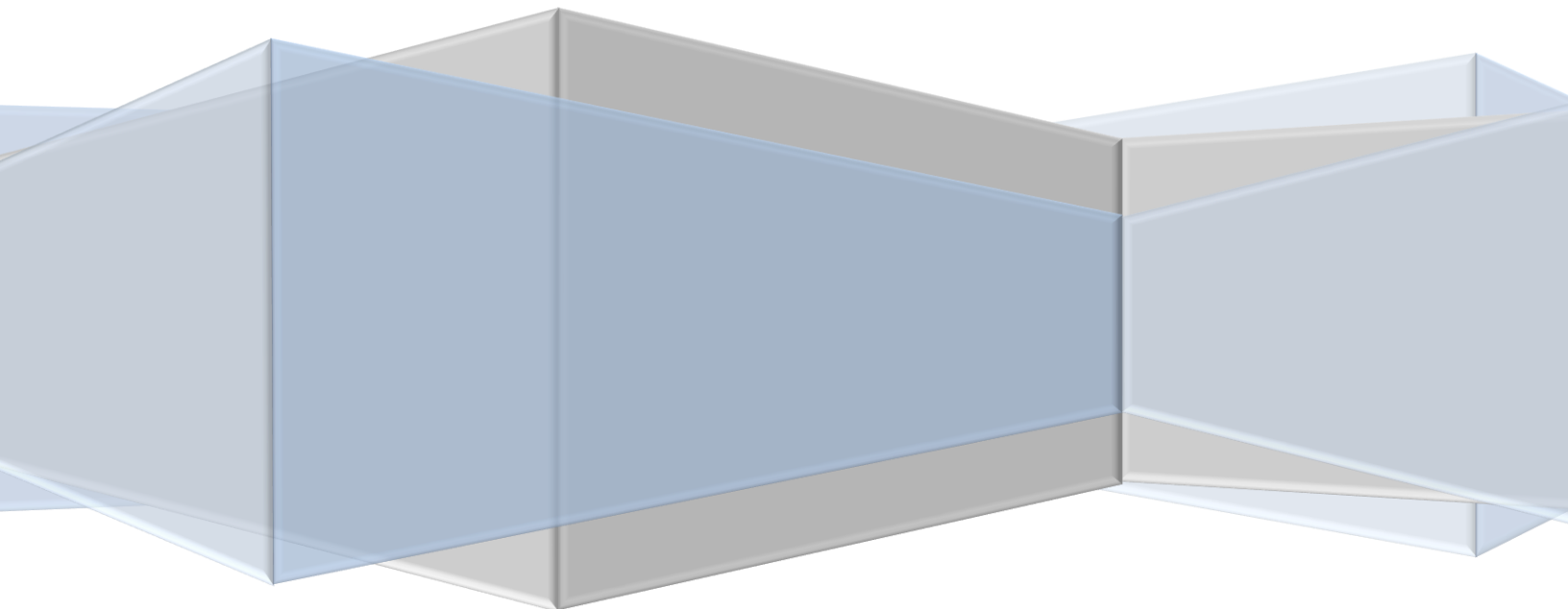


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*The Results are In*  
*Improving Chest Pain Patient Flow in the*  
*Emergency Department*

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This Quest for Excellence Award Application discusses the journey of Great Plains Health (GPH) in North Platte, Nebraska, to accelerate the diagnosis of chest pain patients presenting to the Emergency Department (ED) by using high-sensitivity cardiac troponin assay and the diagnostic H.E.A.R.T. (History, ECG, Age, Risk Factors, Troponin) score algorithm to identify low, intermediate and high-risk patients. The use of the H.E.A.R.T. score supplements the decision by stratifying the low risk patients for discharge once other conditions have been excluded.<sup>4</sup> The ultimate goal is to identify acute myocardial infarction (AMI) sooner and decrease the number observation hours on the inpatient unit. Using the protocol has the potential to reduce emergency department (ED) crowding and hospital admission rates for low risk acute coronary syndrome (ACS) patients for early discharge from the ED.<sup>5</sup> In order to accomplish this project, the team worked in phases. During phase I, The troponin point of care testing to high sensitivity troponin (hsTnl) testing was upgraded and implemented organization-wide. This change provided a level of improved cardiac sensitivity for earlier AMI diagnosis and treatment. This change allowed for optimization of patient care and allowed for safe discharge from the Emergency Department (ED) based on the hsTnl and H.E.A.R.T. score for outpatient follow-up with primary care provider (PCP) and/or cardiology as indicated.

