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Dedication

I would like to dedicate this project to my nursing staff who are extremely gifted and always place the patients first and to my mother who always pushed and supported me in my career.

Acknowledgements

I am grateful for the support and guidance from my mentor Laura Mansfield, as well as the executive leadership of Mount Sinai Heart, Dr. John Puskas and Dr. Beth Oliver for support of this project from the inception. Dr. Mary Ellen Roberts for her guidance and support throughout my doctoral studies. Also a special acknowledgement to Dr. Patricia Clark Pappas her time to be a reader and providing advice on this project.

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Abstract

Clinical pathways are a common component in the quest to improve the quality of health. Clinical pathways are used to reduce variation, improve quality of care and maximize the outcomes for specific groups of patients (Lawal, et al., 2016). The purpose of this project is to develop and initiate a Coronary Artery Bypass Grafting (CABG) clinical pathway to reduce variation in care as a way to improve quality of care and patient outcomes for CABG patients CABG surgery is considered a high risk, high cost, yet highly profitable surgery with considerable post-operative complications that affect numerous quality metrics including Length of Stay (LOS), hospital acquired infections (HAI), mortality rate, readmission rates and patient satisfaction. The importance of delivering high quality clinical management of CABG patients and minimizing postoperative complications is essential for the growth of a Center of Excellence and for financial sustainability. Therefore, implementation of CABG Clinical Pathways (CPW) will improve quality of care delivered to patients who undergo coronary revascularization via CABG. As a result of the implementation of the CABG clinical pathway there was a reduction in HAI including central line associated blood stream infection, catheter associated urinary tract infection and surgical site infection. In addition to the reduction of HAI the CABG clinical pathway also presented an initial reduction in the LOS of CABG patients.

Keywords: Coronary artery bypass grafting, clinical pathways, length of stay, Cochrane Effective Practice and Organisation of Care (EPOC) Taxonomy, Relationship Based Care model, BPCI advanced, post-operative atrial fibrillation, CHAD-VAsc2

Background

Quality metrics has been the focal point in the healthcare environment in determining the efficiency, effectiveness, and positive impact of patient care Length of stay (LOS) can be considered a quality metric indicator to measure the effectiveness of the care provided to patients as well as maintaining the financial viability of the organization. The interdisciplinary team's ability to maintain LOS according to a specific primary disease without any negative impact on patient care as well as demonstrating efficiency on managing the clinical diagnosis is considered ideal. In addition to LOS as an indicator of quality of care and efficiency hospital acquired infection (HAI) and patient satisfaction determine whether or not care provided had a positive or negative impact on the quality of care.

With healthcare reform and competiveness of the healthcare system, organizations make a conscious decision to begin the journey to become a Center of Excellence (COE) for a specific disease diagnosis. COEs consists of teams highly skilled experts and are also involved in research and innovation to advance the field. COEs establish guidelines and standards to a specific endeavor (Sugerman, 2017). In the human collective there is an infinite amount of disease and overlapping of disease that plague humanity. The LOS on an organizations financial bottom line can be both positive and negative. A reduction in the LOS by one day decreases hospital cost by three percent (Torabipour, Arab, Zeraati, Rashidian, Sari, & Sarzaiem, 2016). In comparison, a reverse of an increase in the LOS can place a financial burden on the organization. Annually 610,000 people die from heart disease in the United States; coronary heart disease (CHD) is the most common type of heart disease, killing over 370,000 people annually, and 735,000 Americans will have a heart attack and require hospitalization with intervention (Center for Diease Control, 2017). Coronary Artery Bypass Grafting (CABG) is the most common and

primary surgical intervention for coronary heart disease (Torabipour, Arab, Zeraati, Rashidian, Sari, & Sarzaiem, 2016). CABG is considered a high risk and high cost surgery with potential for considerable post-operative complications that can affect numerous quality metrics, including LOS, mortality and re-admission rates, and patient satisfaction. The decision to become a Center of Excellence for Coronary Artery Bypass Grafting can be extremely profitable for an organization if managed clinically and operationally correctly.

Definition of Terms

Currently, the length of stay at a 300 bed tertiary teaching hospital in New York City from January 2017 to July 2017 for 247 CABG cases is 10.6 with an observed to expected (O/E) ratio of 1.05 and excess days of 1.78 days (Tableau, 2017). The hospital-acquired infection rates for January 2017 to July 2017 was surgical site infection (SSI) rate 3.7%, central line associated blood stream infection (CLABSI) rate 1.15% and catheter associated urinary tract infection (CAUTI) rate 1.07%. The benchmark data set forth by the organization is an O/E less than one, LOS of five days, excess days less than 1.46, and HAI rates equal to CLABSI 0, CAUTI 0 and SSI two percent. According to Joshua Singer, Associate Director Decision Support at Mount Sinai Hospital, excess days is determined by the actual performance of the LOS by diagnosis related group (DRG) minus the expected LOS DRG set forth by the Center of Medicare and Medicaid (CMS). The DRGs are patient classification schemes, which provide a means of relating the type of patients a hospital treats (case mix index) and determining payment rates based on the DRG. Case mix index refers to the severity of the illness, prognosis, treatment difficulty, need for intervention and resource intensity (Center for Diease Control , 2010). The LOS is defined as the days that occur between the admission date and the discharge date. The definition of O/E and other important quality definitions, including significance to the metric of

LOS, are explained by Agency for Healthcare Research and Quality (AHRQ, 2017) as the following:

Observed rate equals the observed events over eligible population

Expected rate equals expected events over eligible population.

Eligible population equals for QI indicator the number of a hospital discharges that qualified for the eligible population for that specific indicator.

Observed events equals for each QI indicator, the total sum of events that occurred in the eligible patient population.

Expected events equals for each QI indicator the total sum of events expected to occur for the specific indicator if the hospital had average performance comparable to the reference population considering its case mix index.

If a hospital's observed rate for an indicator is higher than its expected rate (O/E greater than one), then the hospital performed worse than the reference population with an equivalent patient case mix index. If the observed rate is lower than the expected rate (O/E less than one), then the hospital performed better than the reference population for that indicator with an equivalent case mix index (Agency for Healthcare Research and Quality, n.d.).

Surgical site infection is an infection that occurs after surgery in the part of the body where the surgery took place. Surgical site infections can be superficial involving the skin only, other surgical site infections are more serious and can involve tissues under the skin, organs or implanted material (Center for Diease Control, 2017). A central line-associated bloodstream infection (CLABSI) is a serious infection that occurs when a bacteria or a virus enters the blood stream through the central line (Center for Diease Control , 2010). A catheter-associated urinary tract infection (CAUTI) is an infection involving parts the of urinary system, including the

urethra, the bladder, the ureters and the kidneys from prolonged use of the urinary catheter (Center for Disease Control, 2010).

Patient satisfaction is an important and commonly used indicator for measuring the quality in healthcare. Patient satisfaction affects clinical outcomes, patient retention and medical malpractice claims. Patient satisfaction affects timely, efficient and patient centered delivery of quality health care (National Center for Biotechnology Information, 2017). Patient satisfaction encompasses the range of interactions the patients have with the healthcare system, including their care from health plans, and from doctors, nurses and staff in hospital (Agency for Healthcare Research and Quality, 2016). Reporting of patient satisfaction scores is done through Consumers Assessment of Healthcare Providers and Systems (CAHPS). CAHPS surveys ask consumers and patients to report on and evaluate their experiences with health care. The surveys cover topics important to consumers and focus on aspects of quality that consumers are best qualified to assess (Agency for Healthcare Research and Quality, 2016). The CAHPS program is funded and overseen by the AHRQ.

The rationale for the establishment of standardization of care delivered is to reduce the length of stay, the O/E ratio, excess days, HAI, and increase patient satisfaction is multifaceted stemming from internal and external factors placed on the organization. The internal factors include bed capacity management referring to the accessibility of beds for incoming patients (volume), adequate staffing models to staff beds (premium overtime) and the interrelating relationship of HAI prolonging LOS and LOS causing HAI. LOS is a key indicator of hospital resource consumption and is an indicator used to access the technical efficiency of an organization (Torabipour, Arab, Zeraati, Rashidian, Sari, & Sarzaiem, 2016). The external factors include federal regulations from governing federal bodies monitoring the productivity

and over utilization of heath care dollars (Pearson, Kleefiled, Soukop, Cook, & Lee, 2001). Standardization of order-sets, templates, critical pathways or protocols improves compliance with the processes of care, improved patient outcomes, quality and financial performance. Standardization of order-sets, critical pathways and protocols have been found to reduce overall postoperative LOS. (Ballard, et al., 2017) Standardization in general promotes a culture of safety and high reliability (Ballard, et al., 2017) that aligns with the Center of Medicaid and Medicare Services high quality care at lower costs.

The Center of Medicaid and Medicare Services (CMS) along with the Affordable Care Act (ACA) designed legislature and programs to demand an increase in quality of care while decreasing costs, with penalties if organizations fail to be efficient and provide safe patient care metrics. A CMS program designed for decreased cost and increase quality is the Bundled Payments for Care Improvement (BPCI) initiative. The BPCI is comprised of four broadly defined models of care, which link payments for the multiple services beneficiaries receive during an episode of care. Under the initiative, organizations enter into payment arrangements that include financial and performance accountability for episodes of care. These models may lead to higher quality and more coordinated care at a lower cost to Medicare (Center for Medicare and Medcaid Innovation, 2018). In addition to the implementation of BPCI, CMS also has instituted hospital value based purchasing (VBP). VBP adjusts hospitals' payments based on their performance on four domains that reflect hospital quality:

(1) the clinical care domain

(2) the patient- and caregiver-centered experience of care/ care coordination domain

(3) the safety domain

(4) the efficiency and cost reduction domain. Each domain is weighted at 25% of the

total performance score (TPS).

CMS measures cost of care through the efficiency and cost reduction domain to increase the transparency of care for consumers by recognizing hospitals that provide high quality care at lower costs to Medicare (Center for Medicare and Medcaid Innovation, 2018). Ultimately, the internal and external factors of bed capacity, staffing models, HAI, LOS and federal regulations will play a large role in deciding organizational receipt of reimbursement of services, whether an organization receives reimbursement, remains financially viable, and if patients and families will be future consumers of the organization.

