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UNIVERSITY OF CALIFORNIA,
IRVINE

Implementation of an Acuity-adaptable Staffing Model in a Cardiovascular Surgical Unit:
A Retrospective Review

DNP Scholarly Project Paper

submitted in partial satisfaction of the requirements
for the degree of

DOCTOR OF NURSING PRACTICE

in Nursing Science

by

Kathryn Kay Anotado Lopez

DNP Project Team:
Associate Clinical Professor Nicole Martinez, Co-chair
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2022

DEDICATION

To

my husband, Joseph, who is the rock that supports and strengthens me every day,
my children, Kaylee Jo, Keira Joy, and Josiah, who inspire and ground me,
and my parents, Jose and Susan, who laid the foundation for this life,
for their endless patience and continuous support.
I would not have been able to do this without any of them.

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FIELD OF STUDY

Doctor of Nursing Practice in Nursing Science

ABSTRACT OF THE DNP SCHOLARLY PROJECT PAPER

Implementation of an Acuity-adaptable Staffing Model in a Cardiovascular Surgical Unit:

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by

Kathryn Kay Anotado Lopez

Doctor of Nursing Practice in Nursing Science

University of California, Irvine, 2022

Associate Clinical Professor Nicole Martinez, Co-chair

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Improvement in the hospital patient experience is at the forefront of health system leadership throughout the country. Acuity-adaptable units allow patients to stay in the same hospital room from the time of admission to the time of discharge, regardless of their change in acuity, thereby improving workflow, patient comfort, and the overall patient experience (Shiva Kumar, Somu & Arun, 2017; Kitchens et al., 2018; Caroll & Frey-Moylan, 2020). Cardiac surgery patients have a specific recovery clinical pathway that allows nurses to identify deviations from the path. Registered nurses (RN) and physician teams trained in cardiac surgery care for the open-heart patient from admission to discharge. This relationship creates continuity of care, active communication, and trusting relationships. The team is knowledgeable and adept with a skillset to provide exceptional care while anticipating any complications (Chindhy et al., 2014; Kitchens et al., 2018; Bonuel, 2017; Costello et al., 2017). The quality of nursing care and anticipation of complications results in best patient outcomes and a high-quality patient experience. A retrospective review was completed on the implementation of an acuity-adaptable cardiovascular surgical unit (CVSU). CVSU outcomes were compared to cardiovascular surgery patients recovered in a traditional staffing model. In the CVSU, having the shared mental model of adaptability and flexibility and a structured orientation with knowledge sharing increased engagement and retention

newly hired staff (Clipper & Cherry, 2015). The cardiovascular surgery acuity-adaptable unit improved both patient outcomes with decreased failure-to-rescue rates (2.9%), decreased lengths of stay in the ICU (3.92 days), and decreased hospital lengths of stay (12.5 days); and improved staff engagement with 4.4 staff engagement mean and minimal turnover (4.9%). With the improvements in patient outcomes and staff engagement in this acuity-adaptable staffing model, the overall patient experience and operational budget can improve for the organization.

CHAPTER 1: INTRODUCTION

Implementing an Acuity-adaptable Staffing Model in a Cardiovascular Surgical Unit

Improvement in the hospital patient experience is at the forefront of health system leadership throughout the country. One possible solution to transform the care experience is through adoption of a process where patients recover in one room throughout their stay, called the acuity-adaptable unit. Acuity-adaptable units allow patients to stay in the same hospital room from the time of admission to the time of discharge, regardless of their change in acuity, thereby improving workflow, patient comfort, and the overall patient experience (Shiva Kumar, Somu & Arun, 2017; Kitchens et al., 2018; Carroll & Frey-Moylan, 2020). Cardiac surgery patients have a specific recovery clinical pathway that allows nurses to identify deviations from the path. Registered nurses (RN) and physician teams trained in cardiac surgery care for the open-heart patient from admission to discharge. This relationship creates continuity of care, active communication, and trusting relationships. The team is knowledgeable and adept with a skillset to provide exceptional care while anticipating any complications (Chindhy et al., 2014; Kitchens et al., 2018; Bonuel, 2017; Costello et al., 2017). The quality of nursing care and anticipation of complications results in best patient outcomes and a high-quality patient experience.

