for early discharge, non suffered from MACE.

In another study by Mahler et al. (2016), the HEART pathway was used to evaluate adult patients with acute chest pain and without ST-segment elevation myocardial infarction on ECG. At Wake Forest Baptist Health ED, the HEART pathway could have identified 879 of 1070 patients that were in the observation unit for early discharge without further testing. A multicenter cohort was performed in 18 US EDs with the HEART pathway identifying 218 of 220 patients with ACS (95% CI, 99% sensitivity) and 200 of 991 patients suitable for early discharge (95% CI, 99% sensitivity). This study concluded that the HEART pathway is able to safely reduce the use of healthcare resources.

Low Risk of MACE

In a prospective cohort study by Kelly & Klim (2014), the implementation of a 2 hour accelerated protocol was assessed for its use in patients with atraumatic chest pain who were suspicious of ACS but had no clear evidence of myocardial injury (MI) on the presenting ECGs. The TIMI score (Appendix F), ECG, and troponin I assays were used. Troponin I assays were measured at presentation time to the ED and again 2 hours after. 840 adult patients of an ED of a community teaching hospital who presented with chest pain were studied. Of the 842 that were included in the study, 72 had a diagnosis of ACS and the remaining fit the criteria for lower acuity disposition. In this lower acuity group, 2 hour troponins were performed. At the 30 day follow up, none of the lower acuity patients suffered MI or MACE.

Another study by Than et al. (2012) argues that a 2-hour accelerated diagnostic protocol for use in patients with chest pain can successfully identify patients who are at low short-term risk for MACE and are suitable for early discharge. Of 1,975 patients who participated in a prospective observational study, 392 patients were identified as low risk of MACE by the protocol. Only one of these low risk patients suffered from MACE and resulted in a 95% CI and 99.7% sensitivity for this study.

Theoretical Framework

The theoretical framework that guided this project was the Knowledge-To-Action (KTA) Framework (Appendix B). The two components that make up this framework are knowledge creation and the action cycle. The knowledge creation component has three sub components, which are knowledge inquiry, knowledge synthesis, and creation of knowledge tools and products. With knowledge inquiry, the research studies are discussed. In knowledge synthesis, the results of the research studies are synthesized and interpreted. In creation of knowledge, tools, guidelines, and aides are produced to meet needs. The second component of the KTA

framework is the action cycle. This consists of activities that are already known about a specific problem and identifies if there is a gap or need for change (World Health Organization, 2018). The KTA framework is beneficial to this project because the project consists of the knowledge obtained from already existing research and studies. Knowledge from studies that have been performed on patients that present to the ED with acute chest pain where accelerated diagnostic protocols were used in their evaluation provide a guide and support to show that implementation of such a protocol is effective and helps meet the objectives identified above. The knowledge creation cycle of the framework is of benefit. The use of accelerated diagnostic protocols in past studies enabled the researcher for this project to use their knowledge and apply it to the ED at JCMC. This is where the action cycle of the framework is used. It also assists in identifying where a problem exists and enables previous knowledge to influence an identified problem and promotes generation and translation of new knowledge.

Methodology

The study consisted of a pilot study with a quantitative approach. The subjects were adult patients who presented to the ED with a complaint of chest pain. The implementation of an accelerated troponin protocol among these individuals was compared to those who are evaluated using the contemporary protocol.

Setting

The study took place in the [redacted] ED. This is an urban acute care hospital in [redacted] County, with 18,000 in-patient admissions and over 80,000 ED visits each year ("Quality Care," n.d.).

[redacted] is a 300 bed community hospital. It is a level II trauma ED with approximately 60 treatment areas. A HEART score assessment was calculated for all patients with a presenting

complaint of chest pain to determine their risk of MACE. The accelerated troponin project was explained to eligible patients and consent was obtained.

Study Population

The subjects included adult patients between the ages of 18 to 75, who presented to the ED with a complaint of acute chest pain. The study population consisted of low risk and high risk patients as identified by the HEART score. Patients who presented with ST segment elevation on their ECG were excluded as they will need immediate intervention. Any adult patient who was brought into the ED with chest pain and required a health care proxy to make decisions for them, because of mental incapacity were also excluded. Non-English speaking patients and patients who are not able to read and write in English, were also excluded from the study because the PI is not a certified translator and does not possess the certified translator credentials that is required by the Institutional Review Board (IRB) when seeking participants for research.

Study Interventions

Interventions for the study consisted of the use of the HEART Pathway to help distinguish between low risk patients and high risk patients. The accelerated protocol was applied to eligible and willing participants who were identified as low risk. The patients who were identified as low risk had serial troponin testing performed using an accelerated protocol with the second troponin drawn 3 hours after the first troponin was resulted. After being determined to be eligible for early discharge, patients were approached again by the researcher to confirm their contact information, and to thank them for their participation. During this period, participants were reminded that the researcher will be contacting them in 30-days for their

follow-up. An e-mail was sent to the providers to give them a brief explanation of the protocol that was going to be implemented for the period of time that the study was held.

Outcome Measure

The HEART score was used to collect data and determine each participant's risk factor. A data collection tool was used to collect data regarding HEART score, time of admission, time of discharge, troponin levels, and further return to the hospital for cardiac events.

The researcher accessed the participant's electronic medical record through the use of Cerner. Access to each chart was obtained only in the hospital setting during the study. Access to Cerner database is password protected and encrypted for each individual use only. Access to each chart consisted of reviewing time of admission, time of discharge, calculating HEART score, and viewing troponin results. The HEART score and troponin levels were used in the HEART pathway to help identify patients who were suitable for early discharge.

The participants who were identified as low risk and suitable for early discharge received a 30-day follow up via telephone call by the researcher to inquire about any major cardiac events since their discharge. Participants who were identified as low risk and suitable for early discharge were patients that have a HEART score of 0-3 and were included in the study if they consented. Patients of intermediate risk that require cardiology consult and admission had a moderate risk heart score of 4-6, and those who required early intervention with invasive testing had a high risk score of 7-10.

Benefits/Risks

The study did not pose any significant physical, psychological, emotional, social, or economic risks or harms. Patient privacy, respect, and confidentiality were maintained

consistently. There is scientific evidence to support the use of accelerated diagnostic protocols as a clinical decision tool for patients with chest pain (Than et al., 2014).

The benefits of the study can contribute to future research studies to develop new guidelines for the use of troponin levels for patients with chest pain. The accelerated protocol can aid in a more rapid decision-making process, decrease the length of stay for patients in the hospitals, and decrease the use of unnecessary resources to provide quality patient care.

Subject Recruitment

Participants were recruited during their ED visit. The researcher approached adult patients with a chief complaint of chest pain and explained the project to them. Those who were willing to participate in the study were given the consent to participate. The researcher then collected the completed consents and accessed patient charts to retrieve pertinent data for the project.

Consent Procedure

Participant personal information was collected such as name and telephone number that was required in order to contact them for their 30-day follow up. The participant information used for this study was kept confidential, and will continued to be maintained and only accessible to the researcher. Each participant was given a summary of the project and the goals and objectives and consent. This informed consent was provided to each adult patient that arrived to the emergency department with a complaint of chest pain (Appendix F).

Subject Costs and Compensation

There were no additional costs that subjects incurred for participating in the project. There was no compensation provided for participation. There were no additional costs for the hospital for the implementation of the accelerated protocol.

Project Timeline

The timeline for the planning of this study was approximately 12 months. The timeline for the implementation and evaluation of this project was be approximately 1.5 months (Appendix H).

Resources Needed/Economic Considerations

No additional costs were incurred in this project other than current costs for the standard protocol of evaluation of chest pain patients in the emergency room. The researcher was in the ED to explain the project and its purpose, obtain consent and implement the project. The researcher made the follow-up telephone calls.

Evaluation Plan

Data Maintenance/Security

Data is stored in a USB flash drive and password protected. It will be locked and secured in a compartment in the DNP chair's office at 65 Bergen Street, Newark SSB 1130.

Data Collection Items

In order to effectively organize data that is collected, a separate spreadsheet was used that consisted of the time of admission, time of discharge, HEART score, Troponin results, and if any MACE occurred (Appendix G). The results on the spreadsheet was disseminated into a chosen statistical software to only include information that is pertinent for data analysis.

Data Analysis

The information that was collected and gathered from the collection items was evaluated and analyzed by the researcher. The Statistical Package for Social Sciences (SPSS), version 23.0 was used to analyze the data. Results of the analysis were compiled and assessed to determine the effectiveness of the accelerated protocol.

Findings

This quality improvement pilot study had the purpose of evaluating if the implementation of an accelerated diagnostic protocol for evaluating patients with chest pain in the ED would be safe and effective. The accelerated protocol was implemented in the ED for a period of 3 days, between March 16, 2019 and March 20, 2019, for patients who were identified to be eligible to participate. During the implementation period, 10 patients met eligibility criteria and had a decrease in their length of stay. They were also safely discharged early from the ED as depicted by no MACE at presentation to the ED and at their 30-day follow up. Participants also expressed their pleasure with having a decreased length of stay and also expressed their gratitude for a follow up after their discharge.

Decreased LOS

In order to evaluate for a decreased length of stay, the difference between the time of discharge and time of admission was manually calculated and converted into minutes. The result was the LOS in minutes. It was apparent through the box plot that results were skewed and did not have a normal distribution. To confirm it and check for normality, a Schapiro Wilkes test was performed, which showed that results were positive skewed. This is also evident when viewing the histogram. Results were further analyzed using descriptive statistics to measure central tendency. The average LOS with the implementation of the HEART pathway was 324 minutes (5 hours, 40 minutes), the median LOS was 302 minutes (approximately 5 hours), minimum LOS was 230 minutes (4 hours, 23 minutes), and maximum LOS was 493 minutes (8 hours and 22 minutes) (Appendix L). None of the participants were at the hospital for 18 to 24 hours as they may have been using the current protocol.

MACE

Throughout their stay in the ED, none of the patients experienced MACE and all were determined to be eligible to be discharged early. All participants had two negative troponins with a value of <0.01 respectively. On their 30-day follow up, all participants advised that their chest pain had resolved, had not returned since their discharge, and did not suffer from MACE. 100% of all participants did not suffer from MACE. This also indicates that all participants were safely discharged early. 4 out of 10 participants (40%) advised that they followed up with their primary doctors and had normal evaluations and test results.

Additional Findings

HEART score relationship with LOS

To further assess if there was any correlation between the HEART score and the LOS, a bivariate analysis was performed using a nonparametric test called Spearman's rho (Appendix M). A correlation coefficient between 0.1 and 1 would indicate a correlation between the HEART score and the LOS. However, with a correlation coefficient of .-156 and a p value of .668, results indicate that there is no correlation between the HEART score and the LOS and that results were not statistically significant. To assess if there was any relationship and differences in LOS based on the HEART score, a oneway ANOVA was run (Appendix M). However, with a p value of .507, results were not statistically significant.

Male versus Female

To analyze if there was any difference and relationship between gender and LOS, a oneway ANOVA was run (Appendix N). A p value of .941 showed that the results were not statistically significant. Descriptive statistics were analyzed further. According to the box plot (Appendix N), female participants did show a longer length of stay. However, results did not

follow a normal distribution and results were positively skewed as manifested by histogram (Appendix N).