Project Description

The contributing factors for the SSI rate of 3.8%, CLABSI rate of 1.15%, CAUTI rate of 1.07%, LOS of 10.6, an O/E ratio of 1.05 and 1.85 excess days are numerous and relate to both system and human process issues as well as the overlapping of both. The human process of delivering care to the CABG patient requires education and expertise of the interdisciplinary team regarding the disease treatment and care plan and knowledge of potential postoperative complications. Having the interdisciplinary team understand the required tasks of care and specific tasks to be performed by specific interdisciplinary members on a daily basis to progress patients through the postoperative recovery phase is the cornerstone of quality of care. The different preferences of the clinical providers in clinical management often produce variations in care and deviation from evidence-based practice and guidelines, thus creating confusion amongst the interdisciplinary team regarding the tasks to be performed.

Patients and families not participating in the disease process or in activities to progress through the recovery phase and not having patient family focus can create a separation between the patient and the interdisciplinary team. Miscommunication between the interdisciplinary

teams regarding the care of plan and not having defined team roles leads to errors and missed opportunity to provide care. Communication is a key indicator and mainstay for how information is translated and understood; having a seamless way of communicating knowledge and intent of the communication is essential for a productive efficient recovery phase.

System processes provides structure to the human process; system processes refer to policies, protocols, guidelines, standardization tools and technological support. The framework of the policies, guidelines and protocols describes the knowledge, the appropriate tasks and delineates the scope of practice between the interdisciplinary teams. Technological support reinforces policies, protocols and guidelines in an organized manner easily accessible by the interdisciplinary team. Technology establishes a forum for retrieving and documenting progress, alerting the interdisciplinary team on the next phases of treatment, provides a mechanism for systematizing orders and a reporting system to collect data to measure compliance. The synergy between the human component and the systems component creates an environment that is protective of patient safety as well as promotes efficiency with an overall decrease in cost management. The disconnect of the human and the system components leaves the organization in a vulnerable state of inefficiency, unproductiveness and unsatisfactory outcomes translated by prolonged LOS and other patient safety quality metrics (King, Battles, & Baker, 2008) & (QSEN Insititue , 2017).

Increase in LOS, O/E ratio, and excess days, and HAI of CABG patients often include faulty mechanisms in both human and system processes. When considering the intrapersonal variability associated with processes specifically related to cardiovascular surgery, there is often high variability among surgeons' preference in the clinical management of patients. Surgeon preference may vary in key aspects in the clinical management including, but not limited to,

medication management, discontinuation of no longer needed therapies, and transitions of care decisions, including appropriate timing of discharge for patients.

Examples of surgeon mediated variation of medication management include the time frame of when to initiate aspirin, P2Y12 inhibitors, beta blockers, diuretics, and the titration of vasoactive medications, narcotics and insulin. The variation continues in specific clinical management tasks including chest tube removal, compression bandages, sternal dressings, invasive lines (central lines, a-lines, cordis and pulmonary artery catheters), pericardial wires, indwelling bladder catheters, fast track extubation of patients, and discontinuation of prophylactic antibiotic therapy.

The development and communication of patients' daily treatment/care plans occurs in morning interdisciplinary rounds. Currently, morning interdisciplinary rounds are not a structured streamlined process; the information regarding patients is not presented in a clear and concise manner. Participants in morning rounds do not have clear defined roles, and the plan is often unclear, vague and open to interpretation. The fragmentation and disorganization of the communication in interdisciplinary rounds results in key aspects of patient care to be not performed or performed incorrectly. This can lead to medical errors, delays in treatment plans and removal of devices, which causes the chain reaction of increasing needless utilization of central lines and indwelling bladder catheters, thus leading to higher HAI and LOS and lower patient satisfaction rates.

During this sensitive time of communication where patients' treatment plans are reviewed, revised and discussed, nursing involvement is often inadequate. The lack of nursing involvement stems from the nursing shift starting at 7:30 AM and interdisciplinary rounds starting at 7:00 AM. A nurse not being intimately involved in knowing or participating in the

development of care plans for patients creates a disservice in the patients' care.

The interdisciplinary team requires systems support of policies, protocols and guidelines with technology to guide the interdisciplinary team through the complex clinical management of CABG patients. The current technology embedded in the organization is a primitive electronic medical record (EMR). The EMR has limited reporting functionality, and an inability to supplement innovative functions and progression within the system or collating order-sets. The deficiencies continue with the current documentation process at the institution. Currently, some records are maintained within the EMR system; however, other records still require the need for paper documentation. Paper documentation can prevent the interdisciplinary team from accurately trending data during the clinical course of the CABG patient.

The strategic development of an organized and standardized approach to the clinical management of CABG patients a multidisciplinary approach. The strategy to improve human and system processes will focus on eliminating preventable variation in clinical management and focus on the "right care at the right time" with the adaptation of a CABG clinical pathway. The CABG clinical pathway describes the "right care at the right time" as it pertains to the management of medications, tasks and orders that need to be delivered in a specific sequence during the course of the hospitalization. The operational description of a clinical pathway includes:

1. A structured multidisciplinary care plan
2. Translation of evidence into local structure and practice
3. Interventions detailing the steps in the course of treatment
4. Timeframes or criteria based progression
5. Standardize care for a specific clinical problem or episode of care for a specific

population (Lawal, et al., 2016).

In conjunction with the CABG clinical pathway, the development of protocols and policies will guide the interdisciplinary team through a step-by-step explanation of the pathway components to be completed and will assist in team leaders assigning tasks to the appropriate team member. The protocols and policies developed will incorporate all aspects of the cardiac surgery department from the administrative, the provider and to the nurse. The nurse driven protocols and policies incorporate evidenced-based practical skill sets requisite of those providing care in milieus that offer medical care for cardiovascular surgery patients. Procedures and/or processes that have a direct impact on LOS are most often selected for policy and protocol development. One example would be fast track extubation. Fast track extubation can often decrease LOS by two days, and activities such as ambulatory and incentive spirometer utilization can significantly lower LOS (Zevola, Raffa, & Brown, 2002).

The opportunity to upgrade the EMR also has an impact on how the CABG pathway transcends as the framework of clinical management and practice. The clinical pathway was introduced as paper; paper has limitations on tracking compliance, being user friendly and being productive based on observations and feedback from staff. The electronic form of the clinical pathway will trigger alerts and reminders to the interdisciplinary team regarding individual tasks that need to be completed or initiated to ensure the right care at the right time. The formation of pre-programmed order sets will augment the meaningful use of the clinical pathway in electronic form. The order set includes lab, activity level, electrocardiogram, vital signs, incentive spirometer utilization and chest physical therapy, wound care, antibiotics for 48 hours, social work and physical therapy consults. The clinical pathway provides disease management; however, the clinical pathway would not be complete without a patient-family focus on care. The

formation of a patient-centric clinical pathway incorporates specific patient goals and tasks needed to foster optimal outcomes. The electronically formatted clinical pathway will have compliance reporting mechanisms for individual tasks within the pathway. There will also be options to provide rationale for noncompliance, including patient medical condition necessitating deviation, patient noncompliance, as well as the opportunity to write in other rationales. The success of the CABG pathway is truly becoming an interdisciplinary team with a heart team approach to patient care.

The initiation of the CABG clinical pathway will transform the heart team's interpretation and approach of clinical management of CABG patients. The CABG clinical pathway ensures clinical decisions are based on evidence-based practice, and provides a clear framework of treatment plans, for the CABG patient for the heart team to follow.

Goals and Objectives

The successful implementation of a CABG clinical pathway yields a seamless framework of clinical management for eligible CABG patients, with limited variation in practice. Eligibility of a CABG patient to be placed on the pathway is determined by the patients' clinical course. Patients that are not eligible for the clinical pathway are due to, but not limited to the utilization of balloon pumps, Extracorporeal Membrane Oxygenation (ECMO), Nitric Oxide and patients with a long complicated postoperative course. A process map of the "right care at the right time" decreases variation by standardizing the objectives to be completed, decreasing medical mistakes and miscommunication. Positive outcomes can be obtained when improving the reliability of care to ensure patients receive evidence- based interventions (Borget, Goossens, & Dongelmans, 2015). The CABG clinical pathway enhances communication among interdisciplinary team members by highlighting objectives, goals, and tasks to be achieved every day during the course

of the hospitalization, which minimizes confusion regarding what should be done. The effectiveness of enhancing communication between the interdisciplinary team, the decreasing in medical errors and the decreasing in variation of the clinical management is expressed in the improvement of measurable patient outcomes, increased patient satisfaction, decreased HAI and decrease in the length of stay, O/E and excess days. The patient specific outcomes highlighted for CMS pay for performance coincide to be a direct indicator of positive or poor quality of care provided by the organization.

Prior to the introduction of the clinical pathway into practice, administrative and clinical leadership engagement is necessary to facilitate true cultural and clinical change of practice within the heart team. A presentation can be made for the need for human technological resource investment for both radical and immediate change. To depict the reasons for immediate change and investment of human technological resources will be based on current state of quality metrics in comparison with the benchmark and the vision of the progression of the cardiac surgery program The importance of the support of the executive can determine if an initiative is accomplished and establishes the milieu for the organization.

A clinical pathway committee is formed with a representative from each of the heart team disciplines to review, revise, critique and formulate an efficient pathway for meaningful utilization. The success of the clinical content of a CABG clinical pathway is incorporating the best practices into one document with specific sequencing of the timing of tasks. The committee will not only develop the pathway itself but will also develop the adjuncts to the pathway, the order sets, the protocols and the policies. Once consensus regarding the best practices has been achieved by the heart team committee, the content of the pathway is complete. The heart team committee roles change from policy pathway designers to champions of the pathway to ensure

the utilization and sustainability of the pathway into every day clinical practice. The next steps are partnering with the informatics/EMR team to translate the content of the pathway into a meaningful program within the EMR with the functionality of a reporting tool, a flow diagram framework and connecting the pathway to the providers' orders.

The initial introduction of the pathway, including what its intent and content, will require a well-developed introduction from the pathway committee to the rest of the heart team members The importance of the interdisciplinary heart team's engagement for the utilization and introduction of the pathway to every day clinical practice is as equally, if not more so, significant as the engagement of the executive leadership and team. The interdisciplinary team embracing the clinical pathway into every day practice are the change agents responsible for fostering efficient clinical management, positive outcomes, standardization of patient care, and ultimately the success of the clinical pathway as a crucial clinical instrument for optimizing care, thus ultimately improving team dynamics and communication.