Background/Significance

When acutely ill or injured patients are admitted into an inpatient unit in the hospital, they are assigned a nursing and medical team that provide them full care during their length of stay. An acuity level is also assigned based on the number of interventions, procedures, assessments, and tests required for the patient that determine the nurse's workload (Barton, 2013). A patient acuity is a classification system based on the number of nursing hours and skill competencies needed to optimize a patient's treatment (Garcia, 2017).

According to The Joint Commission (2021), competency is defined as having the knowledge, skills, and abilities to deliver safe care, validated by a defined process that is consistent with the education and training provided. A competency assessment focuses on the verification of the knowledge and skill

(UCI Health, 2021). Each RN must complete a competency assessment on specified skills needed to care for the patient population in specific units.

As the patient's acuity increases, their level of care also increases. As such, the number of RN competencies to care for the patient also increases. Within the organization, there are three different competency lists for RNs working within the following units- critical care (ICU), stepdown, and medical surgical / telemetry. In 2008, the California Department of Public Health (2008) defined minimum nurse-to-patient ratio mandates that are still in effect today. Medical surgical staff nurse competencies are skills needed to care for patients requiring 24-hour inpatient medical care or post-surgical care, with a nurse-to-patient ratio of not more than 1:5. Telemetry RN competencies include continuous cardiac monitoring and interpretation of patients with cardiac conditions. This unit requires a nurse-to-patient ratio of no more than 1:4. Stepdown RN competencies include invasive monitoring, continued cardiac telemetry and mechanical ventilation of patients who are moderately unstable, with a mandatory nurse-to-patient ratio of not more than 1:3. Finally, intensive care unit RNs have the most comprehensive competency list as they care for the most complex, acutely ill and hemodynamically unstable patient populations requiring a ratio of no more than 1:2. The California Department of Health (2008) emphasizes that hospitals must staff the units according to the patient acuity.

The purpose of assigning patients to nursing units based on acuity is to ensure safety of care. These traditional nursing units have specific resources, including specialized nurses as well as equipment, which are only allocated to that specific unit (Kitchens et al., 2018). For example, the cardiovascular ICUs have larger rooms to accommodate additional specialized equipment, such as ventilators and continuous renal replacement therapy (CRRT). The ICU units are staffed by RNs with competencies to manage these types of therapies while telemetry units require less space but have specialized equipment such as wireless telemetry monitoring and ceiling lifts. This type of unit is staffed with RNs experienced in interpreting cardiac arrhythmias. As a patient's condition improves during their hospitalization, they must transfer to a different location based on their new acuity. - During the course of one hospitalization, patients may transfer rooms a maximum of six times during one length of stay, which increases

interactions with multiple caregivers and the number of nursing handoffs which may increase the potential for medication errors, lost patient belongings and decreased patient satisfaction (Kitchens et al., 2018; Chindhy et al., 2014). According to Freel & Flaherty (2021), multiple transfers and multiple handoffs lead to miscommunication, critical data omission and adverse patient outcomes. Minimizing or even eliminating the patient transfers could prevent such adverse patient outcomes.

Traditional Staffing Model in a Patient Classification System

Nursing administration must balance resources. The traditional staffing model uses a staffing matrix, determined by the average amount of nursing hours per patient day (HPPD), using the unit's midnight average daily census (ADC) by the nurse-to-patient staffing ratios (Trepanier, Lee & Kerfoot, 2020). For example, when a stepdown unit in California has an average daily census of 15 and a nurse-to-patient ratio of 1:3, there would be five bedside nurses assigned to the stepdown unit that shift. If the patient's acuity changes during the nurse's twelve-hour shift, the patient may be transferred to a lower level of care unit or remain in the stepdown unit with a telemetry acuity level. Although having a telemetry acuity would appear that there would be more nursing hours available because of less interventions, the transfer would require more time because the nurse would need to complete discharge teaching and documentation, and then prepare for a new admission. Once the new admission arrived, admission assessment and paperwork must be completed on the new patient. Although the nurse had a lower acuity patient assignment with the transfer patient, the amount of nursing HPPD may not have accurately been reflected in the patient acuity system.