Study Limitations

The project did have limitations. This project was a single-center study. Due to the time constraint, the study also had a small sample size. These limitations contributed to the inability for the study to be more randomized and generalized. Furthermore, although all participants did report no MACE at their 30-day follow up, which supports the hypothesis of the project, a small sample size does not provide a strong argument. Another limitation in the study is that implementation results were compared to data from the needs assessment. The results may have been stronger if they were compared to actual patient data with the contemporary protocol in real time.

Recommendations and Discussion

Although the results of the project did indicate a shorter length of stay for the participants involved, obtaining a larger sample size would be beneficial to support the hypothesis in future research. Secondly, results of the project supported that the HEART pathway is a protocol that can aid in determining eligibility for safe early discharge by having all participants report no MACE at their 30-day follow up. However, the small sample size does not provide a strong enough argument. Therefore, obtaining a larger sample size in the future would be beneficial.

Future research can also extend the protocol to higher risk patients with higher HEART scores to determine its generalizability. If successful, the protocol can be tested and used in a more randomized clinical control trial and provide a stronger support for the use of the accelerated protocol.

Translation/Dissemination

The results of the project will be shared within the community nurses and university professors and mentors of Rutgers, The State University of New Jersey in Newark on April 26, 2019. It will also be shared at the research council meeting with the professional community at [redacted] in May 2019. A poster was created with a description of the study, the methodology of the study, the steps in the implementation phase, and the results of the data that will be collected. The poster consisted of key elements of current research regarding accelerated diagnostic protocols for chest pain. The poster did not contain the project's results because the project was still being implemented. However, expected outcomes for a decreased LOS and safety of the protocol, and outcome measures were detailed. The poster was presented at Ackerson Hall at Rutgers University in Newark on April 15, 2019.

The economic and cost benefits of this project aimed to decrease the length of stay for patients who presented to the ED with complaints of chest pain, decreased the unnecessary use of resources in the hospital, and improve wait times in the ED. The impact on healthcare quality and safety consisted of a more effective way of evaluating patients in the ED with chest pain. The project can further direct policy makers to implement accelerated protocols that are safe and effective in evaluating patients in the ED with chest pain. The project can direct and encourage further research on more rapid, safe, and effective evaluation tools for chest pain patients who are admitted into the hospital.

Professional Reporting

The results of this project can be disseminated at multiple nursing conferences, as well as medical conferences. The results would be beneficial to be reported at the conferences held by the Emergency Nurses Association, American College of Emergency Physicians Scientific Assembly, or the American College of Physicians. The Center for Medical Education has a

variety of conferences being held throughout this year that will focus on provocative topics in emergency medicine and acute care. Northwest Seminars is also hosting multiple conferences this year that also focuses on various topics in emergency medicine. Disseminating the results of the project through a power point presentation and poster presentation at any of these conferences would be a possible venture.

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Appendix A
Evidence Table

Article #	Author & Date	Evidence Type	Sample, Sample Size, Setting	Study findings that help answer the EBP Question	Limitations	Evidence Level & Quality
1	Hollander, J. E, Than, M., & Mueller, C. (2016).	Clinical Practice Guidelines	Variable patients presenting to the Emergency Department with potential acute coronary syndromes	The improvement in cardiac troponin assays combined with clinical decision algorithms allows physicians to rapidly rule out myocardial infarctions	Misinterpretation of ECG can hinder the diagnosis of AMI, with false-positive interpretations in at least 11% to 14% of presumes STEMI cases. High sensitivity troponin (hs-cTn) use has not yet been approved for use in the United States.	Non-Research Level: IV Grade: High
2	Fox, W. R., & Diercks, D. B. (2016).	Literature Review	Patients presenting to the ED with reports of chest pain	Use of troponin assays along with risk stratification will help to identify those at increased risk for ACS Researchers have determined that a 2 to 3 hours time point for re-measurement of troponin may be appropriate	Release of cTn are not always a result of ACS	Non-Research Level: V Grade: High

				for certain patients Along with appropriate risk-stratification, troponin at 0 and 2 hours led to a decreased disposition time without MACE compared to "standard" serial troponin measurement		
3	Mahler, S. A., Burke, G. L., Duncan, P. W., Case, L. D., Herrington, D. M., Riley, R. F., Wells, B. J., …Miller, C. D. (2016).	Quasi-Experimental Prospective Cohort Study	Approximately 10,000 patients (5000 pre and 5000 post)-intervention of adults≥21 years of age with acute chest pain at Wake Forest Baptist Health (three-hospital academic health system in Piedmont Region of North Carolina)	The HEART Pathway decreased hospitalizations by 21%, decreased hospital length by about a 12 hour reduction	Secular trends and provider maturation effects are potential threats Electronic surveillance may increase loss-to-follow up rates compared with traditional methods of follow-up Randomized clinical trials have a selection bias because of the consent process	Research Level: II Grade: Good
4	Than, M., Aldous, S., Lord, S. J., Goodacre, S., Frampton, C. M. A., Troughton, R., …Richards, A. M. (2014).	Randomized Clinical Trial	542 adult patients, 18 years or older, who presented to Christchurc	17% early discharge rate in the experimental group compared to	Single-center trial Limit generalizability of findings	Research Level: I Grade:

			h Hospital ED with possible cardiac chest pain	5% in control group (95% CI) Significantly more patients were successfully discharged using the experimental pathway (8.3% statistically significant difference) No significant differences in numbers of MACEs in either diagnostic pathway Provides effective use of experimental pathway in real-life setting	Limited sample size Cannot exclude small difference of MACE following early discharge	
5	Cullen, L. A., Mills, N. L., Mahler, S., & Body, R. (2017).	Systematic Review	Adult patients presenting to the ED with reports of chest pain in variable ED settings.	The APACE cohort was prospectively validated demonstratin g early rule out pathway in 1282 patients of myocardial infarction in 63% of patients with a NPV 99.1% High sensitivity troponin I	Some studies recruited low risk patients; findings may not be generalizable to all patients presenting with suspected ACS Some studies used high-sensitivity assay, which may lead to overestimatio	Resear ch Level: I Grade: High

				testing in the APACE cohort demonstrated that troponin at presentation and a change of <2 at 1 hour rules out MI in 56% of patients with a NPV of 99.2% The ASPECT (Asia Pacific Evaluation of Chest Pain Trial studied 3583 patients from 9 countries in Asia, that evaluated ADP to rule out ACS in patients with TIMI of 0, normal troponin I on arrival and 2 hours later. This ADP had a sensitivity of 99.3% and NPV of 99.1% The Randomized Assessment of Treatment using Panel Assay of Cardiac Markers (RATPAC) trial	n of both the sensitivity and negative predictive value of the high-sensitivity assay Relatively few studies address the important subgroups of patients (i.e. those who present early and within 3 hours of onset of symptoms)	

				The ADAPT, ACS (MIDAS) study, APACE cohort, had lower sensitivities with ADP (87.4%, 56%, and 82.7% respectively). But when troponin results were combined with EKG data and clinical decision aids, sensitivities improved to >99% The ADAPT trial identified low risk patients suitable for early discharge and had a 99.7% sensitivity and 99.7% NPV. The HEART Pathway combines HEART score with serial troponin and identified those who were low-risk and eligible for early discharge. This was		

				100% sensitive with an NPV of 100%. The MIDAS cohort validated the HEART Pathway and had a sensitivity of MACE of 99% with an NPV of 99%, and identified 20% of people eligible for early discharge. 39.7% of HEART Pathway group were discharged early compared to 18.4% of those receiving regular care. This reduced the hospital stay by 12 hours. EDACS incorporated 0 and 2 hour troponin results, EKG findings, and classified more than 50% of ED patients to be low risk and had a sensitivity of 99%		

6	Cervellin, G., Mattiuzzi, C., Bovo, C., &Lippi, G. (2016).	Literature Review	Patients who present to the ED with the symptom of chest pain	ECG guidelines conclude that decision making is based on patient history, differential diagnosis, results of troponin testing and serial ECGs. Identify patients of low risk for ACS with which they will more than likely be harmed than to get benefit from further testing. When this algorithm is followed, 60% of patients have been ruled out.	Study covers literature over a short time span (approximately 15 years)	Non-Research Level: V Grade: Good
7	Than, M., Cullen, L., Aldous, S., Parsonage, W. A., Reid, C. M., Greenslade, J.,…Richards, A. M. (2012).	Non-Experimental Prospective observational study	1975 patients from 2 urban EDs in Brisbane, Australia and Christchurch, New Zealand	392 patients were identified as low risk and suitable for rapid discharge. Only one had MACE, which gave the ADP a 99.7% sensitivity (95% CI)	The ADP was restricted only to selected patients with chest pain that suggested ACSs that attending physicians wanted to investigate	Research Level III Grade: Good

					Inclusion of predominantly Caucasian patients Patients with atypical symptoms without chest pain were not included	
8	Greenslade, J. H., Parsonage, W., Than, M., Scott, A., Aldous, S., Pickering, J. W., Hammett, C. J., & Cullen, L. (2015).	Systematic Review with meta-analysis Prospective Observational Study	2396 patients who present to 2 EDs with chest pain that was suggestive of acute coronary syndrome	Identified a clinical decision rule to risk stratify patients who present to the ED with symptoms of possible ACS. Tool applied to patients with normal ECG, normal 0 and 2 hour serial troponin levels, and do not require further testing. Tool can facilitate discharge in approximately one quarter of the ED (31%) Incorporation of this rule can reduce demands on cardiac investigations without	Uses date from an observational study Hypothesis generating and needs further validation (some patients did not undergo objective cardiac testing resulting in possible underreporting of the incidence of ACS) Low rate of ACS in patients involved (larger study needed) Small sample size Patients who presented outside of the hours were not included	Research Level: III Grade: Good