Creating awareness of the CABG clinical pathway can be achieved through cardiac surgery programmatic data and outcomes transparency. The performance as a heart team and the significance of why change is required will be reflected in this data and outcomes. The content of the clinical pathway can be shared to the heart team as educational material presented in staff meetings, huddles and in-services provided by the heart team champions. In addition to the presentation of the clinical pathway by the heart team champions, an opportunity for the interdisciplinary heart team to make suggestions, revisions and feedback establishes a milieu that all members have input and share the process of CABG pathway implementation. The conversion of the paper clinical pathway into an electronic program in the EMR will be essential for a means of tracking and trending progress, collecting data and comparing the data to the

outcomes. The end goal and objectives of the CABG clinical pathway is to have a computerized standardized tool based on evidence based practice and guidelines utilized by the interdisciplinary team to promote the "right care at the right time" to improve the clinical management and outcomes for patients undergoing CABG surgery.

Project Significance

The nursing discipline is the back bone of the interdisciplinary team connecting disciplines in accordance to patients' needs, systematizing plans, assuring treatment plans are completed, elevating the patient to the center of care and protecting the patient from harm. Nursing is the only discipline that has direct consistent contact with patients 24 hours per day-seven days a week. The nursing process is an orderly systematic manner of determining patients' health statuses specifying the problems, initiating and implementing plans to solve them and evaluating the extent to which the plan was effective (Johny, Moly, Pa, & Nair, 2017). The implications and impact of a CABG clinical pathway for standardizing and organizing clinical care on the nursing process has a multi-prong effect. The clinical pathway for the cardiac surgical nurse provides an educational framework of time and goal oriented nursing and provider interventions to be provided for the patient. The clinical pathway can support the nurse in advocating for the patient by having standardized evidence-based interventions sanctioned by the interdisciplinary heart team to deliver reliable and dependable quality care. The instituting of nurse driven protocols and policies as an adjunct to the clinical pathway allows the advancement of nursing practice and autonomy in nursing practice. Nursing can utilize the pathway as a tool to organize and connect care between the interdisciplinary team and utilize the clinical pathway as a tool to ensure care is performed and not omitted as well as maintain patient safety.
Clinical pathways, policies and protocols discourage disputing and undermining of team

members related to predetermined interventions and framework for the course of clinical care promoting a collaborative and collegial interdisciplinary team. The increase in collaboration and collegiality of the interdisciplinary team improves the work environment, elevates the staff morale and promotes competent care (Edick & Whipple, 2001). The clinical pathway, policies and protocols allow nurses' voices to be heard and have equal weight in an environment that is not always conducive or pro-nursing.

Literature Review

A dynamically changing healthcare system has placed pressure on healthcare organizations to become creative and innovative through quality improvement initiatives to remain financially viable while producing positive patient outcomes. This optimization of patient outcomes and quality improvement has become a strategic goal of managing disease processes and hospital admissions. The focus on quality improvement initiatives has been on standardizing care of specific patient populations with specific diagnosis with the hopes of containing costs and providing quality care for the specific patient population. CABG has been a targeted diagnosis to apply standardization of clinical care related to coronary artery bypass grafting's high-risk nature, high volume and being a high cost surgery with postoperative complications that have the potential to prolong LOS (Johny, Moly, Pa, & Nair, 2017). With the high-risk nature and the high cost of CABG procedures optimizing LOS is a promising alternative for cost management and efficient consumption of hospital resources (Torabipour, Arab, Zeraati, Rashidian, Sari, & Sarzaiem, 2016).

According to Edick et al. (2001), managing clinical care with clinical pathways can be a successful venture if pathways are incorporated into a comprehensive performance improvement process. Clinical pathways are most commonly initiated as an effort for cost containment, but

they can also evolve as a force for outcome orientated improvement. The cornerstone of clinical pathway objectives includes improving clinical outcomes and functional health status, increasing client satisfaction, as well as decreasing utilization and costs. Clinical pathways incorporate concise clinical objectives with goal oriented measurable metrics. Measurable metrics include decreased cost per case through the reduction of the average LOS and resource consumption, standardized clinical process to reduce variation in care, improved discharge process through the reduction of discharge delays with an improvement of patient and family care plans and an improvement of patient outcomes through real time quality monitoring.

Lawal et al. (2016) also described clinical pathways as a means continuous quality improvement to highlight patient safety issues and substandard care. The conceptualization of clinical pathways is to be implemented for specific groups with pre-specified criteria. The purpose of the implementation of the clinical pathway is to reduce pre-identified variations in patient outcomes, improve patient satisfaction by informing patients and families regarding the clinical course of care and minimize organization costs. The most prevalent strategy healthcare organizations utilize to manage source utilization and maintain quality of care is the utilization of clinical pathways or critical pathways (Lawal, et al., 2016).

According to Pearson et al. (2001) clinical pathways are guidelines for managing patient care with specific sequencing and timing of care connected to physician and staff actions to promote optimal efficiency. Johny et al. (2017) discussed clinical practice guidelines (CPG) as quality improvement instruments utilized for maintaining quality, minimizing cost and improving outcomes. Johny et al. (2017) also posit clinical practice guidelines are applied more effectively to a surgical diagnosis related to the predictable of the surgical patient population as oppose to the medical patient population.

The themes of the literature review reinforce the usage of clinical pathways in mainstream clinical care of patients in a specific diagnosis group to improve quality of care, maintain costs, creating an efficient healthcare organization and increasing patient satisfaction. The dimensions for an accurate meaningful clinical pathway to successfully produce positive patient outcomes and provide cost containment in a specific disease population requires interventions based on the flow of the disease process and having a mechanism in place to implement and to sustain the pathway in clinical practice. Lawal et al. (2016) recognized the challenges of the conceptualization, implementation, evaluation and sustainability of the clinical pathways. Through a systematic review, Lawal et al. (2016) initiated the development of a practical operational definition for the clinical pathway. The practical operations of the clinical pathway are a multidisciplinary care plan with translation of the guidelines or evidence into local structures detailing time-oriented interventions pathway, algorithm, and guideline protocol into a criteria-based progression.

Pearson, et al. (2001) explained clinical pathways as sequencing the timing of physician and staff interventions to progress the course of treatment and prompt providers to perform the proper test and treatments for the diagnosis. Johny et al. (2017) defined CPG as a systematic development of statements to assist providers and patient decisions about appropriate health care for specific health issues. The CPG is an organizational tool that stipulates to the providers a blue print that integrates medical treatment protocols, nursing care plans, and activities of allied health professionals into a single care plan, which clearly defines expected progress and outcomes of a patient throughout the hospital stay on a day to day basis. The goal of the CGP is to ensure the essentials of care are performed on time and resources are utilized appropriately. Zevola et al. (2017) expanded on the definition of the clinical pathway with the incorporation of

protocols into the CABG clinical pathways. The protocols in conjunction with clinical pathways outlined specific procedures for the CABG population including early extubation, early ambulation, changes in sedative mediations, prophylactic medications for dysrhythmias and gastrointestinal health. Zevola et al. (2017) also highlighted the importance of preprinted physicians' orders (order sets) that paralleled to the care design to assist with the compliance of the clinical pathway. The preprinted orders outlined all therapies, laboratory blood work and medication that are required for CABG patients.

Once clinical objectives, order sets and timeframes are determined for a diagnosis specific clinical pathway, the next steps are implementation and sustainability of the utilization of the pathway in everyday management of the patient. Edick et al. (2001) proposes implementation and sustainability of the clinical pathway by conducting in-services, distributing email to physicians who could potentially utilize the pathway, marketing communication tactics such as physician and employee newsletters, storyboards and employee forums. The process of streamlining paperwork to prevent double documentation was imperative to create compliance and adherence to utilizing the clinical pathway. Strong executive leadership sponsoring the utilization of the pathway was the single most powerful indicator affecting the outcome and compliance of the clinical pathway.

Implementation of the clinical pathway into the daily workflow of the interdisciplinary team is the most challenging next phase of implementation process. A systematic approach for introducing the educational content and streamlining a process to incorporate the content into the daily workflow requires known strategic tools as well as buy-in from the human perceptive to propel the clinical pathway into effectiveness and meaningful use. Borget et al. (2015) discusses utilizing various strategies for implementation of clinical pathways and categorized the strategies

using the taxonomy developed by the Cochrane effective practice and organization of care group (EPOC). Professional interventions included, but not limited to, distribution of educational materials, educational meetings, local consensus process, educational outreach visits, local opinion leaders, audit and feedback (AF) and reminders. Patient interventions include specific targeted patient -family interventions. Organizational interventions include revision of professional roles, clinical multidisciplinary teams, skill mix changes, continuity of care and satisfaction of the providers. Structural interventions include changes in the medical record system for documentation of the clinical pathway.

Measuring compliance of clinical pathways is to ensure all elements are performed on every eligible patient unless medically contraindicated using the all or none (AON) approach. The AON measurement calculates the percentage of all indicated elements of the clinical pathway patients actually receive; the composite measurement can be calculated as a ratio between care that was actually given divided by the care that should have been given. Item by item which presents the nominator and denominator of each element of the clinical pathway separately and the lowest level of compliance which means that the lowest level of compliance to one of the elements is considered as the total clinical pathway compliance (Borget, Goossens, & Dongelmans, 2015). The impact of utilizing a cardiac surgery clinical pathway according to Zevola et al. (2002) on the metric of the LOS revealed a reduction of LOS from 11.1 days to 7.7 days; in addition to the decrease in LOS, there was a cost decrease of $1,181 per patient. There was also a reduction in hours of intubation from sixteen hours to seven hours, reflected in a metric created by the Society of Thoracic Surgeons (STS) (The Society of Thoracic Surgeons, 2018).

Zevola et al. (2002) also found clinical pathways, protocols, and standing orders sets assist with organizing patients' care and eliminating variations in care created by providers' preferences. Edwick, et al. (2001) recognized clinical pathways would not be successful unless the value is evident to the clinical team. Nursing staff must be able to utilize the care path as the patient's care plan, and physicians must use the clinical pathway for standing orders. Edwick et al. (2001) also recognized organizations that provide this recommended level of support toward clinical pathway implementation and utilization will undoubtedly notice improved patient outcomes with lower costs of care. Johny et al. (2017) also resonated previously results of the utilization of pathways in post CABG patients. Johny et al. (2017) provided a study that produced statistically significant improvement in the quality of nursing care and with patient satisfaction with the implementation of CPG. Cited in this study was a quasi-experimental pre/posttest designed by Velasco, Ko & Rosenger at New York Presbyterian Hospital –Cornell Medical Center to compare outcomes, LOS and cost effectiveness between the clinical pathway and the conventional care groups who undergo CABG. The results of the study showed that when clinical pathways are utilized for patients who undergo CABG surgery, the patients' LOS dropped from11.1 days to 7.7 days (+/-1.5 days), which was statistically significant ($p=0.002$) with a cost saving of $1181 per patient. Therefore, it can be generalized that clinical utilization of the nursing process and availability of clear guidelines can improve the quality of nursing care as well as improve patient outcome.