National Database for Nursing Quality Indicators

Patients expect to receive high quality patient care. Nurses strive to provide the highest quality of patient care with the best possible patient outcomes. The National Database for Nursing Quality Indicators (NDNQI) is the only national database that compares individual unit performance data of nursing care and its relationship to patient outcomes compared to regional, state, and national percentile distributions (Montalvo, 2007). Nursing-sensitive indicators are the direct care processes that nurses perform that affect patient outcomes (Joint Commission International, 2014). Nursing-sensitive indicators

include falls, falls with injury, hospital-acquired pressure injuries, nosocomial infections, nursing hours per patient day (HPPD), nurse satisfaction, and failure-to-rescue (Montalvo, 2007; Oner et al, 2020).

Every quarter the organization shares how each inpatient unit compares to the NDNQI national benchmarks. Each fiscal year, unit and organizational goals are set with goals to remain below the national NDNQI benchmarks in specific categories. Meeting these goals ensures best practices and falling below NDNQI benchmark will allow units to improve on current processes to ensure quality.

Failure-to-Rescue

Failure-to-rescue (FTR) is defined as the failure to recognize and respond to inpatients experiencing complications that were not initially present on admission, ultimately increasing mortality and morbidity (Hall, Lim & Gale, 2020; Bacon, McCoy & Henshaw, 2021). FTR may occur when the registered nurse caring for the patient does not recognize the signs and symptoms of the patient's complications and deterioration or a delay in reporting these symptoms and escalating to the medical team (Steel et al., 2019). Recognizing change in assessments and trends can be vital in preventing the patient's deterioration (Garvey, 2015). Chichi (2021) found that nurses' competence and skills along with adequate resources and communication decreased the FTR in an acute care setting. Ensuring the registered nursing staff have the adequate training and competencies to recognize these complications can decrease the FTR, decrease the re-admission to the ICU, and lead to best patient outcomes.

Acuity-adaptable Model

According to Kitchens et al. (2018), adopting a model of care where level of care is provided to the patient in the same room from admission to discharge, allows the patient to heal without disruption and achieves best patient outcomes (Kitchens et al., 2018). Implementing an acuity-adaptable model is a Quality Improvement (QI) project that intersects with Evidence-Based Practice (EBP) implementation. According to the United States Health and Human Services Health Resources and Services Administration (HRSA) (2011), "Quality improvement (QI) consists of systematic and continuous actions that lead to measurable improvement in health care services and the health status of targeted patient groups" (p.1). Quality improvement projects in healthcare focus on systems and processes that improve

services for the future (Moran, Burson & Conrad, 2020). This project focuses on cardiac surgery patients recovering from postoperative open-heart surgery in an acuity-adaptable cardiovascular surgical unit (CVSU). After the patient's immediate post-operative recovery phase, the patient continues to recover in the same room, cared for by cardiac surgery trained RNs for the entire hospitalization regardless of changes in acuity. The continuity of care in the acuity-adaptable unit improves patient outcomes by decreasing the number of negative outcomes, including readmission to the cardiovascular intensive care unit (CVICU) (Costello et al., 2017; Chindhy et al., 2014). This adaptable acuity model framework can then be applied to all new inpatient nursing units within a large hospital based on the improved services.

Problem Statement

Failure-to-rescue (FTR) events are directly influenced by nursing care, competency, and communication (Chichi, 2021; Garvey, 2015). Traditional workflow models of care transfer patients depending on the level of acuity. Providing the care to the patient in an acuity-adaptable model rather than a traditional model allows the patient to gain rapport with the registered nurses, thereby gaining confidence in their skills and directly affecting the patient experience. Although the registered nursing staff hours may be increased in this acuity-adaptable model, the improvement in patient outcomes by the decreased failure-to-rescue rates should be evaluated for its reduction to organizational cost (Boivin et al., 2017).

PICOT Question

The PICOT question to be answered is: Will cardiovascular surgical patients in a cardiovascular surgery acuity-adaptable unit have a lower failure-to-rescue rate, as noted by readmission to the intensive care unit, compared to traditional stepdown / telemetry unit in Fiscal Year 2021?

CHAPTER 2: Body of Evidence

Review of the Literature

Search Process

A keyword and Boolean Operator search were done with "*acuity-adaptable*," "*acuity-adaptable unit* AND/OR *cardiac*," "*acuity-adaptable model* AND/OR *cardiac surgery*," "*acuity-adaptable*" AND

patient satisfaction,” and “*acuity-adaptable*” AND *quality*” in the CINAHL and MEDLINE databases.