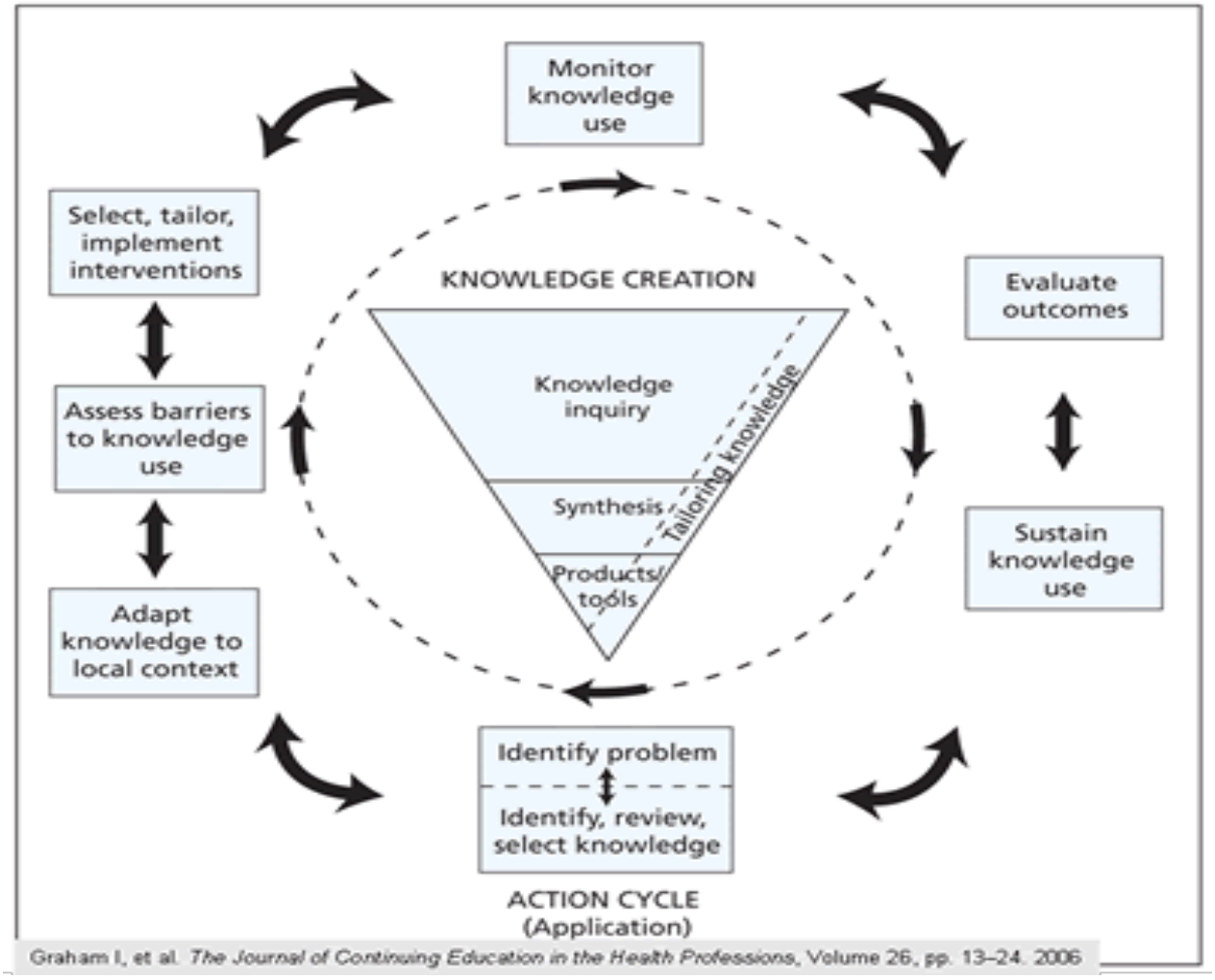
				reduction of safety		
9	Hess, E. P., Brison, R. J., Perry, J. J., Calder, L. A., Thiruganasambandamoorthy, V., Agarwal, D.,…Stiell, I. G. (2011).	Quasi Experimental Prospective Observation Cohort Design	2718 adult patients older than 24 years old from 3 academic EDs in Canada and the United States (The Civic Campus of the Ottawa hospital, The Kingston General Hospital, and Saint Marys hospital)	The clinical prediction rule was 100% sensitive (CI of 95%) and 20.9% specific (CI of 95%) for cardiac events within 30 days. This rule identifies patients who are at very low risk for cardiac events and suitable for early discharge Patients < 50 years old, with atypical chest pain, non ischemic ECG, and 2 negative troponins were at low risk for death, MI, or revascularization within 30 days (sensitivity of 100%, 95% CI, specificity of 29.0%)	One study enrolled only patients with chest pain syndrome. Patients at risk for ACS but without chest pain syndrome were not included, which limits findings to those who have chest pain Investigators interpreted ECGs, not the treating physician All patients did not undergo definitive cardiac testing	Research Level: II Grade: Good
10	Than, M. P., Pickering, J. W., Aldous, S. J., Cullen, L., Frampton, C. M. A., Peacock, F.,…Lord, S. J. (2016).	Systematic review with meta-analysis	558 patients, aged 18 years or older who presented to	There was no difference in the proportion of patients who were	Single-center trial Limit generalizability of findings	Research Level: I Grade:

			the ED with cardiac symptoms suggestive of possible acute MI at Christchurch Hospital	successfully discharged without MACE within 30 between EDACS-ADP and ADAPT-ADP There was no difference in the proportion of patients who were successfully discharged within 6 hours between EDACS-ADP and ADAPT-ADP The absence of adverse cardiac events of patients classified as low risk offers reassurance of the safety of these approaches in the actual patient management setting		High
11	Asher, E., Reuveni, H., Shlomo, N., Gerber, Y., Beigel, R., Narodetski, M.,…Matetzky, S. (2014).	Quasi Experimental	585 adult patients with complaints of chest pain with rule out of ACS (304	Pre-specified and accelerated diagnostic protocol provides better quality of care,	Single-center study Non-randomized design	Research Level: II Grade: Good

			from the chest pain center, 281 from the internal medicine department) at Sheba Medical Center, which is an 1,800 bed tertiary medical center	shorter hospitalization, shorter time to definitive diagnosis, and lower admission rates ADP compared to those receiving routine care had a lower incidence of readmission for chest pain ($p<0.01$) and ACS ($p<0.01$)		
12	Mahler, S. A., Riley, R. F., Russel, G. B., Hiestand, B. C., Hoekstra, J. W., Lefebvre, C. W.,…Miller, C. D. (2016).	Quasi Experimental	282 adult patients 21 years or older, with symptoms suggestive of ACS from Wake Forest Baptist Medical Center	The effect of non adherence to the HEART Pathway resulted in ten additional admissions among patients identified as low risk (CI of 95%) Non adherence decreased discharge rates	Small sample size Single-center study Limit generalizability Incomplete follow-up on four patients may have caused misclassification and underestimation	Research Level: II Grade: High
13	Kelly, A., & Klim, S. (2014)	Quasi Experimental Prospective Cohort Study	840 patients from an ED of a community teaching hospital	2 hour accelerated rule-out process with ECG, TIMI score of 0, and contemporary troponin assay	Single-centre study Not generalizable to other sites Sample size less than planned	Research Level: II Grade: Good

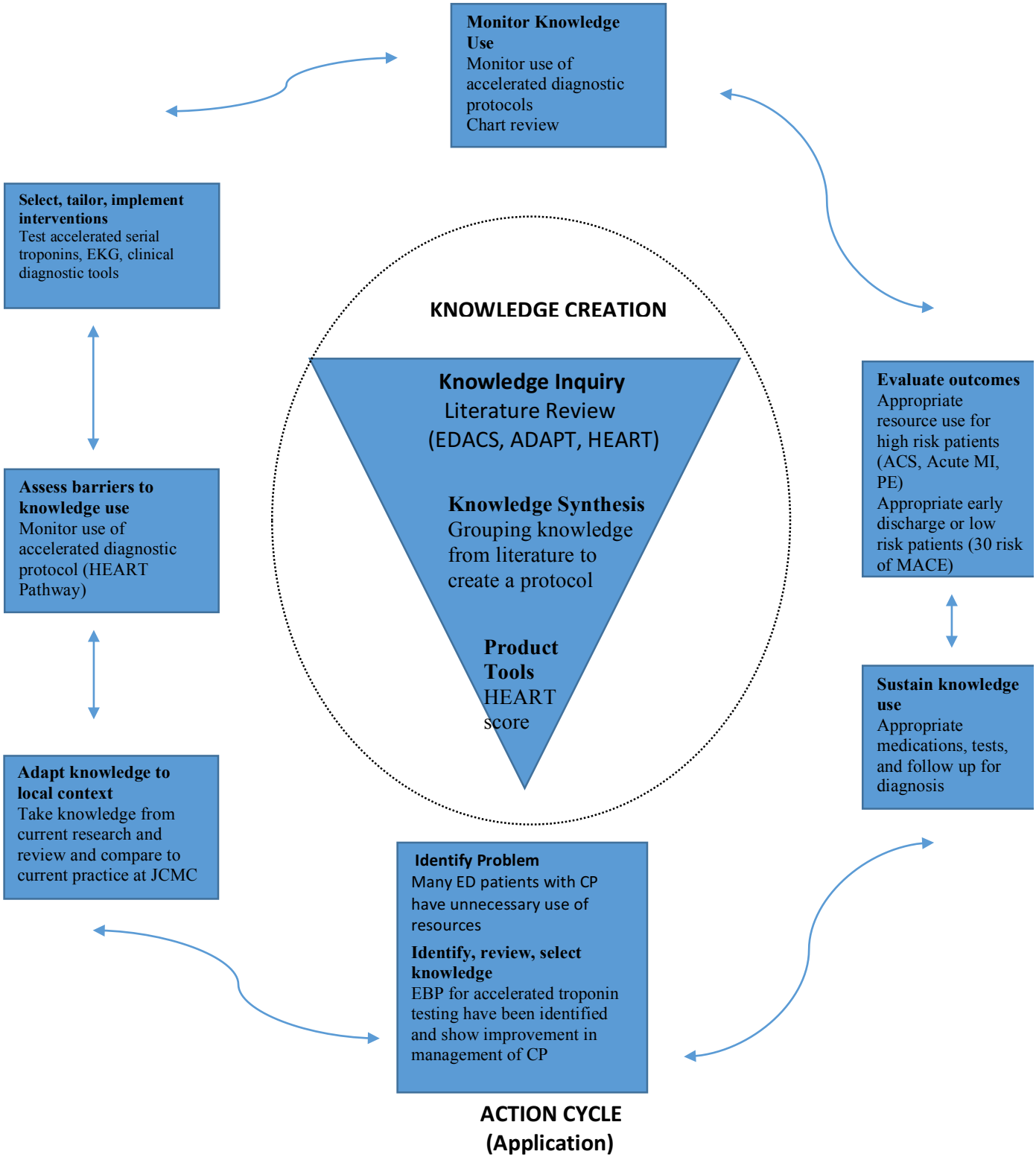
				identifies patients of low risk of 30-day MI or MACE 21% of patients were in the rule-out group and there were no MI, MACE or revascularization (95% CI, NPV was 100%)	resulting in wider confidence intervals Study conducted under pragmatic ED conditions and troponins were not collected at exact planned intervals	