The relationship between clinical pathways, the quality of care, positive outcomes and length of stay with CABG patients cannot be discussed without special emphasis regarding the impact of atrial fibrillation within this patient population. The identification of patients at high risk for developing atrial fibrillation and the management of atrial fibrillation needs special

consideration in the clinical pathway of the CABG patients. According to Echahidi et al. (2008), the incidence of post-operative atrial fibrillation (POAF) is approximately 30% after isolated CABG, 40 % after valve replacement or repair and 50% after combined procedures. POAF usually occurs within day two and day four after cardiac surgery, with a peak incidence on day two. Hospital mortality and six-month mortality were significantly higher in patients in whom POAF occurred (Echahidi, Pibarot, O'hara, & Mathieu, 2008). Furthermore, the impact of POAF on hospital resources is substantial and was estimated to increase LOS by 4.9 days and accrue additional cost per patient between $10,000 to $15,000.

Hashemzadeh et al. (2013) also documented a prolonged ICU stay 6.16 +/-7.36 with patients who developed atrial fibrillation vs. 3.79 +/-3.71 with patients who did not develop atrial fibrillation. They also identified hospital mortality was significantly greater in patients who developed POAF (8.2% POAF vs. 2.1% no POAF). The sequelae of POAF according to Mathew et al. (2004) are a greater incidence of renal failure, cognitive changes and infections affecting length of stay and resource consumption.

To circumvent the negative outcomes that occur with the development of POAF, the devising of an evidence-based method to identify high-risk patients and having a proven prophylactic regimen for high-risk patients include in the CABG clinical pathway is essential. Echahidi et al. (2008) identified risk factors for the development of POAF. The risk factors are categorized into three components: pre-disposing factors, intraoperative factors and post-operative factors with a set of triggers (Table 1).

Hashemzadeh et al. (2013) and Matthew et al. (2004) also identified the same risk factors for the development of POAF with the additional risk factors of smoking, renal dysfunction, aortic cross clamp times and inotropic usage. Quantifying the risk factors into a scoring system

with a validated tool to determine the patients at the highest risk and who are deemed appropriate to receive prophylactic treatment was discussed in a prospective risk stratified study by Chua et al. (2013). Providing prophylactic treatment in all patients to prevent POAF is not cost effective and treatments may have adverse effects. The utilization of the CHADS2 and CHA2DS2-VASc (Table 2) scoring system is a predictor of postoperative atrial fibrillation after cardiac surgery in separate multivariate regression analysis. The Kaplan-Meirer analysis obtained a higher POAF rate based on the CHADS2 and CHA2DS2-VASc scores of at least two than when based on scores less than two. A CHADS2 score of at least two was associated with a 36% risk of POAF; furthermore, a CHAD2DS2-VASc score of three can have a POAF rate as high as 44 %.

Prophylactic treatment options for the prevention of POAF are numerous and overarching from beta-blockers, amiodarone and HMG-CoA reductase inhibitors medications. Echahidi et al. (2008) examines additional medications and modalities in the prevention of POAF with the utilization of calcium channel blockers, magnesium, N-3 polyunsaturated fatty acids (PUFA), anti-inflammatory agents and atrial pacing in addition to beta-blockers, amiodarone and HMG-CoA reductase inhibitors. Special consideration is given to the efficacy and safety of amiodarone demonstrated by the PAPABEAR (Prophylactic Oral Amiodarone for the Prevention of Arrhythmias that Begin After Revascularization, Valve replacement or repair) trial. In this large-scale study, a thirteen-day perioperative course of oral Amiodarone was tolerated and effective for prevention of POAF. Give citation information of study

In conclusion, CABG clinical pathways focus on methods to prevent POAF, protocols for early extubation, protocols for early ambulation, standing providers' orders outlining all therapies, laboratory blood work and medication within a time frame that can standardize care for CABG patients, while also improving outcomes, quality of care, LOS. With all performance

improvement initiatives, there is a requirement of human resources to drive the initiative along with a systematic approach of implementation. The components of the systematic approach include education, a system of audit and feedback and technology to tie the human component and the theory component together for effectiveness of the CABG clinical pathway.

Table 1

Postoperative Atrial Fibrillation Risk Factors

Predisposing risk factors	**Intraoperative risk factors**	**Postoperative risk factors**	**Triggers**
Advanced Age	Surgical atrial injury	Volume overload	Atrial premature contraction
Hypertension	Atrial injury	Increased afterload	Electrolyte Imbalance
Diabetes	Pulmonary vein vent	Hypotension	
Obesity	Acute volume changes		
Metabolic syndrome			
Left atrial enlargement			
Diastolic dysfunction			
Left ventricle hypertrophy			

(Hashemzadeh & Dehdilani, 2013) (Mathew, Fontes, Tudor, Duke, Mazer, & Barash, 2004)

Theoretical Framework

The theoretical framework utilized for this project is the relationship based care model (RBC). The relationship based care model is predicated on Peplau's middle-range nursing theory of interpersonal relations and Watson's theory of human caring or the caring model (Koloroutis, 2004). The RBC is a delivery system in which the patient and family are the central focus of the relationship and is structured on seven principles:

1. The caring and healing environment pertains to the physical environment and the interactions with the interdisciplinary team delivering care as the immediate context for the patient's experience. Caring and healing cultures are those in which there is a palpable, visible regard for human dignity, and where the relationships between the members of the health care team, and the people they serve are built on mutual respect and a shared commitment to healing (Koloroutis, 2004).
2. Leadership represents the leaders within all the members of the interdisciplinary team, thus creating an environment in which people take conscious ownership for their work while contributing to the mission of the organization (Koloroutis, 2004).
3. Teamwork requires the interdisciplinary team to focus on a shared mental model. In healthy and productive teams, each member contributes his or her unique knowledge and skills within a clearly defined scope of responsibility, authority, and accountability (Koloroutis, 2004).
4. Professional nursing practice requires nurses to embrace the responsibilities of professional practice, holding to a set of technical and ethical standards, ongoing self-improvement, and accountability for autonomy. The six practice roles of professional nursing practice within the context of the RBC are: sentry, guide, healer, collaborator, teacher, and leader. The professional nursing practice imparts nurses a fierce voice in commitment to the values of caring, advocacy, collaboration and safety of the patient (Koloroutis, 2004).
5. Patient care delivery system is an infrastructure for organizing and providing care to patients and families. The patient care delivery system is built upon the concepts and values of both relationship-based care and professional nursing practice. The purpose

of the patient care delivery system is to establish a therapeutic relationship between nurses and their patients during an episode of care, to accomplish essential nursing interventions, to maximize collaborative and interdisciplinary practice. The patient care delivery system provides the structure to support the role of the professional nurse, promotes collegial relationships among the interdisciplinary team, provides structures to organize work, is policy driven and effectively utilizes resources (Koloroutis, 2004).

6. Resource-driven practice focuses on resources available for the patients' clinical care and the prioritization of the resources for the greatest impact on the patients' (Koloroutis, 2004).
7. Outcomes are measurements of meaningful data to follow the trajectory of the progress of patient care provided and to serve as motivation for leaders and practitioners to improve the clinical management provided (Koloroutis, 2004).

In addition to the RBC theoretical framework, taxonomies will also be utilized as a framework for the implementation of this project. Taxonomies have been successfully used in healthcare to describe, classify, and organize items based on shared characteristics (Cochrane Efecctive Practice and Organisation Care, 2018). A taxonomy of implementation strategies will provide a standardized framework for the consideration of strategies to improve the uptake of evidence into practice. Implementation strategies are defined as purposeful procedures to achieve clinical practice compliance with a guideline recommendation and effective implementation strategies are necessary for improving the use of clinical practice guidelines (Mazza, Chakroborty, Vanhecke, Grech, & Kunnamo, 2013). Numerous topic-specific taxonomies of implementation strategies have been reported in the literature; however, their specificity prevents

them from offering a comprehensive view of strategies for effective guideline implementation. An additional tool that provides a broad guidance on implementation strategies is the effective practice and organization of care checklist (Mazza, Chakroborty, Vanhecke, Grech, & Kunnamo, 2013).

The EPOC focus is a review of interventions designed to improve professional practice and the delivery of effective health care services. Interventions include various forms of continuing education, quality assurance projects, financial, organizational or regulatory interventions that can affect the ability of the healthcare professional to deliver healthcare services more effectively and efficiently (Mazza, Chakroborty, Vanhecke, Grech, & Kunnamo, 2013). The EPOC checklist enables considerations of combination of factors involved in the implementation by distinguishing between four domains: professional strategies, organizational strategies, financial strategies and structural strategies (Mazza, Chakroborty, Vanhecke, Grech, & Kunnamo, 2013). The EPOC taxonomy utilized will have four domains of professional strategies, organizational strategies, patient strategies and structural strategies for the implementation of the project (Table 3).

Table 2

Explanation of the Implementation Strategies using the EPOC Taxonomy

Professional interventions	
Distribution of education materials	Copies of pathways distributed and laminated copies on work station
Educational meetings	In-services and huddles conducted regarding CPW
Local consensus process	See attached appendix A CPW
Education outreach visits	Nurse manager appointed to discuss CPW
Local opinion leaders	Executive leadership: Chairman of cardiac surgery and Nurse manager of Cardiac surgery ICU
Audit and feedback	Dashboard created compliance and LOS data
Reminders	Checklist (table 3) CPW (see appendix A)

Patient intervention	
Patient-family intervention	CPW specific for patient related goals at bedside (see appendix B)
Organisational intervention	
Revision of professional roles	Additional competencies given (see attached Appendix D)
Clinical multidisciplinary teams	Daily rounds at 7am RNs to attend
Skill mix changes	Hiring more nurse practitioners
Continuity of care	
Satisfaction of providers.	Charge nurse champions
Structural intervention	
Changes in the medical record system	Transitioning CPW from paper to Epic

Adapted from (Borget, Goossens, & Dongelmans, 2015)

The uniqueness of the CABG clinical pathway with the defined objectives and goals fit the theoretical framework of the RBC model seamlessly; moreover, the components and objectives of the clinical pathway tie into the seven principles of the RBC model. The clinical pathway promotes leadership and teamwork by defining roles and objectives to be accomplished with the competencies for the objectives. The principles of the professional nursing practice and patient care delivery system is achieved through the organized infrastructure of clinical pathways by having nurse driven protocols that promote autonomy and promote self-improvement to strengthening the nurse to patient relationship and to strengthening the collaboration with the interdisciplinary team. Having the standardization of clinical management of the clinical pathway provides efficient utilization of resources and promotes measurable metric outcomes such as HAI, patient satisfaction, and LOS. The result of the introduction of the clinical pathway is to create a caring and healing environment where patients feel safe, cared for, and are returning back to a normal or improved state of health and wellness.