Articles were limited to peer-reviewed journals and academic journal articles. Fifty-two total articles were obtained from CINAHL and MEDLINE databases. Twenty-six were duplicates and removed. Eight were excluded because they were other medical / surgical service lines including respiratory, urology, oncology, transplant, emergency medicine and spinal cord injuries. Eight were excluded because they were specific to the environment and equipment including room design and central lines. Ten articles were included based on the criteria. Two qualitative studies and eight quantitative studies were included. (Appendix A).

Appraisal of Evidence

There were multiple retrospective studies on cardiovascular acuity-adaptable units (Level 3 evidence) and comparative studies on acuity-adaptable units (Level 2 evidence) used in the literature review (Appendix C).

Selection of Acuity-Adaptable Patient Populations

Acuity-adaptable units allow patients to recover in the same accommodation from the time of admission to the time of discharge, regardless of their change in acuity (Shiva Kumar, Somu & Arun, 2017; Kitchens et al. 2018). To create a successful adaptable acuity unit, the patient population must be carefully selected and informed of the acuity-adaptable model of care on the unit where they will receive care. Professional nursing staff must be carefully selected and trained to deliver care in an acuity-adaptable unit prior to implementation. Zimring & Seo (2012) noted two themes when comparing multiple hospitals who implemented adaptable acuity units. The units with the most success implemented the adaptable acuity model for patients with predictable recoveries and had flexible staff who were open to change. Surgical units were more successful with the acuity-adaptable model because there was a defined treatment pathway. Medical telemetry units, however, have patients with more complicated hospital courses, with additional treatments and interventions that change the nurses’ workload and staffing patterns (Zimring & Seo, 2012). Cardiovascular surgery patients have specific algorithms for both the coronary artery bypass graft (CABG) patients and valve replacements (mitral valve, aortic valve

or tricuspid valve) that are followed by the interdisciplinary treatment team (physicians, registered nurses, laboratory, pharmacy, physical and occupational therapists) (UCI Health, 2021). Having an organizational surgical pathway allows the nurses to anticipate complications when patients deviate from the course (Chindhy et al., 2014; Costello et al., 2017).

Hendrich, Fay & Sorrells (2004) compared the effects of an acuity-adaptable comprehensive coronary critical care (CCCC) unit using a pre-post method, gathering data for two years before implementation and three years after implementation. The original goals for the acuity-adaptable CCCC unit were to eliminate resource waste (both caregiver and financial); improve the health care providers' work environment and personal satisfaction; create a healing environment with an exceptional patient experience; and support the future delivery of care through this workflow. (Hendrich et al., 2004). Hendrich et al. (2004) found significant improvements in quality and operational costs including reductions in clinician handoffs, reductions in medication errors and falls, decrease in number of budgeted nursing hours per patient day, and increase in number available nursing time for direct care without additional cost. Prior to the creation of the acuity-adaptable unit, there were 200 transfers from the coronary care unit to stepdown. After the creation of the acuity-adaptable CCCC unit, transports decreased by 90% with this patient population, reducing the amount of time needed for transport and handoff wherein the nurse had more time for direct patient care (Hendrich et al. 2004). There was a 70% reduction in medication errors and a two-hour increase of direct nursing care, highly attributed to the reduction in handoffs and elimination of transferred patients (Hendrich et al., 2004). Hendrich et al. (2004) showed the significant benefits and improvement in patient outcomes and nurse efficiencies in an acuity-adaptable unit comprehensive coronary critical care unit.

Shared Mental Model

Creating a shared mental model with the new registered nursing staff sets the expectation of competency and flexibility from the onset of their tenure in the unit. A shared mental model is the understanding of relevant knowledge shared by all team members (Manges et al., 2020). Teams with shared mental models have a common understanding among all team members of the patient, unit and

organizational goals, problem-solving strategies, information-sharing and defined roles (Riley et al., 2017). Having a shared mental model facilitates effective teamwork and enhances clinical decision-making in the unit (Gisick et al., 2018). According to the Gallup-12 staff engagement survey, the number one survey item is “I know what is expected of me” (Gallup INC, 2021). Explaining to staff what is expected of them allows them to understand their job description and perform to their best abilities. Onboarding staff with a shared mental model of the acuity-adaptable model that includes the knowledge, skills, and flexibility of changing acuities and staffing assignments will allow the unit to succeed.