Appendix B
Theoretical Model

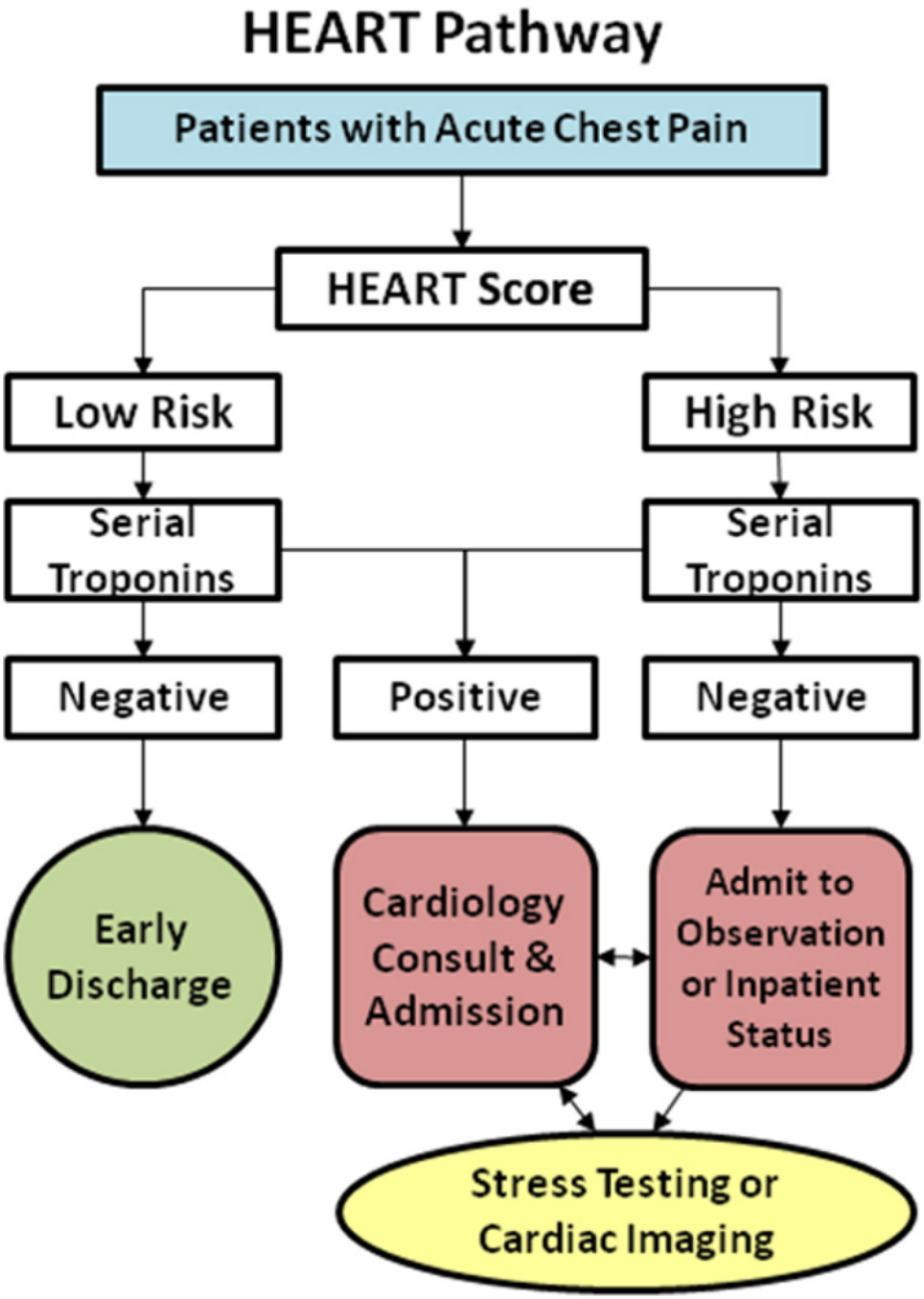


Graham I, et al. *The Journal of Continuing Education in the Health Professions*, Volume 26, pp. 13–24. 2006

Appendix C
Concept Map



Appendix D


HEART Pathway
Patients with Acute Chest Pain
HEART Score
Low Risk
High Risk
Serial Troponins
Serial Troponins
Negative
Positive
Negative
Early Discharge
Cardiology Consult & Admission
Admit to Observation or Inpatient Status
Stress Testing or Cardiac Imaging

Appendix E

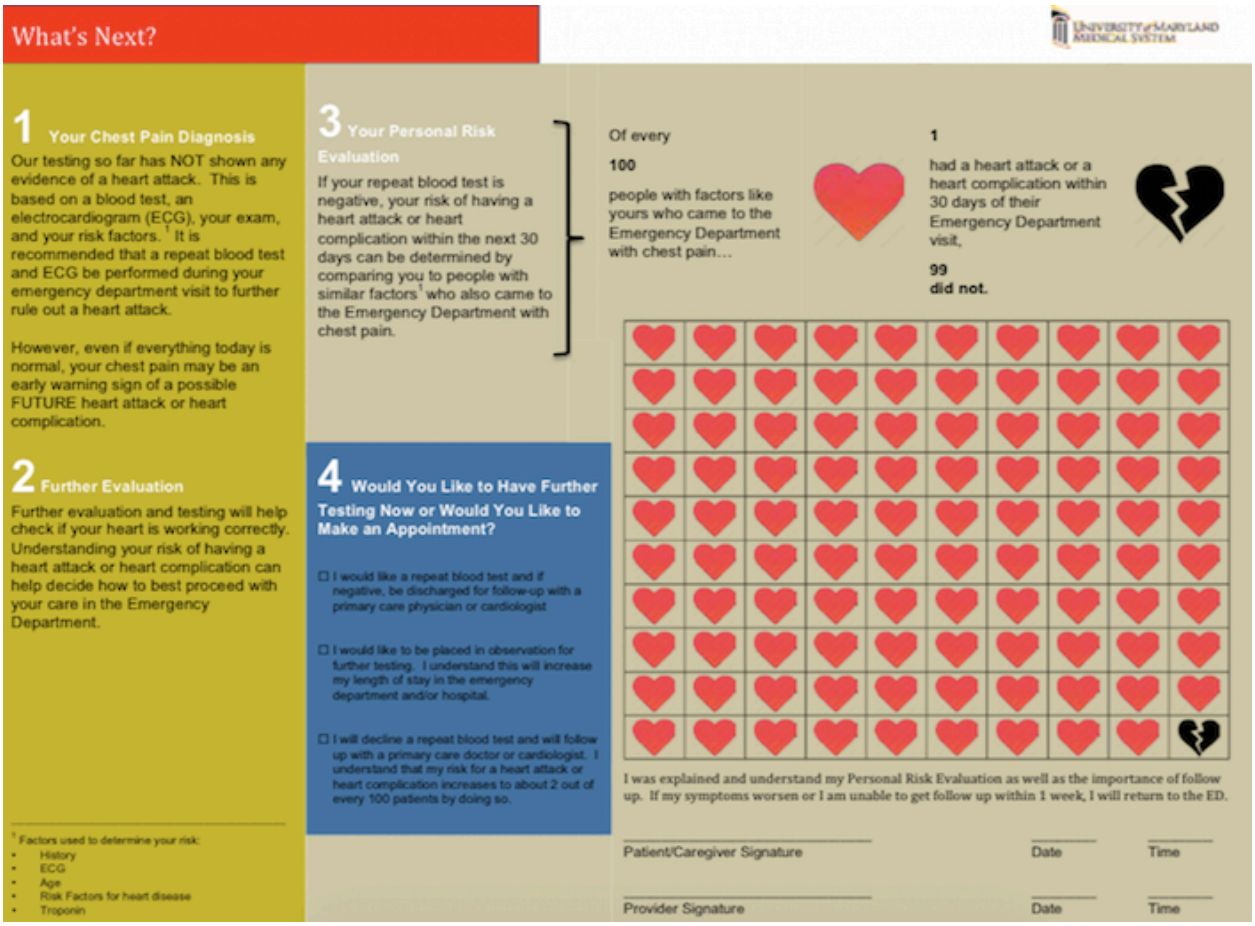
HEART score for chest pain patients

History (Anamnesis)	Highly suspicious	2	
	Moderately suspicious	1	
	Slightly suspicious	0	
ECG	Significant ST-deviation	2	
	Non-specific repolarisation disturbance / LBBB / PM	1	
	Normal	0	
Age	≥ 65 years	2	
	45 – 65 years	1	
	≤ 45 years	0	
Risk factors	≥ 3 risk factors *or* history of atherosclerotic disease	2	
	1 or 2 risk factors	1	
	No risk factors known	0	
Troponin	≥ 3x normal limit	2	
	1-3x normal limit	1	
	≤ normal limit	0	
		Total	

Risk factors for atherosclerotic disease:

Hypercholesterolemia	Cigarette smoking
Hypertension	Positive family history
Diabetes Mellitus	Obesity (BMI>30)

Appendix F
"Beyond HEART" Teaching Tool



What's Next?

University of Maryland Medical System

1 Your Chest Pain Diagnosis

Our testing so far has NOT shown any evidence of a heart attack. This is based on a blood test, an electrocardiogram (ECG), your exam, and your risk factors.[1] It is recommended that a repeat blood test and ECG be performed during your emergency department visit to further rule out a heart attack.

However, even if everything today is normal, your chest pain may be an early warning sign of a possible FUTURE heart attack or heart complication.

2 Further Evaluation

Further evaluation and testing will help check if your heart is working correctly. Understanding your risk of having a heart attack or heart complication can help decide how to best proceed with your care in the Emergency Department.

[1] Factors used to determine your risk:
- History
- ECG
- Age
- Risk Factors for heart disease
- Troponin

3 Your Personal Risk Evaluation

If your repeat blood test is negative, your risk of having a heart attack or heart complication within the next 30 days can be determined by comparing you to people with similar factors[1] who also came to the Emergency Department with chest pain.

Of every **100** people with factors like yours who came to the Emergency Department with chest pain...

1 had a heart attack or a heart complication within 30 days of their Emergency Department visit,

99 did not.

4 Would You Like to Have Further Testing Now or Would You Like to Make an Appointment?

☐ I would like a repeat blood test and if negative, be discharged for follow-up with a primary care physician or cardiologist

☐ I would like to be placed in observation for further testing. I understand this will increase my length of stay in the emergency department and/or hospital.

☐ I will decline a repeat blood test and will follow up with a primary care doctor or cardiologist. I understand that my risk for a heart attack or heart complication increases to about 2 out of every 100 patients by doing so.

I was explained and understand my Personal Risk Evaluation as well as the importance of follow up. If my symptoms worsen or I am unable to get follow up within 1 week, I will return to the ED.

Patient/Caregiver Signature _____ Date _____ Time _____

Provider Signature _____ Date _____ Time _____

Appendix G

Letter of Cooperation

Date: *[11/15/2018]*

Re: Letter of Cooperation For [redacted]