Methodology

Approval Process

The implementation project site is Cardiac Surgery Intensive Care Unit in New York, New York. Permission was granted for the project on this site was given by Dr. John Puskas, Chair of Cardiac Surgery and Beth Oliver, System Vice President of Cardiac for Mount Sinai Health System. The practice site person serving on the scholarly project is Laura Mansfield and for Seton Hall Dr. Maryellen Roberts. This project was deemed a quality improvement project and did not require Institutional Review Board (IRB) approval. Ms. Mansfield has extensive experience with quality improvement programs and initiated and sustained many successful projects with positive outcomes.

A SWOT analysis was created as part of the CABG clinical pathway implementation process to understand the internal strengths and weaknesses and external threats and opportunities of the cardiac surgery program in having a successful quality improvement project. Along with the SWOT analysis a risk management matrix was created to assist the clinical pathway committee to focus on resources and create contingency plans for obstacles. Identification of the risks and benefits were based on feedback from the interdisciplinary team

Implementation

Phase I Organizational Readiness

In 2016, a health system executive decision was made to terminate the cardiac surgery program on the Lower East Side campus and to relocate the entire cardiac surgery program to the Upper West Side campus. The determination was financially motivated to merge two smaller cardiac surgical programs and produce one larger cardiac surgical program in the hopes of condensing resources and becoming more financially viable. In addition to the merging of the two cardiac surgical programs, there was also a focus on becoming a Center of Excellence for coronary revascularization focusing all efforts and investments in CABG.

One manifestation of the organization's interests in becoming more financially viable, an exploration in participating in CABG bundles bundled payments for care improvement (BPCI) advanced. However, based on the performance of the cardiac surgical team in terms of LOS, HAI and patient outcomes, this venture proved unsuccessful. BPCI in 2018 was to be a mandatory program defined as a target price of reimbursement for an episode of hospital care plus 90 days; however, BPCI has changed to a voluntary program. BPCI advanced with an uncertainty in the upcoming years to reverse back to a mandatory program. In an effort to remain ahead of the curve and to become a Center of Excellence, the method in which clinical care was rendered required altering. The transitioning of the cardiac program and the merging of resources created a relatively new program with exponential growth in volume, but lacking the foundations of clinical care, policies, protocols, team dynamics and communication.

Phase II Support from Stakeholders

The Chairman of Cardiac Surgery and the Vice President of Cardiac Services for Mount Sinai Health System and the interdisciplinary team supported the implementation of clinical pathways with adjunct policies, protocols and orders based on the current data of the LOS and hospital acquired infections. The roles of the stakeholders varied, but each played an integral part in the success of the initiative and its evaluation. Stakeholders are able to implement strategies, collaborate with other members of the interdisciplinary team and also offer feedback as to what works and what does not work with suggestions for improvement for a successful initiative.

Phase III Initial Implementation

The initial implementation required the development of a committee of the vested stakeholders to come together to create the clinical pathway, policies, protocols and order set to guide the clinical management of CABG patients. The chair of the committee was the Chairman

of Cardiac Surgery and the nurse manager of the cardiac surgical intensive care unit; the members of the committee included another surgeon, a physician assistant, nurse practitioners from both the outpatient setting and inpatient settings, a staff registered nurse, a social worker, a physical therapist, and an intensivist. The committee started to meet in May 2017 and convened weekly to discuss current practice and the data of the quality metrics of the cardiac surgical team. The committee researched best practices of the clinical management of the CABG patient and benchmarked with other cardiac surgical programs for best practices. In a consensus process the formulating of the evidenced-based practice content of the paper clinical pathway, protocols, policies and order-sets were created (Appendix A).

Phase IV Ongoing Implementation Process

From the original committee, a subcommittee was formed to continue the implementation of the clinical pathway and the adjunct initiatives. The subcommittee selected the EPOC taxonomy format to guide the implementation process of the CABG clinical pathway, protocols, policies and order-sets. Professional interventions are the initial introduction the heart team has to the pathways, protocols, policies and order-sets. The information and copies of the paper documentation were disseminated through educational meetings in the form of in-services and huddles provided by the nurse manager; copies of the clinical pathway were laminated and placed within nursing workstations. During the educational meetings, dashboards regarding LOS, HAI, and patient satisfaction will be distributed and posted on the unit with monthly updates on progress. Broadcast emails will be sent out monthly to all heart team members containing the same information giving in the educational meetings.

Organizational interventions focus on nurses by expanding their practice and competencies. The first intervention will be a full-scale educational session with a competency

skills checklist to properly remove central lines, pulmonary artery catheters, and the proper weaning protocol for fast track extubation. The charge nurses will champion the education of the competency of the staff and be the advocators of the clinical pathway. All new recruiting nurses will automatically be trained in those skills and a copy of the pathway, policies and protocols will be provided in the orientation handouts. The next intervention is to have full participation by the registered nursing team at interdisciplinary heart team rounds by changing the start of shift for all registered nurses in the cardiac surgery intensive care unit to 7am. To support the growing volume and the expansion of the cardiac surgery program additional human resources in the way of nurse practitioners will be on-boarded to the heart team.

Structural interventions are technological derived; this section is transitioning the clinical pathway from paper to the EMR. This transitioning from paper to the EMR required the assistance of the EMR team. The subcommittee met with the EMR team on a biweekly basis to organize, categorize, and design how the pathway will be programmed into the EMR. The subcommittee and EMR team translated the clinical pathway, as a worksheet of itemized items that were completed and not completed: a step further any item not completed required a reason why the item was not completed. The rationale for designing the pathway in this manner was to devise a monthly report on compliance of the itemized tasks and also to generate a report on the reasons item tasks were not adhere to further understand and develop quality improvement processes.

In consultation with the EMR team and the subcommittee, order set parameters were also designed to be all inclusive of the standard and required orders. The EMR team was also able to design alerts and reminders if itemized tasks were not addressed in the time frames specified. In the meantime, while the EMR team was constructing the clinical pathway within the EMR, the

subcommittee did not want to lose momentum; therefore, they initiated the clinical pathway into practice. The original committee decided the clinical pathway utilization should occur during interdisciplinary heart team morning rounds. It is during this sensitive time when decisions regarding clinical management occur. However, to initiate a ten-page document effectively and not miss any key points during morning rounds was not feasible. The subcommittee devised a condensed checklist that was goal and provider driven to be utilized during morning round. During the creation the pathway into EMR, the executive leadership decided to extend the production date to April 1, 2018; however, the order sets will be placed in the EMR, but the pathway will remain on paper for now. The final piece of the EPOC taxonomy implementation of the CABG clinical pathway is the patient-family intervention. As healthcare shifts from provider-centric care to patient-family centered care, patients and families need to participate in care and the decision making process to promote health and wellness. Patient and family involvement are essential for quality and safety and can lead to better health outcomes and improved patient and family experience (Institute for Patient and Family Centered Care, 2017).

A condensed version of the CABG clinical pathway was created as a patient-family user-friendly pathway. The patient-family clinical pathway incorporates patient oriented-goals and tasks significant to the patient. Patient oriented goals included on the pathway are ambulation, incentive spirometer usage, bowel regiment, pain management and the time sequence when chest tubes, central lines and indwelling bladder catheters require discontinuing (Appendix E). The patient oriented pathway was designed into a care board and installed in all patients' rooms to facilitate all patients and families being able to continually visualize and know the progress made and the progress that should be made.

Phase V Project Evaluation Process

The quantitative LOS data collection is extracted from Tableau®, a data program based on discharges from the EAGLE admitting system. Prior to the posting of data in Tableau®, the data is processed through Premiere, a third party independent vendor that processes the data through logistic models based on CMS criteria. Tableau® confirms the volume of CABG cases performed, calculates LOS, O/E ratios, and excess days in numerous variations. The display of the data can be formatted by month, individualized surgeon's data, transitions of care, procedure, insurance type, or discharge unit. For the purposes of this project, the display of data utilized incorporates all CABG procedures performed by all surgeons (together and individually) discharged from all units with LOS, excess days and O/E expressed monthly and then expressed accumulated average for all months.

HAIs are measured by data collected by infection control on a monthly basis regarding CLABSI, CAUTI and SSI (Table 8 and Table 9). The CLABSI rate per 1000 central line days is calculated by dividing the number of CLABSIs by the number of central line days and multiplying the result by 1000. (Source for this equation) CAUTI rate is determined by the same method, the CAUTI rate per 1000 indwelling catheter days is calculated by dividing the number of CAUTIs by the number of indwelling catheter days and multiplying the result by 1000 source. In addition to the rule in data collected, infection control monitors device utilization (DU); device utilization refers to the percentage of patients with centrals lines and the percentage of patients with indwelling catheter as it relates to patient days. Source Patient satisfaction scores are measured via CAHPS.