Lack of a shared mental model or lack of understanding of the acuity-adaptable model prior to implementation may instead cause adverse outcomes. In the Costello et al. (2017) acuity-adaptable study, there was loss in efficiency because the new admissions could not be received into the unit because of the logistics of staffing and space as bedside nurse staffing ratios were 1:1 (patient-to-nurse), 2:1, and 3:1. New patient admissions could not be accommodated because there were not enough nurses for appropriate staffing ratios. Sosebee et al. (2019) noted that the lack of success of the acuity-adaptable model in a rural community hospital was due to the nursing staff’s dissatisfaction with caring for different levels of care. Patients in this acuity-adaptable unit noted that their emotional needs were not addressed by this staff and reported decreased patient satisfaction (Sosebee, 2017). Hendrich et al. (2004) noted that there was an increase in staff turnover during the first year of implementation of the acuity-adaptable care model because of the workflow change but recovered to baseline turnover after that first year. Therefore, lack of a shared mental model of the adaptable acuity model can lead to adverse patient outcomes and staff turnover.

Decreased lengths of stay and decreased failure-to-rescue rate

When reviewing cardiovascular surgical units that have implemented an acuity-adaptable model across the nation, these units have shown decreased post-operative complications including decreased lengths of stay and decreased failure-to-rescue. Failure-to-rescue is defined as the failure to recognize and respond to inpatients experiencing complications that were not initially present on admission, ultimately increasing mortality and morbidity (Hall, Lim & Gale, 2020; Bacon, McCoy & Henshaw, 2021). Two

studies have been done in the cardiothoracic surgery acuity-adaptable unit at University of Wisconsin Hospital and Clinics (UWHC). In Osaki et al. (2013), the median length of intensive care unit (ICU) and hospital stays were significantly shorter in the acuity-adaptable unit by five and six days, respectively ($p < 0.01$) for their Left Ventricular Assist Device (LVAD) patients. In Chindhy et al. (2014), they found a decrease in all complications defined by the Society of Thoracic Surgeons (STS) including decreased median length of intensive care unit stay (49 hours vs. 26 hours, $P < 0.01$), decreased hospital stay (six vs. five days, $P < 0.01$) and decreased readmission rate to the ICU (5% vs. 2%, $P < 0.01$). Both Osaki et al. (2013) and Chindhy et al. (2014) attribute the improved outcomes to the acuity-adaptable unit, noting since patients are not transferred to other units, the same registered nurse (RN) and physician care teams manage the patients and quickly recognize signs and symptoms of complications and treat accordingly. Costello et al. (2017) attributed their 52% improvement in failure-to-rescue to the specialized training and continuity of nursing care in their acuity-adaptable cardiovascular pediatric unit. Vendetti (2015) noted the median length of stay time was six days for the cardiac acuity-adaptable model patients versus seven days for traditional Cardiac ICU patients ($p < 0.0001$). The RN in these cardiovascular acuity-adaptable units have advanced assessment skills to anticipate and reduce complications from their experience with the cardiac surgery patient population.

Continuity of Care

Maintaining the same RN and physician teams from admission to discharge not only decreases complications, but it provides continuity of care, active communication, and the formation of trusting relationships (Chindhy et al., 2014; Kitchens et al., 2018; Bonuel, 2017; Costello et al., 2017). Having all care delivered in the same hospital accommodations throughout their hospital course allows the patient comfort, emotional stability, decreased anxiety, and the ability to heal because of the continuity of care and elimination of physical room transfer (Carroll & Frey-Moylan, 2020).