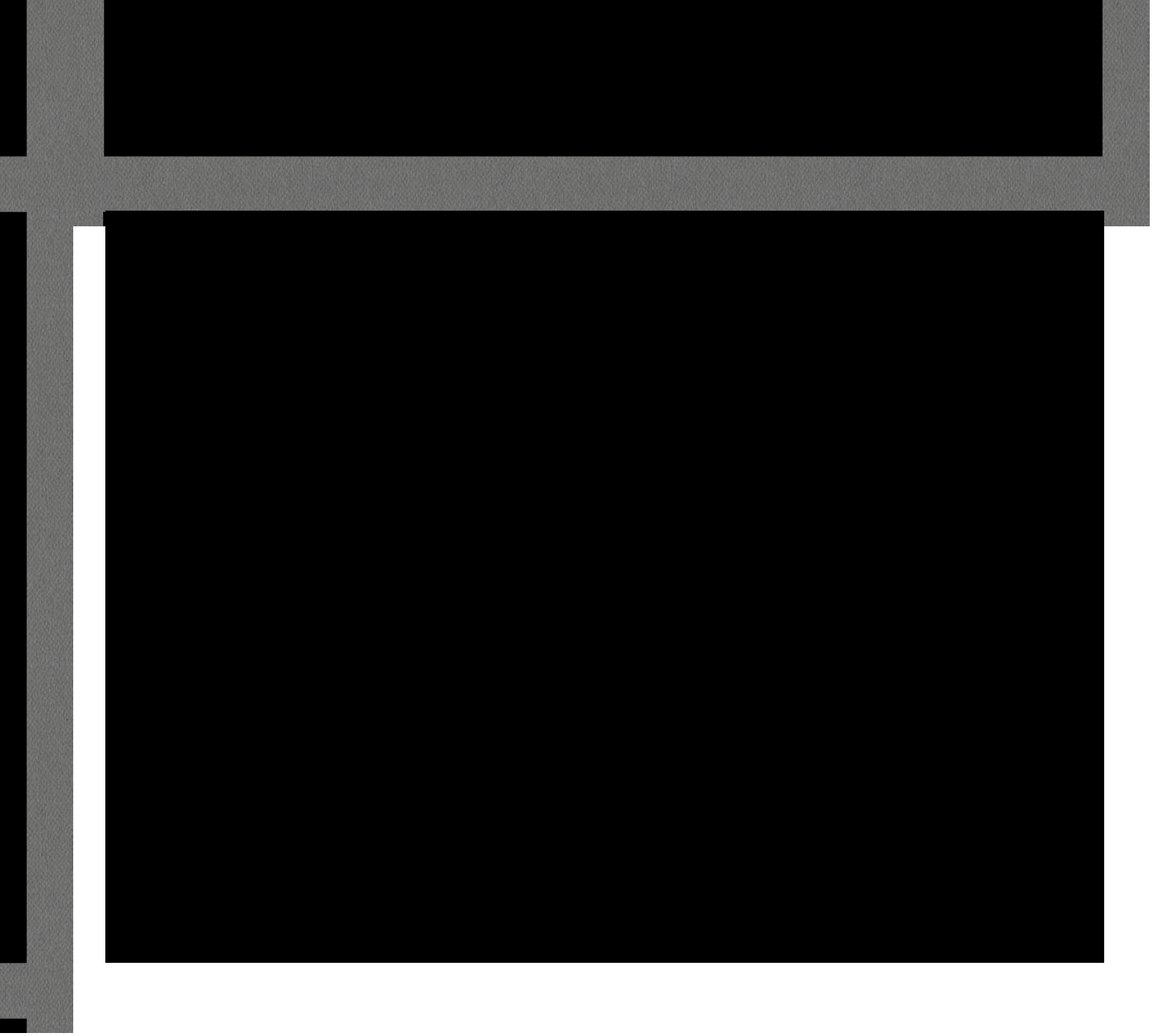
Dear *Ria Charisma Abadinas,*

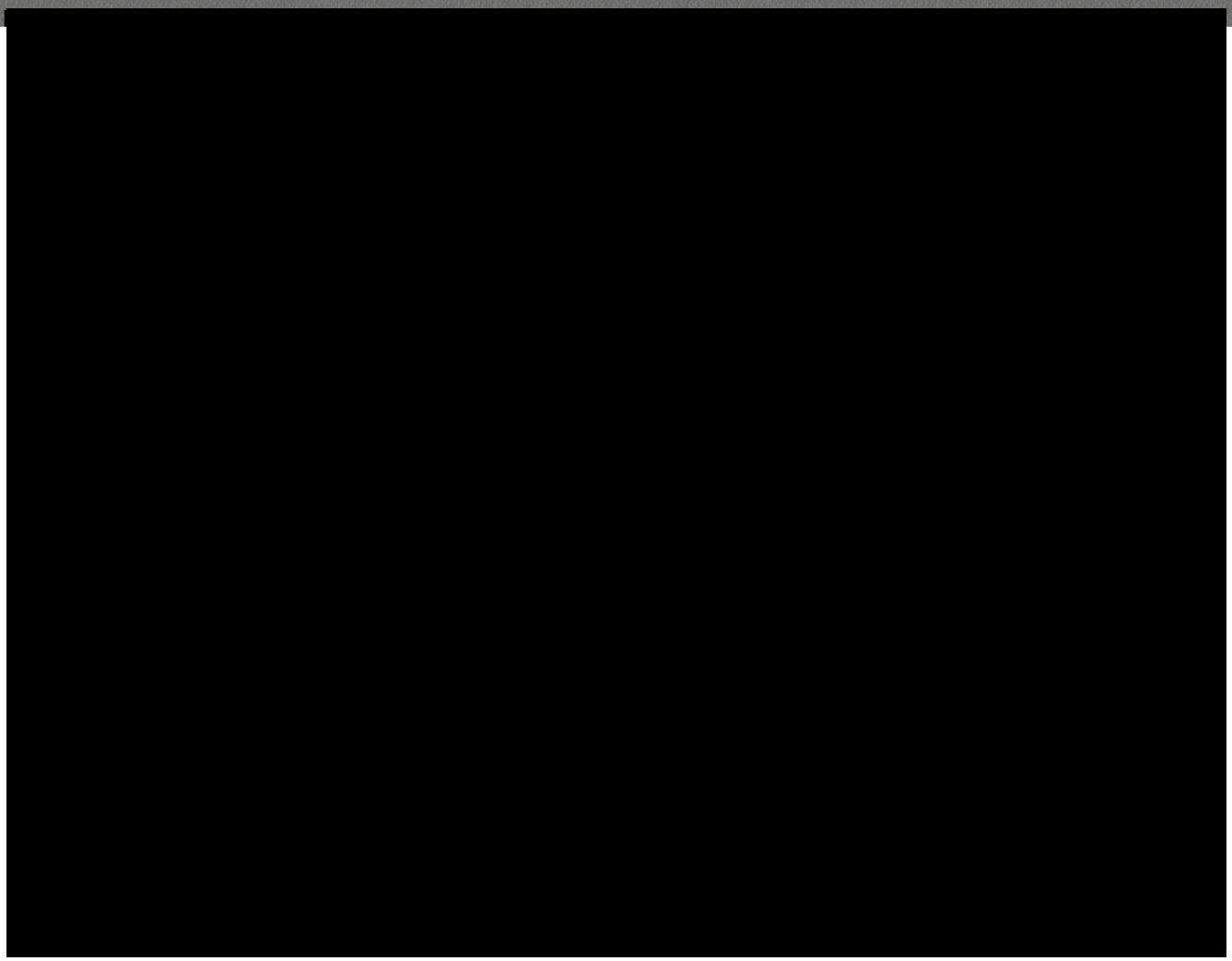
This letter confirms that that I, as an authorized representative of *Jersey City Medical Center]*, allow the Principal Investigator access to conduct study related activities at the listed site(s), as discussed with the Principal Investigator and briefly outlined below, and which may commence when the Principal Investigator provides evidence of IRB approval for the proposed project.

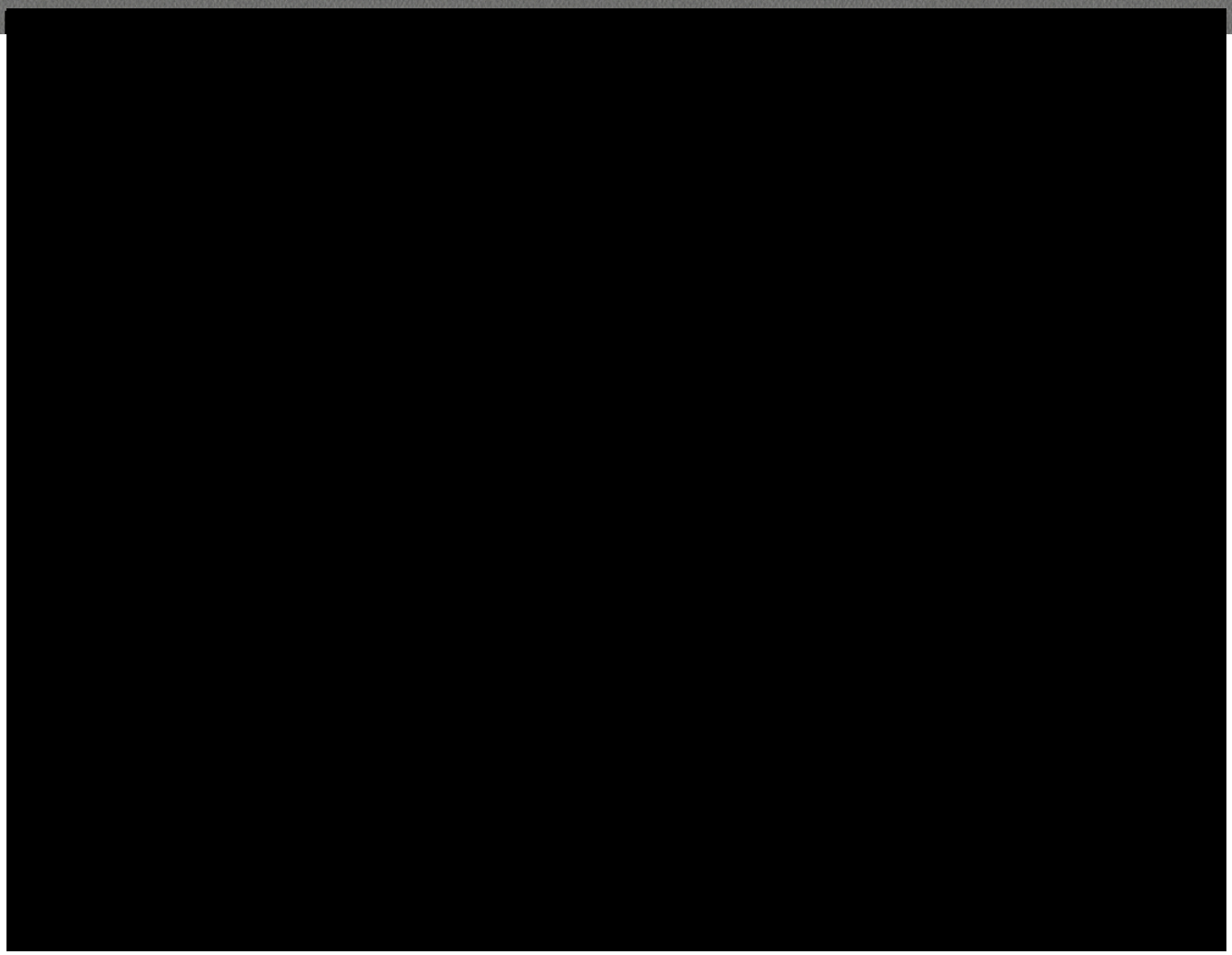
- **Research Site(s)**: [redacted]
- **Study Purpose:** ***The purpose of this project is to validate an accelerated protocol strategy for evaluating patients with chest pain compared to the contemporary 6-hour troponin testing strategy that is currently in place. The aims of the project are to improve practice by decreasing length of stay for ED patients who present with chest pain, decrease overcrowding in the ED, decrease wait times, and identify patients who are at low risk of ACS and can be safely discharged. .***
- **Study Activities:** *Troponin testing will be performed every 3 hours for two sets rather than the 6 hours for low risk patients. If troponin testing is negative, patients will be eligible for early discharge. A 30-day follow up with be done to assess risk of MACE.*
- **Subject Enrollment:** ***Adult patients between the ages of 18 to 75 with chest pain will be enrolled if they have a low HEART score. Patients brought in with ST segment elevation on their EKG, require a health care proxy to make decisions for them, non-English speaking, patients who cannot read and write in English, and those with a moderate to high HEART score will be excluded from the study.***
- **Site(s) Support**: *An email will be sent to providers to advise of the study that will take place and leadership will provide time to educate staff during staff meetings. The site is willing to deviate from their current procedure, for 30 days to pilot this work.*
- **Data Management:** *Confidentiality of participants that are involved in the study will be maintained. Medical record numbers will not be transcribed into the data collection tool for the project. The principal investigator will securely maintain data for the project in an encrypted file and kept locked in the project chair's office in Rutgers University-Newark. This will be password protected.*
- **Anticipated End Date:** *03/01/2018*