Table 3

CABG PATHWAY CHECKLIST

Day 1
- ☐ D/C Swan, CVP, A-line, Introducer
- ☐ Insert PIVL
- ☐ D/C leg/arm JP drain ☐ D/C leg/Arm wraps
- ☐ Assess the need for Chest tubes
- ☐ Assess the need Foley
- ☐ Diuretic/ Electrolyte replacement
- ☐ Beta-blocker
- ☐ GI prophylaxis
- ☐ Restart pre-op meds ☐Statin
- ☐ Heparin SQ TID
- ☐ ASA 81 for on pump ☐ASA and Plavix for off pump
- ☐ Isordil 10 mg po q8
- ☐ Continue Insulin protocol/transition/Endo Consult
- ☐ PO narcotic
- ☐ Labs
- ☐ Clear liquids/ Continue bowel regimen
- ☐ SW/CM
- ☐ Transfer to 10 east

Day 2
- ☐ D/C Mediastinal CT, Plural blakes
- ☐ D/C wires prior to CT
- ☐ D/C Foley
- ☐ Diuretic/ Electrolyte replacement
- ☐ beta-blocker
- ☐ GI prophylaxis
- ☐ Restart pre-op meds
- ☐ Statin
- ☐ Heparin SQ TID
- ☐ ASA 81 or ☐ASA and Plavix
- ☐ D/C antibiotics
- ☐ Transition off insulin start lantus
- ☐ PO Narcotic
- ☐ Regular diet

Day 3
- ☐ D/C Chest tubes
- ☐ D/C wires
- ☐ Titrate Diuretic/ Electrolyte replacement
- ☐ Titrate beta-blocker
- ☐ ASA 81 ☐ASA and Plavix
- ☐ Transitions Isordil to Imdur 30 mg PO QD
- ☐ Start Tramadol
- ☐ Start discharge planning

Day 4
- ☐ Remove CT sutures leave in for thin robotic patients until office visit
- ☐ Titrate Diuretic/ Electrolyte replacement
- ☐ Medication reconciliation
- ☐ ACE for EF<40
- ☐ RX for discharge pain plan
- ☐ CBC and BMP
- ☐ Assess incision for infection

Day 5
- ☐ Titrate Diuretic/ Electrolyte replacement for weight based
- ☐ Review Med reconciliation
- ☐ Vaccine given and documented
- ☐ Beta-blocker, ASA, Statin, ACE/ARB (EF<40)
- ☐ Antithrombotic if applies
- ☐ Iron for 30 days with stool softener
- ☐ PPI if dual Antithrombotic
- ☐ no labs
- ☐ Discharge before noon
- ☐ refer to cardiac rehab

(Friedman, 2018)

Table 4
Surgical Site Infection (SSI) Rate (2017)

Case type 2017	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2017 ytd
SSI	0	1	0	1	0	0	1	1	0	0	0	0	4
SSI rate	0	3.7%	0	4.35%	0	0	3.6%	3.4%	0	0	0	0	1.29%
CABG	22	27	32	23	22	17	28	29	37	32	22	18	309

Table 5
CLABSI and CAUTI Rates (2017)

Device utilization	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Overall
CVL	56.4	65.3	69.92	69.9	53.31	65.9	63.9	57.3	64.1	55.9	61.6	56.9	61.87
Foley	72.4	73.6	72.36	72.4	69.01	73.4	29.6	75.3	71.8	54.4	64.2	62.8	66.49

	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Overall
CAUTI RATE	0.00	5.13	0.00	0.00	0.00	0.00	15.4	0.00	0.00	0.00	0.00	0.00	1.07
CLABSI RATE	0.00	5.78	0.00	0.00	0.00	6.71	0.00	0.00	0.00	0.00	0.00	0.00	1.15

Project Outcomes

The purpose of this quality improvement initiative was to answer the following clinical question: Can standardizing clinical management through CABG clinical pathways reduce the LOS of CABG patients, increase patient satisfaction, and decrease HAI? The creation and implementation of the CABG clinical pathway with the adjuncts of policies, protocols and orders sets commenced on August 1, 2017. In terms of LOS, when the clinical pathway was first initiated, there was a decline in LOS in August (LOS 8.13 O/E .87) and September (LOS 7.68 O/E .88); however, October and November returned to previous baseline outcomes. The assumptions for the return in baseline data relate to the loss of the momentum of the clinical pathway by the interdisciplinary team. The intervention is reinvigorating the champions to spearhead the utilization of the CABG pathway and to bring the pathway back into the forefront of practice. Also, having the pathway installed into the EMR to assist with data collection and having a reporting option regarding adherence and non-adherence to the pathway is problematic. In addition to the loss of momentum, the attitudes and perceptions of the surgeons play a role in the success of the CABG clinical pathway. According to the LOS data by physician, the second surgeon with the second highest case volume has an average LOS of 12.48 and O/E 1.21. He has expressed negative attitudes and perceptions regarding the CABG clinical pathway. The surgeon does not regularly adhere to the action items on the clinical pathway. As in contrast to the first surgeon with the highest volume with a LOS 9.02 and O/E 0.95 and has positive attitudes and perceptions of the clinical pathway. He also champions the pathway to the interdisciplinary team. However, these behaviors will hopefully adjust once the pathway can be programmed into EMR and become a reporting tool with objective data and compliance rates. During the implementation phase of the clinical pathway, it has become apparent that more than clinical

management affects the LOS, and LOS is not a stand-alone metric. LOS is driven and correlates to the O/E and the excess days. The LOS can be higher than the expected and benchmarked metric of five days; however, if the O/E is less than one and the excess days is less than 1.45, the organization is still efficient and cost effective. The variables that affect O/E and excess day are proper documentation to express the case mix index and proper coding of the case mix index. Standardizing the proper coding and the proper documentation of the CABG patients will be the next focus and addition to the CABG clinical pathway.

In terms of HAI rate when the pathway and the adjunct policies and protocols were introduced in August, 2017, there was a remarkable decrease in surgical site infection to a rate of zero for the months following August leaving the accumulative average for the year to have a SSI rate of 1.26% from a rate that was 3.7% prior to the pathway. The same results were seen for CLABSI and CAUTI after the introduction of the CABG clinical pathway both CALBSI and CAUTI were a rate of zero for each of the months following August with an accumulative average for the year CLABSI 1.15% and CAUTI 1.07%, which has not increased since the initiation of the pathway.

The data regarding the utilization of central lines and indwelling bladder catheters per patient days displays no mark difference in utilization however, increases in volume and average daily censes is not accounted for in the data. If there is a higher volume of cases and a higher average daily census, the expectation would be higher DU, with more patients more devices. DU is not a good indicator whether devices are being removed sooner. Regarding patient satisfaction, the data remained flat with no real changes in patient satisfaction scores except for an anomaly in October where there was a major decrease in the scores. However, the cardiac surgical program

remains the service line with the highest patient satisfaction scores and leads the hospital with positive patient satisfaction scores.

Summary

The DNP project demonstrated that standardizing care for the clinical management of the CABG patient is beneficial on numerous systems levels. The development of the CABG clinical pathway was truly an interdisciplinary approach with input and expertise from all team members. The nurse driven protocols, policies and competencies that promote nursing autonomy in line removal, indwelling bladder catheter removal, and standardization in surgical site care has resulted in a decrease in HAIs. With the continued usage of the nurse driven protocols for central line removal and indwelling catheter removal, there is an expectation to see a marked decrease in DU in future data. The standardization of clinical management had benefits on identification of team roles, as well as having a vision of a shared evidence based practice model of patient clinical management. The CABG patient clinical pathway was the first formalized mechanism to ensure patients and their families are included in the plan of care development conversation and are made aware of what to expect as they progress through each phase of recovery.

Even though patient satisfaction remained flat, the assumption moving forward will be an increase in patient satisfaction scores, especially in the domain of pain management. Initially there was a marked decrease in LOS. O/E and excess days' metrics, however, are trending upwards and a closer scrutiny at what affects the metric of LOS, O/E, and excess days is required. Risk adjusted LOS also needs to be examined and incorporated into evaluation of effectiveness of clinical management, which was not previously done

It was also discovered that excess days was not reported on a monthly basis like the other quality metrics. Variables such as documentation, surgeon engagement and having data

reporting capabilities in the EMR on compliance of the pathway and the individual tasks should assist in understanding what drives noncompliance and assist with improving LOS, O/E and excess days. During the CABG clinical pathway initiation, some of bundles were not initiated at the time of the DNP project; these included fast track extubation and determining patients with high risk of developing atrial fibrillation and treating prophylactically with amiodarone. Once fast track extubation and prophylactic treatment of atrial fibrillation is initiated, there should hopefully be a decrease in LOS. Overall, in its infancy stage, the clinical pathway and the adjunct initiatives have created a change in culture in the clinical management of CABG patients and will continue to benefit patients' outcomes and team dynamics.

References

Agency for Healthcare Research and Quality. (n.d.). *Agency for Healthcare Reseacrch and Quality*. Retrieved January 9, 2018, from Agency for Healthcare Reseacrch and Quality: https://www.aqualityindicators.ahrq.gov

Agency for Healthcare Research and Quality. (2016, October). *Agency for Healthcare Research and Quality*. Retrieved 30 2017, January , from Agency for Healthcare Research and Quality: https://www.ahrq.gov/cahps

Ballard, D., Ogola, G., Fleming, N., Heck, D., Gunderson, J., Khetan, R., et al. (2017). *Agency for Healthcare Research and Quality* . Retrieved Febuary 24, 2018, from Agency for Healthcare Research and Quality : http://www.AHRQ.gov/doenloads/pub/advances2/vol2/advances-ballard_12.pdf

Borget, M., Goossens, A., & Dongelmans, D. (2015). What are effective strategies for the implementation of care bundles on ICUS: A systematic review . *Implementation Science, 10* , 1-11.

Center for Diease Control . (2010). *CDC*. Retrieved December 6, 2017, from CDC: https://www.cdc.gov/hai/ssi

Center for Diease Control. (2017, November). *Center for Diease Control*. Retrieved January 6, 2018, from Center for Diease Control: https://www.cdc.gov/heartdisease

Center for Disease Control. (2010, April). *Center for Disease Control*. Retrieved December 7, 2017, from CDC: https://www.cdc/CLABSI

Center for Disease Control. (2010). *Center for Disease Control*. Retrieved December 7, 2017, from Center for Disease Control: http://ww.cdc.gov/CAUTI

Center for Medicare and Medcaid Innovation. (2018). *Center for Medicare and Medcaid*

Innovation. Retrieved January 10, 2018, from Center for Medicare and Medcaid Innovation: https://www.cms.gov/innovation/initiatives/bpciadvanced

Chua, S.-K., Shyu, K., MIng-Jen, L., Li-Ming, L., Lin, C., Chao, H., et al. (2013). Clincal utility of CHADS2 and CHA2D2VASc scoring system for predicting postoperative atrial fibrillation after cardiac surgery. *The Journal of Thoracic and Cardivascular Surgery, 146* (4), 919-926.

Cochrane Efecctive Practice and Organisation Care. (2018). *Cochrane Efecctive Practice and Organisation Care*. Retrieved January 10th, 2018, from Cochrane Efecctive Practice and Organisation Care: https://epoc.cochrane.org/epoc-taxonomy

Echahidi, N., Pibarot, P., O'hara, G., & Mathieu, P. (2008). Mechanisms, prevention, and treatment of atrial fibrillation after cardiac surgery. *Journal of the American college of Cardiology , 51* (8), 793-801.

Edick, V., & Whipple, T. (2001). Managing patient car with clincal pathways: A practical application. *Journal of Nursing quality , 15* (3), 16-31.

Friedman, S. (2018, March 28). Can standardizing CABG care with clinical pathways to reduce length of stay and Hospital Acquired infections? Unpublished manuscript, Seton Hall University.