Patient Satisfaction

Kitchens et al. (2018) found that increased nurse proficiency, or the nurses' clinical knowledge, skills, and experience allowed the patients to establish a trusting relationship with their nurses and

increased patient satisfaction (Yarney et al., 2021). Ramson et al. (2013) found an increase in the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) scores, standardized patient surveys of hospital inpatient care (Centers for Medicare and Medicaid Services, 2021). Patients "Rate the Hospital" nine to ten score increased from 62% to 79.7% in adaptable acuity setting from a traditional workflow setting and Patients who "Recommend the Hospital" increased from 59.8% to 75.5% (Ramson et al., 2013). This is important because in accordance with the Patient Protection and Affordable Care Act of 2010 (P.L. 111-148), HCAHPS scores are used to calculate value-based incentive payments in the Hospital Value-Based Purchasing program (Center for Medicare & Medicaid Services, 2021). Patient satisfaction is one nurse-sensitive quality indicator available in the data.

Although there is evidence of decreased lengths of stay and decreased complications in cardiovascular acuity-adaptable units, there is little evidence to correlate acuity-adaptable units with failure-to-rescue rates captured through re-admission to the ICU. The literature review also found acuity-adaptable units had increased patient satisfaction because the patient was able to recover in the same accommodation with the same RN staff for the length of stay in a private room (Chindy et al., 2014; Venditti, 2015; Kitchens et al, 2014). There is no indication of patient satisfaction in the acuity-adaptable model that include semi-private rooms.

Evidence-Based Recommendation for the Project

The Joint Commission began to measure nurse-sensitive quality indicators, indicators that “quantify the effect that nurses and nursing interventions have on the quality of the care processes and on patient outcomes” (p. ii). The purpose of this project is to assess if adult cardiac patients in an acuity-adaptable unit have decreased failure-to-rescue rates, captured through readmission rates to the ICU, based on the increased skills and competencies of the RNs compared with patients in a traditional unit workflow in changes in level-of-care. Based on this evaluation, the acuity-adaptable staffing model may be used to improve healthcare delivery throughout the organization.

CHAPTER 3: PROJECT FRAMEWORK

Evidence-Based Practice Model

The theoretical framework used for this project is the logic model. A logic model is a visual graphic to organize how a project should work, recognizing relationships among the initial actions, resources, and expected outcomes (Knowlton & Phillips, 2009; Center for Disease Control and Prevention, 2021). The model shows the logical flow of the project, the inputs, strategies, activities, and outcomes, while also considering external contextual factors that influence these outcomes (Joly et al., 2007; Savaya & Waysman, 2005). In this acuity-adaptable unit, there are multiple stakeholders who must understand the entire project, especially the improvement of patient outcomes, to agree to its' purpose and vision.

For this project, a logic model for the acuity-adaptable model was created (Figure 1). It includes the target population, resources/inputs, activities, outputs, results / outcomes, and the external influences (spheres of influence) that can affect the outcomes. In particular, external influences increased hospital census requiring the unit to have more stepdown patients, relying on float pool or registry nurses to staff the unit, and changing the workflow and workload of the nurse.

For this project, a logic model for the acuity-adaptable model was created (Figure 1). It includes the target population, resources / inputs, activities, outputs, results / outcomes, and the external influences (spheres of influence) that can affect the outcomes.

CHAPTER 4: METHODS

Project Goals

The goal of this acuity-adaptable project was to complete a retrospective review on nursing care of post open-heart surgery patients in the same accommodations from admission to discharge. This project focused on cardiac surgery patients who recovered from post open-heart surgery in an acuity-adaptable cardiovascular surgical unit (CVSU). After the patient's immediate post-operative recovery phase, the patient continued to recover in the same room and were cared for by cardiac surgery trained RNs for the entire hospitalization regardless of changes in acuity. The continuity of care in the acuity-adaptable unit would improve patient outcomes, decrease the failure-to-rescue rate, and prevent readmissions to the ICU compared to the previously used traditional staffing model.

Research in two acuity-adaptable cardiovascular units attribute the improved patient outcomes to the acuity-adaptable model, noting that since the patients are not transferred to other units, the same RN and physician teams care for the patients and can recognize signs and symptoms of complications and treat accordingly (Osaki et al., 2013; Chindhy et al. 2014). Orientation of newly hired RN into a new specialty unit requires preparation and collaboration with an interprofessional team. The unit manager must first collaborate with the clinical nurse educator to assess basic knowledge of new staff and plan specific didactic classes for care of the patients recovering from open-heart surgery. Once the didactic class is completed, hands-on orientation must be scheduled to complete the open-heart training. Charge nurses trained with previous cardiac surgery experience will serve as resources to the newly hired and newly trained RNs with experience in open-heart surgery recovery and cares ensure safety and competency during this transition. Understanding the patient population and the expectations from initial onboarding will provide the team and the patients with successful outcomes.