### Leadership/Planning

At Great Plains Health, senior leadership guides and sustains the organization by establishing the organizational mission, vision, values and performance expectations as set by our Board of Directors.

Our Mission- To inspire health and healing by putting patients first – always

Our Vision- To become the region’s most trusted healthcare community

Our Values- We are genuine  
We are passionate  
We have integrity  
We listen  
We are a team

Our Strategic Objectives- To ensure access to quality care  
To deploy innovation to improve organizational outcomes  
To grow services to exceed our region’s needs  
Live our mission, vision, and values  
To maintain the independence of healthcare in our region

GPH is fortunate to have strong medical staff and senior leadership teams with diverse healthcare backgrounds who champion and engage in continuous quality improvement. As part of the GPH strategic objectives to “encourage innovation” and “live our mission” of “putting patients first – always,” leaders formed a team to improve the diagnosis efficiency and care of chest pain patients entering the Emergency Department (ED). With team effort, the laboratory, the medical and nursing staff successfully implemented high sensitivity troponin (hsTnl) as our standard of care on November 1, 2021 and the H.E.A.R.T. algorithm in May 2022.

### Process of Identifying Need

More than 5.5 million people present to emergency departments each year with chest pain and only 13% receive diagnosis of acute coronary syndrome. The assessment of such patients uses clinical history, electrocardiograms (ECG’s), and serial cardiac troponin levels to rule out acute myocardial infarction. This process involves considerable time and economic burden to the health care system.<sup>1</sup> At GPH, the need to address chest pain patients in the ED was reexamined when our cardiologists requested an ED chest pain team that would consider

utilizing the new high sensitivity troponin I assay and an accelerated diagnostic algorithm. They theorized that identifying a low-risk cohort may permit early emergency department discharge and avoid unnecessary hospitalization.<sup>3</sup> Prior practice was to admit all chest pain patients under observation status for the completion of serial troponins and cardiac stress testing. The issue was the patient inconvenience and length of stay (LOS) on the observation unit, occupying a hospital bed, and using inpatient nursing resources. Improving early diagnostic accuracy in patients with chest pain would result in better tailoring of patient to treatment, lower utilization of resources, mitigation of the ED patient, and better patient outcomes. The H.E.A.R.T. score stratifies patients into low, intermediate or high risk for acute coronary syndrome. Internal data indicated an opportunity for decreased LOS by changing to a rapid chest pain assessment in ED. Low risk H.E.A.R.T. patients could be sent home safely for outpatient follow-up testing within 2-3 days. Historically chest pain patients entering through the ED had an initial troponin, EKG and other workup. If determined to be a NSTEMI (non-ST elevation myocardial infarction), they were transported to an inpatient observation room to complete the remaining troponin labs and a cardiac workup before discharge. Typically having a stress test the next day, waiting for the reading of the test to determine discharge or admission. Baseline data from 2020 indicates average LOS of thirty-four hours.