Hashemzadeh, K., & Dehdilani, M. D. (2013). Postoperative atrial fibrillatio following open cardiac surgery: Predisposing factors and complications. *Journal of Cardivascular and Thoracic Research , 5* (3), 101-107.

Institute for Patient and Family Centered Care. (2017). *Institute for Patient and Family Centered Care*. Retrieved March 30, 2018, from Institute for Patient and Family Centered Care: http://www.ipfcc.org/about.html

Johny, S., Moly, K., Pa, S., & Nair, R. (2017). Effectivness of nursing process based clincal guidline of nursing care amoung post CABG patients. *International Journal of nursing education*, 120-126.

King, H., Battles, J., & Baker, D. (2008, August). *Teamstepss: Team strategies and tools to enhance performance and patient safety*. Retrieved March 15th, 2015, from NCBI Bookshelf: http://www.ncbi.nlm.nih.gov/books

Koloroutis, M. (2004). *Relationship -Based Care Model A Model fror Transforming Practice.* Minneapolis, Minn: Creative Healthcare Managment INC.

Lawal, A., Rotter, T., MAchotta, A., Ronellenfitsch, U., Scott, S., Goodridge, D., et al. (2016). What is a clincal pathwayy? Refinement of an operational definition to ifdentify clincal pathway studies for a Cochrane systematic review . *BMC Medicine* , 2-5.

Mathew, J., Fontes, M., Tudor, I. R., Duke, P., Mazer, D., & Barash, P. (2004). A multicenter risk index for atrial fibrillation after cardiac surgery. *JAMA , 291* (14), 1720-1729.

Mazza, D., Chakroborty, S., Vanhecke, O., Grech, C., & Kunnamo, I. (2013). Refining a taxonomy for guidline implementaton: Results of an exercise in abstract classification. *Implementation Science , 8* (32), 1-10.

Mount Sinai Heart. (2018, March 28). Can standardizing CABG care with clinical pathways reduce length of stay and Hospital Acquired Infections? Unpublished manuscript, Seton Hall University.

National Center for Biotechnology Information. (n.d.). *National Center for Biotechnology Information*. Retrieved December 10, 2017, from NCBNational Center for Biotechnology Information: https://www.ncbi.nlm.nih.gov/articles

Pearson, S., Kleefiled, S., Soukop, J., Cook, F., & Lee, T. (2001). Critical pathways interventions

to reduce length of hospital stay . *The American Journal of Medicine* , 175-180.

Sugerman, D. (2013). Centers of Excellence . *JAMA , 310* (9), 994-996.

Tableau. (2017). *Tableau*. Retrieved December 15, 2017, from Tableau: https://mountsinai.okta.com/app/tableau/exkbnkod7rDu9KlfG0x7/sso

The Society of Thoracic Surgeons. (2018). *The Society of Thoracic Surgeons*. Retrieved January 15, 2018, from The Society of Thoracic Surgeons: https://www.sts.org/quality-safety/performance-measures

Torabipour, A., Arab, M., Zeraati, H., Rashidian, A., Sari, A., & Sarzaiem, M. (2016). Multivariate analysis of factors influencing length of stay after coronary artery bypass surgery in Tehran, Iran. *Acta Medica Iranica , 54* (2), 124-133.

QSEN Insititue . (2017). *Quality and Safety Educaton for Nurses*. Retrieved October 10th, 2017, from Quality and Safety Educaton for Nurses: http://QSEN.org/competencies/graduate-ksas

Zevola, D., Raffa, M., & Brown, K. (2002). Using clincal pathways in patietns undergoing cardiac valve surgery. *Critical Care Nurse , 22* (1), 31-48

Appendix A
CABG Clinical Pathway

DAY OF STAY	PRE-OP	DAY OF SURG Day 0	POST OP Day 1	Day 2	Day 3	Day 4	Day 5
SETTING	Office/DAS Education regarding disease process and expectations in the hospital • See DAS protocol	COR- CSICU	Transfer to STEPDOWN	STEPDOWN	STEPDOWN Post-op discharge teaching offered 3x/week	STEPDOWN/ DISCHARGE	STEPDOWN/ DISCHARGE
Assessments	• STS score • Pre-op activity assessment (walk freely, climb stairs) • Baseline (dry) weight • BMI • Pedal pulses • Neuro assessment • Confirmation of insurance status • Metabolic screen for at risk patients • SW consult for those patients with lack of social support or social resources	• Head to toe assessment • ROS • 3M Nasal Swap	• Daily morning weight (compare to pre-operative weight – may use weight from pre-op office visit) • Head to toe assessment • ROS • Plan of the day decided before 10 am	• Daily morning weight and I/O data before 7am • Head to toe assessment • ROS • Plan for the day decided and ordered by 8:00am	• Daily morning weight and I/O data before 7am • Head to toe assessment • ROS • Plan for the day decided and ordered by 8:00am	• Daily morning weight and I/O data before 7am • Head to toe assessment • ROS • Plan for the day decided and ordered by 8:00am	• Daily morning weight and I/O data before 7am • Head to toe assessment • ROS • Plan for the day decided and ordered by 8:00am
Drains/Lines/ Wires		• Central line, A line, pacing wires, • Selective use of PA catheters: EF <30%, severe pulm HTN • End tidal Co2 • CLABSI dressing change only if soiled or falls off • mediastinal CT, pleural blakes, Foley	• D/C CVP, swan, A line, introducer, Insert peripheral IV by 9am • D/C leg/arm JP Drain • D/C leg/arm wraps • Assess the need for mediastinal CT, plural blakes, foley	• D/C Chest tubes • D/C wires prior to CT removal • D/C Foley Evaluate peripheral IV	• D/C Blakes • D/C wires • Evaluate peripheral IV	• Assess and remove Chest Tube Sutures • For thin robotic CABG patients, leave Chest Tube sutures in until office visit • (to avoid PTX).	• D/C peripheral lines on day of discharge
Activity/ Mobility	• Assess physical activity/mobility • Pre-op exercise therapy: Ambulation, aerobic exercise, inspiratory muscle	• PT Eval Order • HOB to 30 • Bed to chair position	• Dangle edge of bed • PT Eval/Visit • OOB to chair • Ambulate once in the ICU and again on floor	• PT Visit Ambulate 3x/day	• PT Visit Ambulate at least 3x/day	• Ambulate at least 3x/day	• Ambulate at least 3x/day

DAY OF STAY	PRE-OP	DAY OF SURG Day 0	POST OP Day 1	Day 2	Day 3	Day 4	Day 5
	training and incentive spirometry practice						
Fluid Management		• Judicious fluid resuscitation in OR	• Diuretic for fluid overload • Electrolyte replacement	• Diuretic for fluid overload • Electrolyte replacement	• Diuretic until weight at baseline • Electrolyte replacement	• Diuretic until weight at baseline • Electrolyte replacement	• Diuretic until weight at baseline • Electrolyte replacement
Medications	Take meds until pre-op night except: • hold ACE 2 days prior • Bactroban or Iodine nasal swap • Hold oral hypoglycemic medications as per DAS • Hold meds (e.g. anticoagulant and antiplatelet agents) as per AHA Guidelines and department protocols • Administer beta blockers • D/C estrogen replacement therapy as per AHA Guidelines Note: ASA SHOULD CONTINUE TO SURGERY	• If not initiated preop, start ASA within 6 hours post op for on-pump CABG • If bleeding is <50/hr for 2 hours for OPCAB cases, give ASA 162mg and Plavix 150mg one-time dose orally or via NGT, preferably within 6 hours of arrival in ICU. • Initiate Chlorhexidine mouth wash q 6hrs if needed. • Antibiotics (must be completed within 48 hrs post anesthesia end time). • Start PUD prophylaxis • Start Insulin protocol • For thin robotic CABG patients, leave Chest Tube sutures in until office visit	• Beta blocker • Initiate Diuretics • Continue PUD prophylaxis • Restart pre-op meds (don't change if possible) • Note that BP meds may be best restarted at ½ the preop doses, then increased as tolerated before discharge. • Initiate high intensity Statin on all pts unless intolerant. • SQ Heparin TID • Continue ASA 81 mg for on-pump CABG cases. • Daily ASA 81mg plus Plavix 75mg po if OPCAB • Isordil 10mg po q8hrs or Amlodipine for multiple-arterial CABG cases • Continue insulin protocol and transition if applies	• Titrate Beta blocker • Continue PUD prophylaxis • Titrate diuretics based on wt. • Continue ASA for on-pump CABG cases • DAPT for OPCAB • Statin • Continue SQ heparin • Discontinue antibiotics • Transition off IV insulin to either Lantus plus coverage of oral diabetes meds. • Review home meds	• Titrate Beta blocker • Continue PUD prophylaxis • Titrate diuretics based on wt. • Continue ASA for on-pump CABG • DAPT for OPCAB • Statin • Prepare Discharge Rx • Transition isordil 10mg po q8hrs to imdur 30mg po qd • Review home meds	• Update medication reconciliation • Assess Ace inhibitors for Heart Failure • Review home meds	• Review medication reconciliation • Vaccine given/ documented • ASA 81, betablocker and high intensity statin unless contraindicated • ACEi/ARB if EF<40, HFrEF, DM, CKD, ACS, if not contraindicated • Consider second antithrombotic if applies • Iron for 30 days with stool softener • PPI if dual antithrombotic