Outcome Measures: Failure-to-Rescue Rates: Readmission to the ICU

Prior to opening the acuity-adaptable CVSU, patients recovering from open-heart surgeries were cared for in the surgical stepdown unit, where all general surgery post-operative patients, inclusive of vascular, hepatobiliary, bariatric, minimally invasive, plastics, otolaryngology, and transplant, received care. Fiscal year (FY) data is gathered from the months of July to June. Data from the cardiovascular surgical patients in the surgical stepdown / telemetry unit for FY2019-2020 are obtained and compared to data obtained from the cardiovascular surgical patients in the acuity-adaptable CVSU. For this project, data would be gathered from the beginning of fiscal year 2020 through the end of quarter 3 (July 2019 through March 2020) and through the same timeframe for FY2020-2021. Data would include patient demographics (age, sex, race, insurance), co-morbidities, admitting diagnosis, length of stay in the ICU, length of hospital stay, and any re-admissions to the

ICU.

Project Description

Project Type/Design

This DNP project is a Quality Improvement Project that focuses on decreasing the failure-to-rescue (FTR) rates of cardiovascular surgery patients by decreasing the number of re-admissions to the intensive care unit. The project design is a retrospective chart review. The acuity-adaptable CVSU opened in April 2020. A chart review was completed on patients recovering from open-heart surgery in the acuity-adaptable CVSU compared to patients recovering from open-heart surgery in a traditional staffing unit, prior to implementation of the acuity-adaptable unit.

Project Setting/Population

The setting for this project is a 16-bed CVSU in an academic medical center in Southern California. The cardiovascular surgical unit is the receiving unit for adult patients recovering from post-open heart surgeries after their immediate recovery from the cardiovascular intensive care unit (CVICU). The cardiovascular surgical patients will remain in this unit until discharge from the hospital.

Participants and Recruitment

Participants included in the project were adult patients (18 years or older) who recovered from post-open heart surgery from April 2020 through March 2021. Additional participant data was gathered from adult patients (18 years or older) who recovered from post-open heart surgery from April 2019 through March 2020. Post-open heart surgery patients include those who underwent coronary artery bypass grafts (CABG), mitral valve replacement (MVR), aortic valve replacement (AVR), tricuspid valve replacement (TVR), aortic dissections, post-left ventricular assist device (LVAD) placements, and post-extracorporeal membrane oxygenation (ECMO). Participants excluded from this project are adult patients assigned to the CVSU but did not have a cardiovascular surgery performed during the current hospital inpatient admission. No participants were recruited; data was reviewed based on the inclusion criteria.

Description of Interventions

Selecting Cardiovascular Surgical Unit Registered Nursing Staff

Hiring into a new cardiovascular surgical acuity-adaptable unit required careful selection of staff. Many current inpatient nurses did not have experience caring for patients recovering from open heart-surgery, however having forty-five staff members who were new to the organization would be difficult when implementing organizational policy and standards of care. Therefore, the nurse manager and the nurse director created two different job descriptions. One job description required two years of experience caring for patients recovering from open-heart surgery. Because the cardiovascular surgery program at this organization was small, there was a limited number of qualified internal applicants. This then gave the opportunity to hire new nurses with cardiovascular surgical experience into the organization. The second job description required two years of cardiac telemetry experience, for which current organizational staff were qualified. Current organizational staff understood organizational policy and documentation in the electronic medical record, helping to bridge the newly hired RN into the unit and the organization.

During the interview process, the nurse manager introduced two new concepts for the CVSU: acuity-adaptable staffing and primary nursing care. Acuity-adaptable units allow patients to recover in the same accommodation from the time of admission to the time of discharge, regardless of their change in acuity (Shiva Kumar, Somu & Arun, 2017; Kitchens et al. 2018). In the acuity-adaptable model, primary nursing care had two meanings. In the first, primary nursing care is based on continuity of care of the patient, establishing the relationships between patient and nurse to drive care from admission to discharge (Cocchieri et al., 2021). Because the primary nursing care concept includes nurses and patients with one-to-one relationships, this also drove the second concept, the primary nursing total care model, where the nurse is responsible for total care of the patient needs (Fawcett, 2021). In the second model, RNs would care for the patient as a whole, completing all vital signs, intake and output, ambulation and activities of daily living. Combining both meanings of primary nursing care, this delivery model meant there was no ancillary staff within the unit; the nurses would establish relationships with their patients as they attended to all their needs. Due to the increased nurse-patient interaction required of this model, applying it to the acuity-adaptable unit meant the nurse-to-patient ratio would be decreased to 1:2 for stepdown level of