When the idea was initially proposed, the ED medical and nursing staff had reservations about giving up the troponin iStat due to convenience and quick resulting. When the goals, research, and improved patient care was examined, the ED staff embraced the change to hsTnI understanding it would give better precision, better decisions with improved diagnostic accuracy, and accelerated decision-making. The increased sensitive cardiac troponin tests

enabled greater confidence in results. The use of hsTnl accelerates a clinician's ability to rule in (or rule out) myocardial infarction, and provide efficiency improvements in cardiac patient management.<sup>2</sup> An initial hsTnl is collected upon arrival and 2-hours post initial hsTnl to measure the delta change and paired with the H.E.A.R.T. Score; criteria of history, ECG, age, risk factors, troponin to determine low, intermediate or high risk. If the provider determines the patient is low risk, H.E.A.R.T. score 0-5 (0-1% risk) the patient is sent home with instructions for outpatient follow-up with PCP (primary care provider). If determined to be intermediate H.E.A.R.T. score 6-8 (2-4% risk) the patients are admitted for observation and further testing. A high score of 9-10 (9-11% risk) warrants full admission and cardiology evaluation.

### Process Improvement Methods

The process improvement methodology utilized for the Chest Pain improvement initiative included utilization of the PDSA (Plan, Do, Study, Act) tool, the following steps were initiated. In the planning stage of the PDSA cycle, a team was formulated to research the concept of a chest pain team in the ED. A multidisciplinary team began with key stakeholders for our quest for best practice of ED patients arriving with the primary diagnosis of chest pain. The team included the medical directors of ED, cardiology, radiology, Sr. leadership from nursing & quality, director of radiology, Information Systems, and education. The objective of the team was to move towards early, safe discharge of low risk chest pain patients from the ED. Using the H.E.A.R.T. score algorithm; which includes high sensitivity troponin with Coronary CT Angiogram (CTTA) scanning added in a later phase. The goal is to send a patient home within 4-6 hours if cleared for discharge versus admitting patient as an observation patient until the next day when the troponin series and cardiac stress test were completed.

During the Do phase of the PDSA cycle, the team reviewed historical admissions for chest pain patients with observation or inpatient status LOS and acute myocardial infarction (AMI) readmission data with ED as the patient's point of entry. The team decided to initiate a phased approach for implementation and improved efficiency for ED chest pain patients. The internal team worked with Nebraska Medicine Community Connect Epic team to change the AMI order sets to hsTnl with laboratory results since we were the first hospital in Nebraska to implement this change.

Phase I was completed on November 1, 2021 when the organization successfully changed to the new high sensitivity troponin (hsTnl) assay testing. Phase II included PACS (picture archiving and communication system) upgrade of the medical imaging system that was completed January 2022. The PACS upgrade was necessary for the CCTA study to be completed and interpreted. In Phase III, CCTA diagnostic study for ED chest pain patients was introduced as the goal of sending the intermediate H.E.A.R.T. score patient home for outpatient follow up versus being admitted as observation status for further testing.

Through the study phase, the team reviewed readmission data noting 2Q 2021 AMI inpatient readmissions was 14.3%, this was an increase from 1Q 2021 of 4.0%. 1Q 2022 was 0.0%. In addition, the laboratory completed a troponin and high-sensitivity troponin correlation study. Follow up education of the medical and clinical staff occurred with the assistance of a physician educator from the vendor. There were some concerns voiced from some medical staff about the different result values of the hsTnl compared to troponin, additional education was provided. The GPH H.E.A.R.T. algorithm was developed and implementation for the ED providers as an integrative tool with hsTnl and the H.E.A.R.T. scoring system. In Phase III CCTA

is now orderable for ED patients with chest pain to rule out AMI. Due to limited credentialed medical staff that interpret the study, this testing is available Monday through Friday, 0800-1700. The goal is to have full coverage as additional medical staff credential for interpretation of this study. Tracking and trending results include: a) the number of patients and average length of stay for NSTEMI chest pain patients admitted to OBV & Inpatient status having a stress test, b) AMI inpatient readmissions baseline data with monthly readmission rates, c) ED 72 hour bounce-back visit with diagnosis of chest pain. All data was collected from EMR.