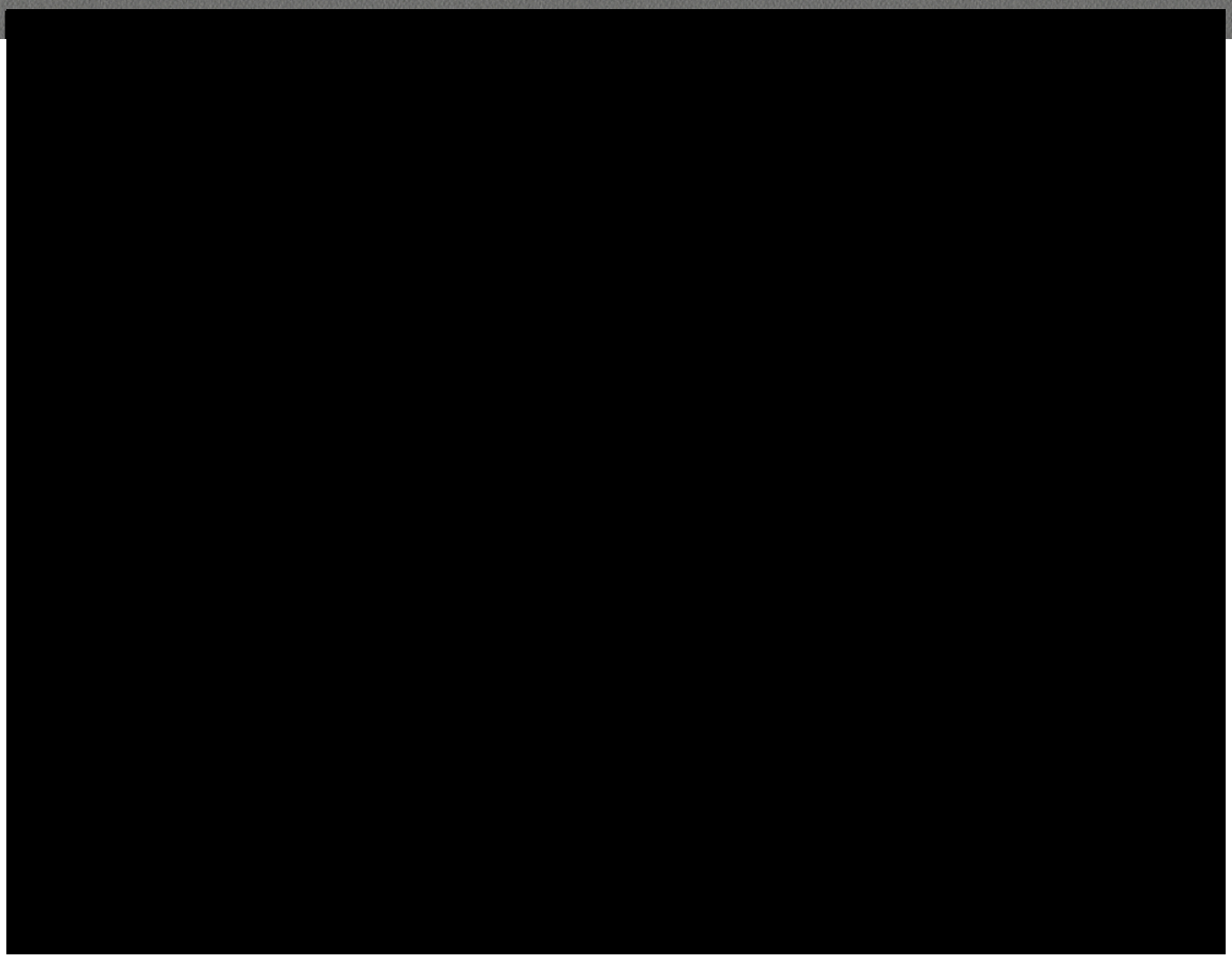
We understand that this site's participation will only take place during the study's active IRB approval period. All study related activities must cease if IRB approval expires or is suspended. I understand that any activities involving Personal Private Information or Protected Health Information may require compliance with HIPAA Laws and Rutgers Policy.

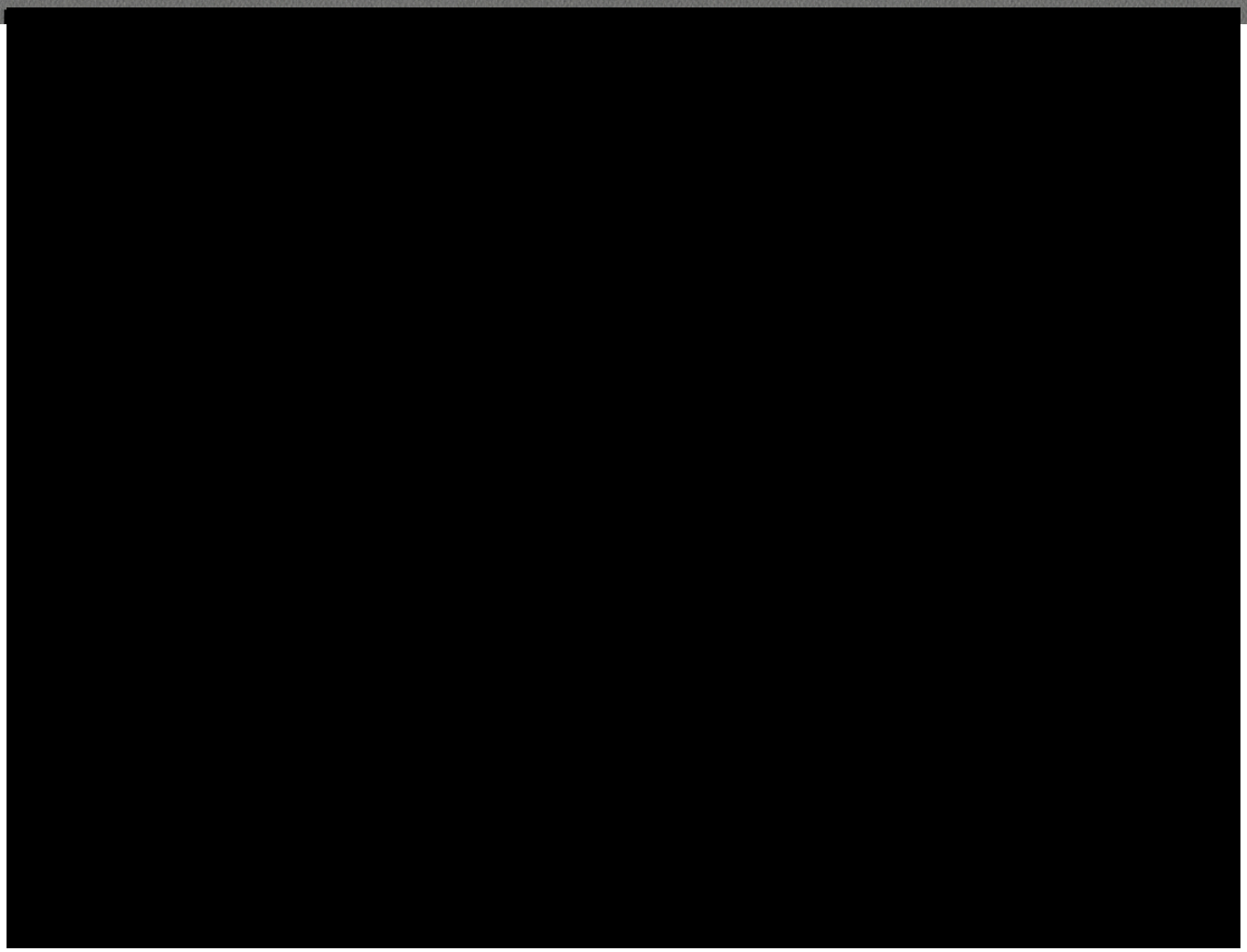
Our organization agrees to the terms and conditions stated above. If we have any concerns related to this project, we will contact the Principal Investigator. For concerns regarding IRB policy or human subject welfare, we may also contact the Rutgers IRB (see orra.rutgers.edu/hspp).

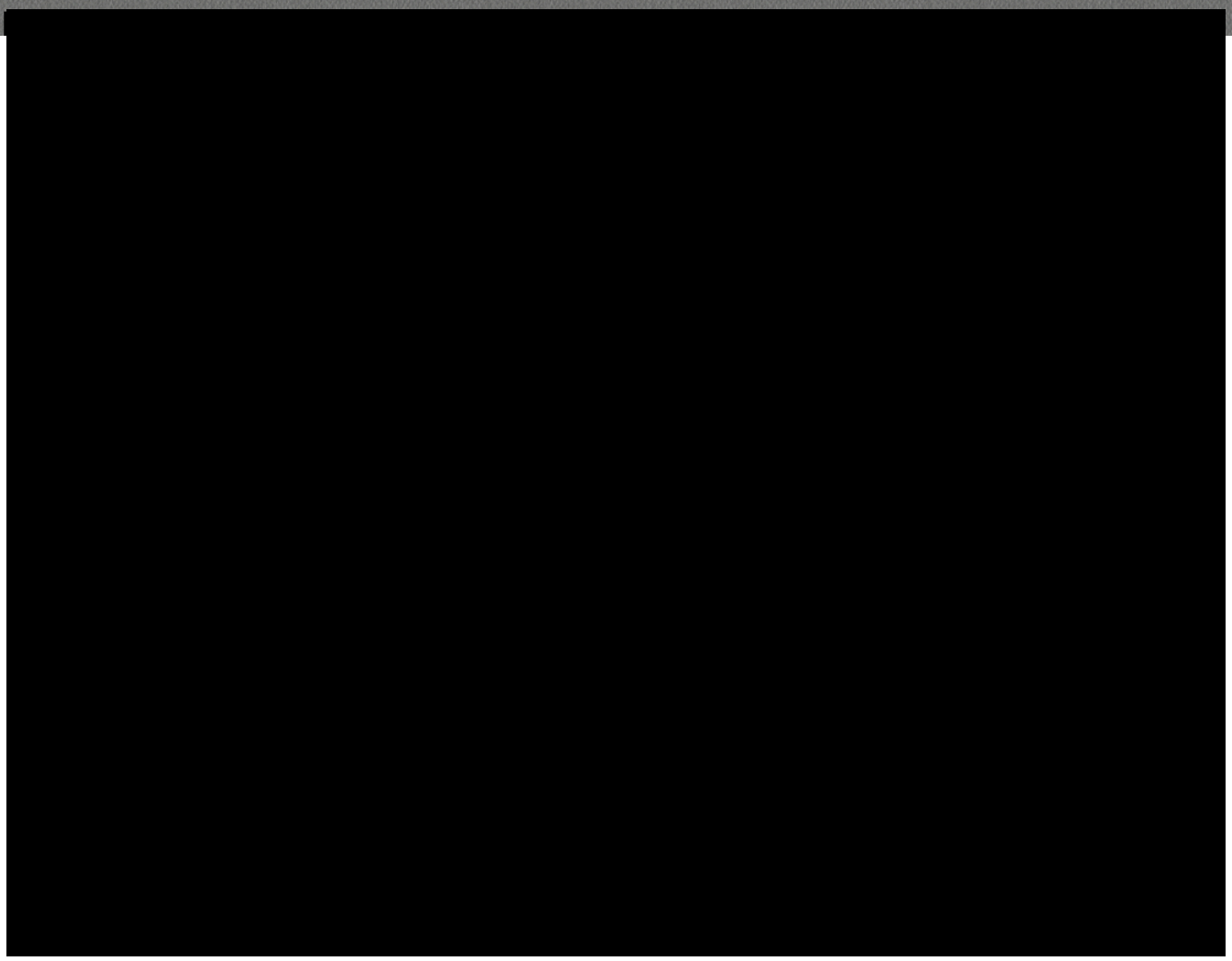












Appendix I

RUTGERS
School of Nursing

CONSENT TO TAKE PART IN A RESEARCH STUDY

TITLE OF STUDY: Implementation of Accelerated Troponin Testing in the Emergency Department for Chest Pain

PROTOCOL NO.: None
WIRB® Protocol #[redacted]

SPONSOR: [redacted]

PRINCIPAL INVESTIGATOR: Ria Charisma S. Abadinas, AS, BSN
65 Bergen Street
Newark, New Jersey 07107
United States

STUDY-RELATED PHONE NUMBER(S): [redacted]

This informed consent form provides information about a research study and what will be asked of you if you choose to take part in it. If you have any questions now or during the study, if you choose to take part in it, you should feel free to ask them and should expect to be given answers you completely understand. It is your choice whether to take part in the research. Your alternative to taking part is not to take part in the research.