DAY OF STAY	PRE-OP	DAY OF SURG Day 0	POST OP Day 1	Day 2	Day 3	Day 4	Day 5
		• OFF Pump/Robotic Plavix 150mg, ASA 162mg					
Pain Management	• Assess pain Hx as part of H&P	• High power iv narcotic (i.e. Dilaudid) • Consider Toradol if renal function wnl, dose less for older patients • Consider Tylenol IV as needed	• Start po narcotic	• Finalize iv pain plan • Convert to PO pain medications	• Continue plan • Consider starting Tramadol	• Revise or continue plan • RX for discharge pain meds • Consider Tramadol as preferred pain medication	• Consider Tramadol as preferred pain medication
Respiratory Support	• Teach use of incentive spirometer • Teach proper positioning, posture, and deep breathing • PFT (HX of lung disease or at risk)	• Assess patient's level of sedation using the RAS Sedation Assessment Scale • Extubate when clinically stable (goal <**6 hrs**. from ICU admission)	• Titrate O2 per NC/mask to keep sats > 94% • Incentive spirometry, cough and deep breathing q 1 hr while awake	• Titrate O2 per NC/mask to keep sats >92% • Incentive spirometry, cough and deep breathing q 1 hr while awake	• Titrate O2 per NC/mask to keep sats >92% • Incentive spirometry, cough and deep breathing q 1 hr while awake	• Room Air • O2 prn • Incentive spirometry, cough and deep breathing q 1 hr while awake	• Room Air • O2 prn • Incentive spirometry, cough and deep breathing q 1 hr while awake
Imaging/ Monitoring	• See DAS protocol • CXR • EKG • Catheterization • Echo • CT chest- non contrast in selected patients • Carotid duplex over 65yrs, Hx of smoking; LM disease; hx CVA/TIA/bruit	• CXR post-op • Cardiac monitoring • Review CVP numbers • EKG • End tidal Co2	• Cardiac monitoring or telemetry • EKG • CXR	• Telemetry • EKG if indicated • CXR before and after tube removal	• Telemetry • EKG if indicated • CxR as needed	• Telemetry if required • EKG if indicated • CxR as needed	• Telemetry if required EKG if indicated
Lab Testing – NO LABS AFTER 10 PM (target 9pm for latest daily labs)	• See DAS protocol • CBC, Basic metabolic, pt/ptt, Type and Screen, A1c, LFTS	• ICU protocol- arterial panel ICU, ABG (Frequency)Mixed Venous	• ICU Protocol, arterial panel ICU, **1** ABG • Basic metabolic, Mg, phos PT/PTT, CBC, LFT	• CBC • BMP • Mg	• Labs only as indicated	• CBC and BMP in preparation for discharge • Final labs completed evening before discharge	• No labs on day of D/C unless indicated

DAY OF STAY	PRE-OP	DAY OF SURG Day 0	POST OP Day 1	Day 2	Day 3	Day 4	Day 5
		• Basic metabolic, Mg, pt/ptt, , CBC (see PRISM), LFTs					
Skin/Incision Care	• Chlorhexidine shower x2	• Sternal wound dressing as per protocol • Ace wrap to lower extremities if veins harvested	• Assess incisions, remove ACE.	• Assess incisions sites for signs of infection, instruct patient on wound care	• Assess incisions sites for signs of infection, instruct patient on wound care • Remove Aquacel if applied	• Assess incisions sites for signs of infection, instruct patient on wound care	• Reassess incisions sites. Instruct pt on wound care.
Nutrition/ Bowel Regimen	• NPO after MN • Nutrition consult	• NPO • Bowel regimen: Senakot and Colace after extubation • Lactulose prn	• Clear liquids • Continue bowel regimen	• Reg/Diabetic	• Reg/Diabetic • If no BM, supplement bowel regimen with suppository, enema and/or Miralax	• Reg/Diabetic	• Reg/Diabetic
Patient Education	• Pre-operative education provided • Smoking cessation counseling		• Continue patient education- provide booklet	• Continue patient education	• Continue patient education	• Continue patient education	• Continue patient education • Final review of questions or concerns regarding wound care, common complications, activity, restrictions, follow ups • Emphasize MSH or MSSL as the preferred center in case of readmission or to contact the service
Discharge Planning	• SW/CM begin discharge planning (target discharge on day 4-5) – identify any barriers For those likely to need SNF post discharge, visit/select facility pre-op if possible • Special Social Service attention to all patients at risk for prolonged LOS: age > 80,		• SW/CM continue discharge planning (target discharge on day 4-5) – identify any barriers	• Continue DC planning – identify any barriers	• IDP for Day 5 discharge (48 hrs in advance) • Smoking cessation counseling per AHA guideline • Start discharge summary with RX • Schedule outpatient appointments	• Discharge patient if able • Finalize discharge plan • Post discharge apt w CT surgery and cardiology made prior to discharge if possible • Continue discharge summary with RX • Schedule outpatient	• Discharge before noon • Give cardiac rehab referral

DAY OF STAY	PRE-OP	DAY OF SURG Day 0	POST OP Day 1	Day 2	Day 3	Day 4	Day 5
	frail, lives alone, limited preop mobility, extensive co-morbidities, weak social support, multiple story walk-up • Complete advanced directive & health care proxy, pre-op if lead time prior to surgery.					appointments • Schedule follow up appointment at NP clinic within 1 week • Schedule follow up appointment with cardiology and PCP in 1-2 weeks • Follow up appointment with surgeon in 3-4 weeks	
Other consults		• Physical therapy • Endocrinology if MD or HbA1c> 6.5 • EP if rhythm abnormalities	• Social worker • Case manager	• Urology if fails voiding trial as per hospital policy	• Psych cons as needed		

(Mount Sinai Heart, 2018)

Appendix B
CABG Clinical Pathway (Patient)

Mount Sinai Heart

Coronary Artery Bypass Graft Surgery

Daily Patient Goals **Today's Date:**

Day of Stay	Day of Surgery Day 0	Post Operative Day 1	Day 2	Day 3	Day 4	Day 5
Setting	ICU	ICU/Stepdown	Stepdown	Stepdown	Stepdown/Discharge	Stepdown/Discharge
Drains / Lines / Wires	Arterial line, Pacing wires, CLABSI dressing change only if soiled or falls off, mediastinal chest tubes, pleural blakes, foley	Discontinue CVP, Swan Ganz, Arterial Line, insert peripheral IV. Remove JP drain, leg/arm wraps. Assess need for chest tubes, pleural blakes, foley	Discontinue pacing wires, chest tubes, foley. Evaluate peripheral IV(s)	Discontinue blakes, pacing wires. Evaluate peripheral IV(s)	Assess and remove chest tube sutures. For thin robotic CABG patients, sutures will remain until office visit.Evaluate peripheral IV(s).	Discontinue peripheral line(s) on day of discharge.
Activity / Mobility	Physical Therapy (PT) evaluation order, HOB to 30°, Bed to chair position	Dangle edge of bed, PT Evaluation/Visit, OOB to chair, Ambulate once in the ICU and again on the floor	PT visit, Ambulate 3x/day	PT visit, Ambulate at least 3x/day	Ambulate at least 3x/day	Ambulate at least 3x/day
Pain Management	High power IV narcotic, Toradol if appropriate, IV Tylenol as needed if appropriate	Start oral narcotics	Continue oral pain plan	Continue pain plan, Consider starting Tramadol	Plan continued, Prescription for discharge pain meds, Tramadol is preferred pain medication	Tramadol is preferred pain medication
Nutrition / Bowel Regimen	Nothing by Mouth, Bowel Regimen: Senakot & Colace after extubation, Lactulose as needed	Clear Liquids, Continue bowel regimen	Regular / Diabetic diet	Regular / Diabetic diet. If no BM, supplement bowel regimen with suppository, enema and/or Miralax	Regular / Diabetic diet	Regular / Diabetic diet
Discharge Planning		Social Worker (CW) / Case Manager (CM) - discharge planning (target discharge on day 4-5) - identify any barriers	Discharge planning continues	Smoking cessation counseling per AHA guideline	Discharge if able. Discharge plan is finalized. Schedule follow up appt at NP clinic within 1 week, Schedule follow up appointment with Cardiologist and PCP in 1-2 weeks, Follow up appointment with surgeon in 3-4 weeks	Discharge before noon. Cardiac Rehab Referral.
Patient Education	Post Operative Discharge Education Class on: _____					
Today I...	Sat in chair ☐☐☐☐ Walked ☐☐☐☐					
Incentive Spirometer:	☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐					
Last Bowel Movement:						

Thank you for choosing Mount Sinai Heart!

(Friedman, 2018)

Appendix C
SWOT ANALYSIS

INTERNAL FACTORS	
STRENGTHS (+)	**WEAKNESSES (-)**
• Upgrade computer system in 2018 (EPIC) • Expert clinical nursing staff • Engagement of nursing staff • Surgeon engagement • Interdisciplinary team engagement • Executive leadership support • Advanced degrees of nursing staff • Evidenced- based clinical pathway • Protocols, Policies and Guidelines	• Staff engagement • Surgeon engagement • Interdisciplinary team engagement • Executive leadership support • Approval of policies, protocols and guidelines on a hospital executive level • Effective teamwork dynamics • Outdated computer system and paper charting until epic upgrade • Emergency coronary artery bypass grafting surgery • Emergency modalities i.e. balloon pump and extracorporeal membrane oxygenation (ECMO)

EXTERNAL FACTORS	
OPPORTUNITIES (+)	**THREATS (-)**
• Technology • Affordable care act • American Heart Association creating community awareness • Society of Thoracic Surgeons (STS) guidelines and innovation • Bundle payments for care improvement (BPCI) advanced	• Underserved population • Comorbidities • Poor economical- social population • No insurance • No primary care physician (non-compliance with follow up, medications and diet) • Low educational level of population • Disparities of the population • Language barriers • Patient compliance

(Friedman, 2018)

Appendix D

Risk Management Matrix

Risk Management Worksheet						
Type of Risk	**Jeopardy**	**Description of Risk**	**Expectation of the Risk (1-5)**	**Impact of the Risk (1-5)**	**Severity of the Risk (Expectation x Impact)**	**Contingency Plan of Action**
Schedule	1. Increase financial cost 2. Increase length of stay (LOS) 3. Increase hospital acquired infections (HAI) 4. Decrease patient satisfaction	Unable to create a clinical pathway, policies and protocol based on evidence practice in a timely manner	4	5	20	Offer overtime to staff Find expert staff Consult other experts
Finance	1. loss of profit margin R/T increase LOS 2. Unable to invest in future program growth	Organization unable to sustain and produce an effective clinical pathway and increase in LOS and poor outcomes	4	5	20	Create business plan Apply for grant and funding Downsizing nonessential programs
Staffing	1. higher financial cost 2. Failure to decrease LOS	Expertise of staff member to implement and sustain clinical pathway	2	5	10	Reeducation of pathway and content

Type of Risk	Jeopardy	Description of Risk	Expectation of the Risk (1-5)	Impact of the Risk (1-5)	Severity of the Risk (Expectation x Impact)	Contingency Plan of Action
Political Regulation	Financial penalties	Change in federal regulations, insurance reimbursement Affordable Care Act. Patient lack of insurance	5	1	5	Unable to control Involvement of experts for strategic planning
Project size/ Complexity	1. Project failure 2. Increase LOS	Unable to sustain clinical pathway into everyday practice with positive results	5	5	25	Offer overtime to staff. Redo EPOC Taxonomy
Quality	1. Increasing LOS 2. Increasing HAI 3. Decreasing patient	Quality of content of the clinical pathway, policies and protocols	1	5	5	Review content with the evidenced based practice guidelines and new evidenced based practice

(Friedman, 2018)