### Results

The GPH Chest Pain Team outcomes are showing early success. The change from troponin to hsTnl and the use of the H.E.A.R.T. scoring algorithm in the ED has improved the access to tools available to rapidly rule out AMI and safely discharge the patient for outpatient follow up. Trends of LOS continue to be monitored, with varied improvement. An average of 15 patients per quarter were admitted for an average of 32 hours in 2021. 1Q 2022 there were 20 patients admitted for an average of 36 hours. Though we aren't seeing a significant decrease yet, providers are making the adjustment and starting to discharge to home those that would have been staying overnight or longer. We anticipate a decrease of observation admissions and LOS for NSTEMI patients with the implementation of CCTA scanning for ED patients starting in July 1, 2022. The AMI IP readmission for March 2022 YTD is 0.0%. The ED 72-hour bounce back visit with initial diagnosis of chest pain and subsequent visit trend between zero and one with the diagnosis of chest pain. This data also includes those that left AMA through May 2022. Sustained change will be through consistent accountability and reporting of trends cascading up to through the Board Quality Committee.

## Lessons Learned, Replicability, Sustainability

Lessons learned from the ED chest pain improvement initiative include the importance of the failure mode effect analysis (FMEA) adopted by the board of directors for our 2021 hospital wide project. Using the FMEA we addressed the highest scoring *Process Step* of the current troponin values being measured in nanograms ng/ml with the hsTnl test being measured in pictograms pg/ml. The *Failure Mode* was the misinterpretation of lab values by providers and other clinicians. The *Effect of Failure* included wrong diagnosis, treatment, not treating patient based on correct interpretation of results. *The Cause of Failure* was missing an abnormal troponin value thinking it is within the old normal range. The FMEA reinforced the need for a robust education plan, to ensure a safe change to hsTnl hospital wide. For replicability, we recommend utilization of a FMEA matrix to identify key bottlenecks and risks for the organization early on in the process and review throughout the project. The FMEA process really drove the PDSA priorities with our project and kept us from allowing the scope of the project to creep outside of set parameters.

Other lessons learned include the importance of having a back-up team member for the laboratory who could attend the team meetings and communicate the information back to the laboratory staff. Team building between the ED and the lab assistants was critical. It was a major change for the ED nursing staff performing their own troponin testing via iStat changing to lab drawn. The team decided the second troponin draw would occur at two hours post initial. We experienced some late draws by lab assistants, due to the lack of understanding of the importance of on time blood draws. Some RN staff went ahead and drew the blood, others waited for the lab assistant. This affected the hsTnl delta change between the initial and two-