After all of your questions have been answered and you wish to take part in the research study, you will be asked to sign this informed consent form. You are not giving up any of your legal rights by agreeing to take part in this research or by signing this consent form.

Who is conducting this research study?
Ria Charisma S. Abadinas is the Principal Investigator of this research study. A Principal Investigator has the overall responsibility for the conduct of the research. However, there are often other individuals who are part of the research team.

Ria Charisma S. Abadinas may be reached at [redacted], 65 Bergen St., Newark NJ 07107.

Ria Charisma S. Abadinas or another member of the study team will also be asked to sign this informed consent. You will be given a copy of the signed consent form to keep.

Why is this study being done?
The purpose of this study is to learn how an accelerated diagnostic protocol called Accelerated Troponin Testing will help to quickly evaluate patients who present to the Emergency Department with chest pain. It aims to identify patients who are at low risk or high risk for Acute Coronary Syndrome. This may help differentiate between patients who can be safely discharged early, and those who require observation or admission into the hospital for further testing.

Who may take part in this study and who may not?
Adult patients who are between the ages of 18 and 75 years of age with a complaint of chest pain are being asked to participate in this study. If you have changes in your EKG that needs immediate intervention, have a health care proxy to make decisions for you, non-english speaking, and cannot read or write in English, you will not be asked to participate.

Why have I been asked to take part in this study?
You are being asked to take part in this study because you are in the Emergency Department with chest pain and you do not meet the criteria to be excluded from this study.

How long will the study take and how many subjects will take part?
The study will take approximately 3 months with approximately 10 to 50 subjects to take part.

What will I be asked to do if I take part in this study?
After you are seen by the doctor, standard testing will be done to evaluate your chest pain. These initial results will be used to calculate your HEART score. Regular repeated blood tests will be drawn with less time in between than is the standard procedure for those reporting chest pain and the results will be monitored. The goal is to more quickly distinguish between low risk from high risk patients. Once you are discharged, the researcher will contact you in 30 days to see how you are doing. Please see the chart below for timing.

STEP	TIME
First set of blood work and EKG will be done	After ED (Emergency Department) doctor evaluation
Second set of blood work and EKG will be done	3 hours after initial ED doctor evaluation
Discharge to home	After second set of blood work is resulted and ED doctor reevaluation
Follow up contact with researcher	30 days after discharge

What are the risks and/or discomforts I might experience if I take part in this study?
Drawing blood may cause pain, bruising, lightheadedness, or, on rare occasions, infection. Other than the immediate discomfort from having blood drawn with a needle, which is common, there are not expected to be any risks and/or discomforts that are expected if you take part in this study. Privacy, respect, and confidentiality will be maintained.

There is a risk that early release from the emergency department could result in not detecting a heart attack.

Are there any benefits to me if I choose to take part in this study?
The benefits of taking part in this study may be: Benefits of the proposed study can contribute to future research studies to develop new guidelines for patients with chest pain. If successful, the accelerated protocol can aid in a more rapid decision making process, decrease the length of stay for patients in the hospitals, and decrease the use of unnecessary resources for patients where it is not necessary. Patients who volunteer to be a part of this study will be a part of this advancement in evaluating and treating patients with acute complaints of chest pain.

The emergency department of [redacted] receives a large number of patients with a complaint of chest pain. Chest pain can vary from non-life threating to life threating outcomes. This causes long lengths of stay in the emergency department. We hope to learn if an accelerated diagnostic protocol will help quickly and better distinguish patients who can be safety discharged home and those who require further observation or admission into the hospital.

However, it is possible that you may not receive any direct benefit from taking part in this study.

What are my alternatives if I do not want to take part in this study?

Alternative treatment: If you do not enroll in this study, your blood will be drawn and evaluated following the standard procedure for those admitted to the ER with chest pain.

How will I know if new information is learned that may affect whether I am willing to stay in the study?
During the course of the study, you will be updated about any new information that may affect whether you are willing to continue taking part in the study. If new information is learned that may affect you after the study or your follow-up is completed, you will be contacted.

Will there be any cost to me to take part in this study?
There will be no cost to you to take part in this study.

Will I be paid to take part in this study?
You will not be paid to take part in this study.

Who might benefit financially from this research?
1. University holds patent on test, drug, device, treatment:
Research studies like this one are designed to determine whether the accelerated chest pain protocol is safe and effective. Rutgers University owns a patent on some of the technology used in the accelerated chest pain protocol being studied. If research shows the accelerated chest pain is safe and effective, the Rutgers University would receive a part of the profits from any sales of the accelerated chest pain protocol.

How will information about me be kept private or confidential?
All efforts will be made to keep your personal information in your research record confidential, but total confidentiality cannot be guaranteed. Data that is collected for this study will be maintained in a locked and secured compartment in Rutgers University, Newark Campus. The only person who will have access to the locked compartment is the researcher for this project. Data will be stored in a USB flash drive and password protected.

What will happen if I am injured during this study?
1. For research on subjects with a disease or medical condition:

Subjects in this study will be exposed to certain risks of personal injury in addition to those associated with standard forms of treatment, which include: bruising from blood draw. In addition, it is possible that during the course of this study, new adverse effects of the accelerated chest pain protocol that result in personal injury may be discovered. The University will make appropriate referrals for medical treatment for subjects who sustain personal injuries or illnesses as a direct consequence of participation in the research. The subject's health insurance carrier or other third-party payer will be billed for the cost of this treatment;

provided that the University shall not submit to federally funded programs, e.g., Medicare, Medicaid or CHAMPUS, for reimbursement first if submission to such programs is prohibited by law. No financial compensation will routinely be provided by the University and no other type of assistance is available from the University.

What will happen if I do not wish to take part in the study or if I later decide not to stay in the study?

It is your choice whether to take part in the research. You may choose to take part, not to take part or you may change your mind and withdraw from the study at any time.

If you do not want to enter the study or decide to stop taking part, your relationship with the study staff will not change, and you may do so without penalty and without loss of benefits to which you are otherwise entitled.

You may also withdraw your consent for the use of data already collected about you, but you must do this in writing to [redacted].

> *NOTE:* At any time, the study doctor can take you out of this study because it would not be in your best interest to stay in it. Your study doctor can stop treatment even if you are willing to stay in the study.

If you decide to withdraw from the study for any reason, you may be asked to return for at least one additional visit for safety reasons.

Who can I call if I have questions?

If you have questions, concerns, or complaints about taking part in this study or if you feel you may have suffered a research related injury, you can call the study doctor: [redacted]

This research is being overseen by an Institutional Review Board ("IRB"). An IRB is a group of people who perform independent review of research studies. You may talk to them at [redacted] help@wirb.com if:

- You have questions, concerns, or complaints that are not being answered by the research team.
- You are not getting answers from the research team.
- You cannot reach the research team.
- You want to talk to someone else about the research.
- You have questions about your rights as a research subject.

If you have questions about your rights as a research subject, you can call the IRB Director at: *Newark HealthSci or* the Rutgers Human Subjects Protection Program at [redacted] in Newark.

PERMISSION (Authorization) TO USE OR SHARE HEALTH INFORMATION THAT IDENTIFIES YOU FOR A RESEARCH STUDY

The next few paragraphs tell you about how investigators want to use and share identifiable health information from your medical record in this research . Your information will only be used as described here or as allowed or required by law. If you sign this consent form, you agree to let the investigators use your identifiable health information in the research and share it with others as described below. Ask questions if there is something you do not understand.

What is the purpose of the research and how will my information be used?
You are being invited to take part in this research study which is described at the beginning of this form. The purpose of collecting and using your health information for this study is to help researchers answer the questions that are being asked in the research.

What information about me will be used?

- *Medical history or treatment*
- *Medications*
- *Laboratory/diagnostic tests or imaging*
- *EKG*
- *Admission time*
- *Discharge time*

Who may use, share or receive my information?
The research team may use or share your information collected or created for this study with the following people and institutions:

- Rutgers University investigators involved in the study;
- Non-Rutgers investigators on the study team: [redacted]
- The Rutgers University Institutional Review Board and Compliance Boards
- The Office for Human Research Protections in the U.S. Dept. of Health and Human [redacted]
- The Western Institutional Review Board

Those persons or organizations that receive your information may not be required by Federal privacy laws to protect it and may share your information with others without your permission, if permitted by the laws governing them.

Will I be able to review my research record while the research is ongoing?

No. We are not able to share information in the research records with you until the study is over. To ask for this information, please contact the Principal Investigator, the person in charge of this research study.

Do I have to give my permission?
No. You do not have to permit use of your information. But, if you do not give permission, you cannot take part in this study. (Saying no does not stop you from getting medical care or other benefits you are eligible for outside of this study.)

If I say yes now, can I change my mind and take away my permission later?
Yes. You may change your mind and not allow the continued use of your information (and to stop taking part in the study) at any time. If you take away permission, your information will no longer be used or shared in the study, but we will not be able to take back information that has already been used or shared with others. If you say yes now but change your mind later for use of your information in the research, you must write to the researcher and tell him or her of your decision: [redacted]

How long will my permission last?
Your permission for the use and sharing of your health information will last until all patients participating in the study have completed their 30-day follow-up and all the study data have been analyzed.

AGREEMENT TO PARTICIPATE

1. Subject consent:

I have read this entire consent form, or it has been read to me, and I believe that I understand what has been discussed. All of my questions about this form and this study have been answered. I agree to take part in this study.

Subject Name:_____

Subject Signature:_____Date_____

2. Signature of Investigator/Individual Obtaining Consent:

To the best of my ability, I have explained and discussed all the important details about the study including all of the information contained in this consent form.