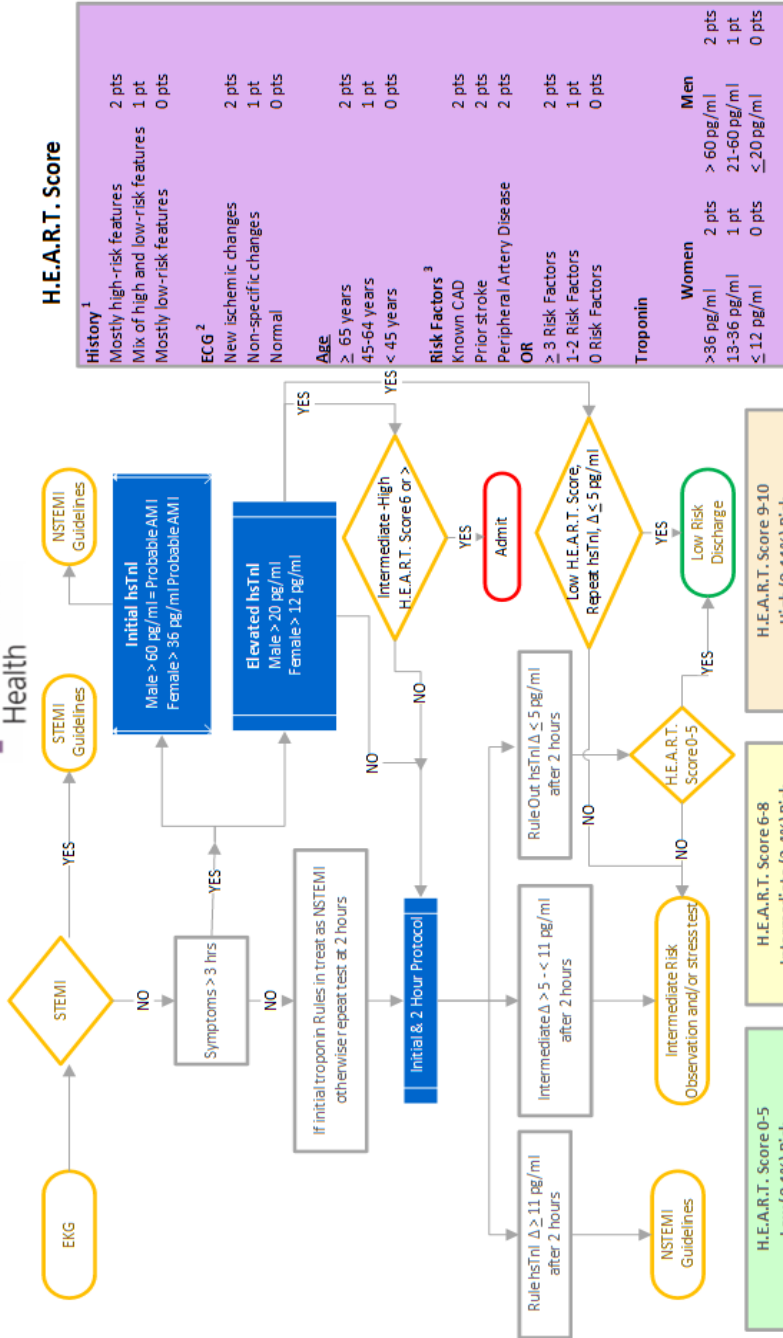
hour mark. With additional education and training, the lab assistants have corrected the approach by understanding the priority of this draw to meet the time lines for the provider to use the result for accurate diagnosis. Monitoring continues for on time lab draws, if outliers exist, the director reviews the process with lab assistants, reeducation if given as needed.

Support of our ED medical director and nursing leadership were vital to relinquishing iStat bedside troponin testing for the increased accuracy of the hsTnl. The collaboration of the ED Medical Director and ED Director of Nursing as a united force with continuous communication and obtaining feedback from providers and nursing created buy in and a smooth transition to high sensitivity troponin and the use of the H.E.A.R.T. scoring algorithm. In addition, the collaboration of cardiology and radiology providers to cover call for timely CCTA interpretation of 90 minutes or less for ED patients opened up the feasibility of phase III of the initiative.

Next steps of the chest pain center in the ED include additional CCTA interpretation to expand to daily availability. Continuous monitoring of how the CCTA imaging impacts the number of patients admitted to OBV/inpatient and requiring a stress test prior to discharge and their LOS. Ongoing monitoring and assessment of the metrics with adjustment and ongoing PDSA cycles to fine tune this process and improve patient outcomes.

## References:

1. Greenslade, J., Carlton, E., Van Hise, C., Cho, E., Hawkins, T., & Parsonage, W. et al. (2018). Diagnostic Accuracy of a New High-Sensitivity Troponin I Assay and Five Accelerated Diagnostic Pathways for Ruling Out Acute Myocardial Infarction and Acute Coronary Syndrome. *Annals Of Emergency Medicine*, 71(4), 439-451.e3. doi: 10.1016/j.annemergmed.2017.10.030
2. The Advantages of High-sensitivity Troponin Tests. (2022). Retrieved 27 July 2022, from <https://www.beckmancoulter.com/products/immunoassay/hstni-education>
3. Peacock, W., Baumann, B., Bruton, D., Davis, T., Handy, B., & Jones, C. et al. (2018). Efficacy of High-Sensitivity Troponin T in Identifying Very-Low-Risk Patients With Possible Acute Coronary Syndrome. *JAMA Cardiology*, 3(2), 104. doi: 10.1001/jamacardio.2017.4625
4. Long, B., Oliver, J., Streitz, M., & Koyfman, A. (2017). An end-user's guide to the HEART score and pathway. *The American Journal Of Emergency Medicine*, 35(9), 1350-1355. doi: 10.1016/j.ajem.2017.03.047
5. Leung, Y., Cheng, N., Chan, C., Lee, A., Wong, J., & Yan, B. et al. (2017). Early Exclusion of Major Adverse Cardiac Events in Emergency Department Chest Pain Patients: A Prospective Observational Study. *The Journal Of Emergency Medicine*, 53(3), 287-294. doi: 10.1016/j.jemermed.2017.05.006



**H.E.A.R.T. Score**

<b>History</b> <sup>1</sup>	Mostly high-risk features	2 pts
	Mix of high and low-risk features	1 pt
	Mostly low-risk features	0 pts
<b>ECG</b> <sup>2</sup>	New ischemic changes	2 pts
	Non-specific changes	1 pt
	Normal	0 pts
<b>Age</b>	≥ 65 years	2 pts
	45-64 years	1 pt
	< 45 years	0 pts
<b>Risk Factors</b> <sup>3</sup>	Known CAD	2 pts
	Prior stroke	2 pts
	Peripheral Artery Disease	2 pts
<b>OR</b>	≥ 3 Risk Factors	2 pts
	1-2 Risk Factors	1 pt
	0 Risk Factors	0 pts
<b>Troponin</b>		
	<b>Women</b>	<b>Men</b>
	>36 pg/ml	> 60 pg/ml
	13-36 pg/ml	21-60 pg/ml
	≤ 12 pg/ml	≤ 20 pg/ml
	0 pts	0 pts
	1 pt	1 pt
	2 pts	2 pts

**Total Score** \_\_\_\_\_ **pts**

<p><b>1. High Risk features</b></p> <ul style="list-style-type: none"> <li>Middle or left sided</li> <li>Heavy chest pain</li> <li>Diaphoresis</li> <li>Relief of symptoms by sublingual nitrates</li> <li>N/V</li> <li>Radiates</li> <li>Emotional</li> </ul> <p><b>Low Risk features</b></p> <ul style="list-style-type: none"> <li>Well localized</li> <li>Sharp pain</li> <li>Non-emotional</li> <li>No diaphoresis</li> <li>No N/V</li> </ul> <p><b>Intermediate Risk</b> Observation and/or stress test</p> <p><b>H.E.A.R.T. Score 0-5</b> Low (0-4%) Risk Stress Test or CCTA Hospitalization Not Recommended</p>	<p><b>2. New Ischemic changes</b></p> <ul style="list-style-type: none"> <li>Ischemic ST segment depression</li> <li>New Ischemic T-wave</li> </ul> <p><b>Non specific changes</b></p> <ul style="list-style-type: none"> <li>Repolarization abnormalities</li> <li>Non specific T-wave changes</li> <li>Bundle Branch blocks</li> <li>Digoxin effect</li> <li>Pacemaker arrhythmia</li> </ul> <p><b>H.E.A.R.T. Score 6-8</b> Intermediate (2-4%) Risk Consider outpatient stress test or observation</p> <p><b>H.E.A.R.T. Score 9-10</b> High (9-11%) Risk Consider hospitalization and Cardiology consult</p>	<p><b>3. Risk factors</b></p> <ul style="list-style-type: none"> <li>Obesity (BMI&gt;30)</li> <li>Smoker</li> <li>Diabetes mellitus</li> <li>Family history of CAD 1<sup>st</sup> degree relative</li> <li>Diagnosed with/ or treated hypertension</li> <li>Hypercholesterolemia</li> </ul>
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Appendix B