Investigator/Person Obtaining Consent (printed name):_____

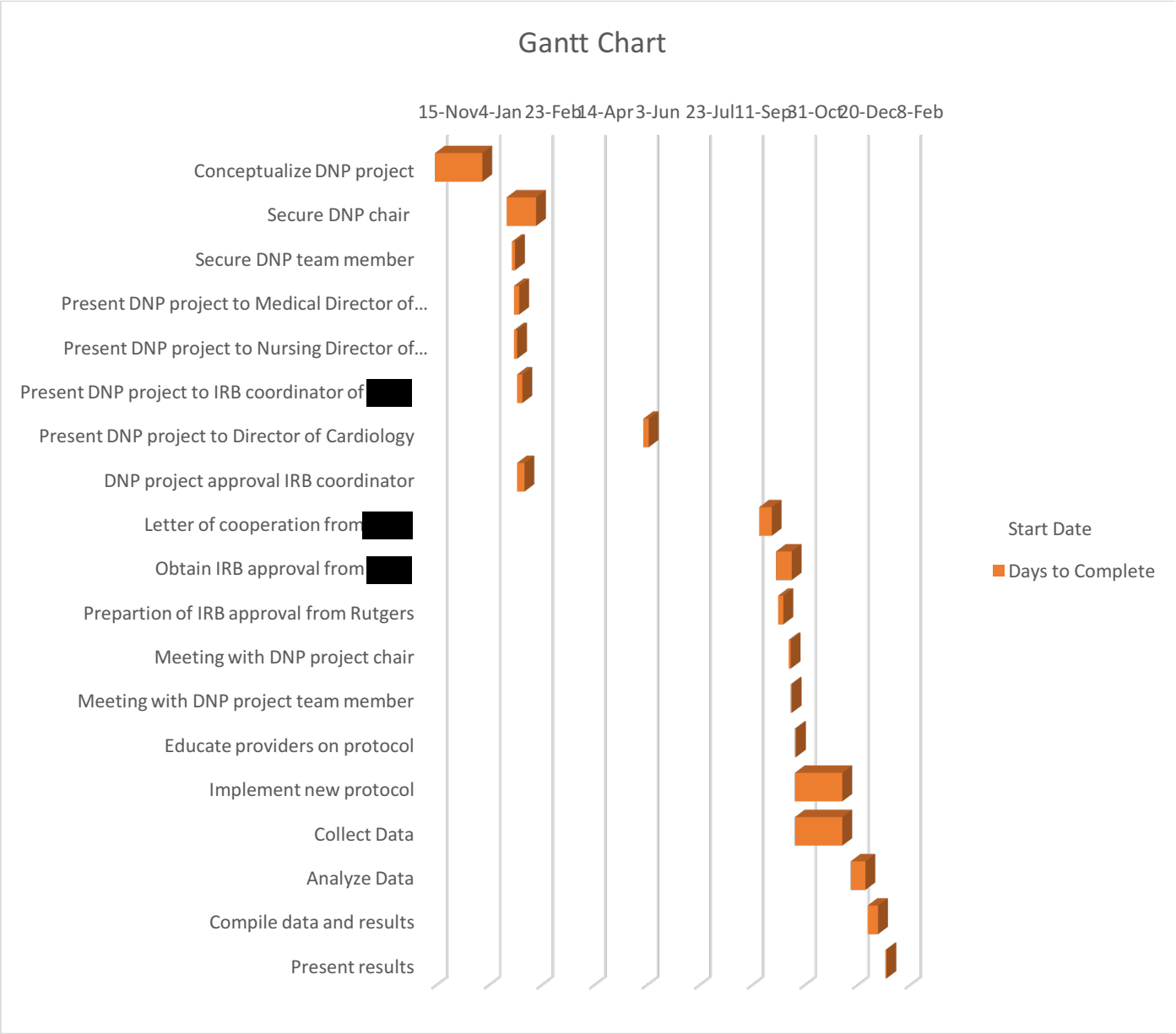
Signature:_____Date:_____

Appendix J

Accelerated Troponin Protocol for Patients with Acute Chest Pain in the Emergency Department
Data Collection Tool

	Time of Admission	Time of Discharge	HEART Score	Troponin Result	MACE (yes/no)
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					

Appendix K


Gantt Chart
15-Nov
4-Jan
23-Feb
14-Apr
3-Jun
23-Jul
11-Sep
31-Oct
20-Dec
8-Feb
Conceptualize DNP project
Secure DNP chair
Secure DNP team member
Present DNP project to Medical Director of...
Present DNP project to Nursing Director of...
Present DNP project to IRB coordinator of [redacted]
Present DNP project to Director of Cardiology
DNP project approval IRB coordinator
Letter of cooperation from [redacted]
Obtain IRB approval from [redacted]
Prepartion of IRB approval from Rutgers
Meeting with DNP project chair
Meeting with DNP project team member
Educate providers on protocol
Implement new protocol
Collect Data
Analyze Data
Compile data and results
Present results
Start Date
Days to Complete

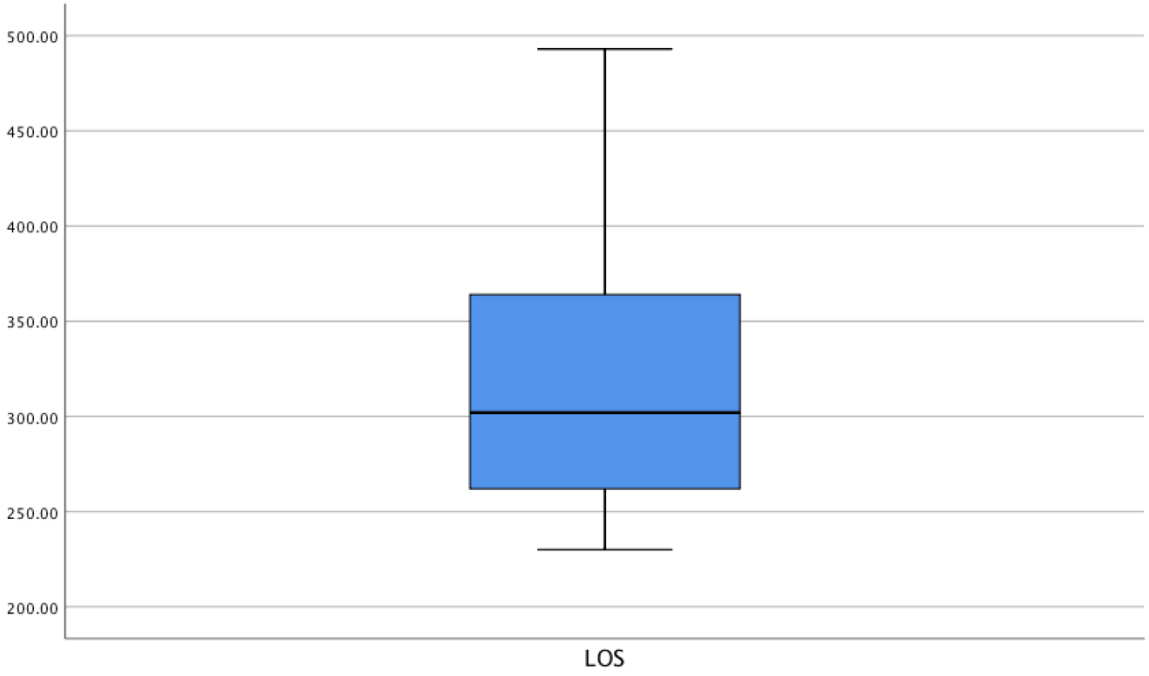
Appendix L

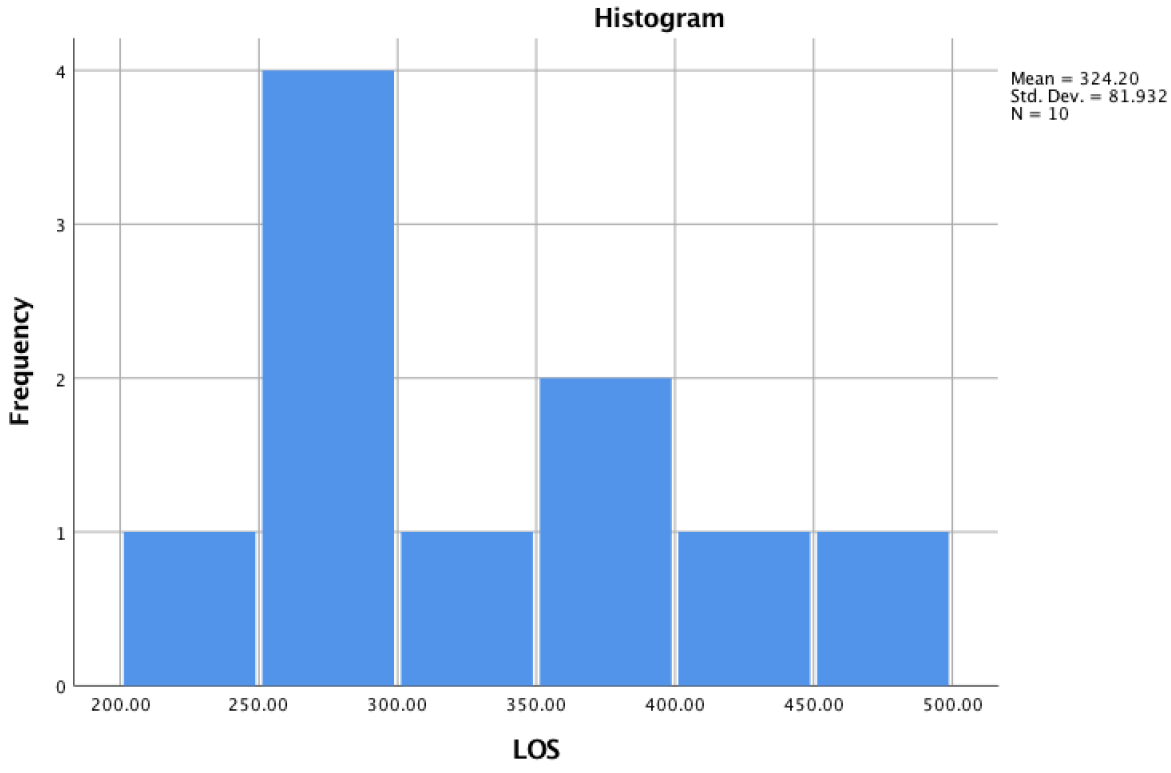
Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
LOS	10	230.00	493.00	324.2000	81.93195
Valid N (listwise)	10				

Descriptives

			Statistic	Std. Error
LOS	Mean		324.2000	25.90916
	95% Confidence Interval for Mean	Lower Bound	265.5894	
		Upper Bound	382.8106	
	5% Trimmed Mean		320.0556	
	Median		302.0000	
	Variance		6712.844	
	Std. Deviation		81.93195	
	Minimum		230.00	
	Maximum		493.00	
	Range		263.00	
	Interquartile Range		114.00	
	Skewness		.985	.687
	Kurtosis		.479	1.334


500.00
450.00
400.00
350.00
300.00
250.00
200.00
LOS


Histogram
Mean = 324.20
Std. Dev. = 81.932
N = 10
Frequency
4
3
2
1
0
200.00
250.00
300.00
350.00
400.00
450.00
500.00
LOS

Appendix M

LOS relationship to HEART Score

Correlation

Nonparametric Correlations

Correlations

			LOS	HEART_Score
Spearman's rho	LOS	Correlation Coefficient	1.000	-.156
		Sig. (2-tailed)	.	.668
		N	10	10
	HEART_Score	Correlation Coefficient	-.156	1.000
		Sig. (2-tailed)	.668	.
		N	10	10

Relationship

Oneway

ANOVA

LOS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10646.100	2	5323.050	.749	.507
Within Groups	49769.500	7	7109.929		
Total	60415.600	9			

Appendix N

LOS relationship to Gender

Relationship

Oneway

ANOVA

LOS

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	44.100	1	44.100	.006	.941
Within Groups	60371.500	8	7546.438		
Total	60415.600	9			

Descriptive Statistics