care or 1:3 for patients with telemetry level of care. This differs from the California Department of Health (2008) nurse-to-patient ratio requirement of 1:3 for stepdown level of care and 1:4 telemetry level of care.

In the second sense, building on this combined model meant the nurse was the driver of care from admission to discharge and would be assigned the same patient in consecutive shifts to provide the best care to the patient. This model was explained to all interested applicants in an effort to ensure transparency and begin the creation of the shared mental model of flexibility and adaptability in the unit. Creating a shared mental model of competency and flexibility with the new registered nursing staff during the hiring and orientation phases set the expectation from the onset of their tenure in the unit and the organization. Teams with shared mental models have a common understanding among all team members of the patient, unit and organizational goals, problem-solving strategies, information-sharing and defined roles (Riley et al., 2017). Introducing the acuity-adaptable model during this time helped facilitate teamwork and enhanced the clinical decision-making in the new unit (Gisick et al., 2018).

Creating Didactic Classes and Competency Checklists

Structured orientation and knowledge sharing increases engagement and retention of newly hired staff (Clipper & Cherry, 2015). The nurse manager and critical care nurse director met with the Clinical Nurse Specialist (CNS) and critical care educator to discuss the training, competencies, and skills needed for the registered nursing staff in the CVSU to ensure patient safety and proper care of patients recovering from open-heart surgery. There were a variety of learning needs since there was a mixed skillset of telemetry nurses with no cardiovascular surgical experience to intensive care unit nurses with open-heart surgery recovery experience from various hospitals. The nurse leadership and education department collaborated and reviewed the current telemetry competency, stepdown competency, and recovery of the open-heart patient competency to plan didactic classes and hands-on orientation training (Appendix E). Didactic classes included a four-hour class on care of the open-heart patient. Topics reviewed in this class included the different types of cardiac surgery, the anatomy and physiology of the heart, review of the cardiac surgery pathway, and post-operative care. Post-operative care included monitoring for

complications including bleeding, cardiac tamponade, and overload, placement of a temporary pacemaker, care and maintenance of chest tubes for drainage, medication maintenance, ambulation, and discharge planning. The unit manager coordinated schedules and preceptor assignments to orient the telemetry nurses new to cardiovascular surgery: two shifts in the cardiovascular intensive care unit (CVICU) to care for the patients recovering from open heart surgery, one shift in the surgical intensive care unit to review ventilator management, and four shifts in the surgical stepdown unit to review workflow and documentation requirements for three surgical patients. The newly hired nurses to the organization were given an additional three shifts of orientation in the surgical stepdown to orient to organizational workflow.

Measurements/Instruments

Data was extracted from the electronic medical record using the RedCap database at the university medical center and supplemented with medical chart review. Data from the traditional staffing model was collected from the cardiovascular surgical patients recovered in the surgical stepdown unit for four quarters of FY2019-2020, from April 1, 2019, through March 2020. This data was compared to data from the acuity-adaptable cardiovascular surgical patients through the same timeframe for FY2020-2021, from April 1, 2020, through March 2021. An Excel spreadsheet was used to collect and store the data. The Gallup Staff Engagement survey was used to measure staff engagement in acuity-adaptable unit in FY21 and traditional stepdown unit in FY20. The Gallup survey scores staff satisfaction and engagement on a 5-point scale, with a score of 5 being highest.

Data Collection Procedures

Data was extracted from the electronic medical record using the RedCap database at the university medical center and supplemented with medical chart review. Data from the traditional staffing model was collected from the cardiovascular surgical patients recovered in the surgical stepdown unit for four quarters of FY2019-2020, from April 1, 2019, through March 2020. This data was compared to data from the acuity-adaptable cardiovascular surgical patients through the same

timeframe for FY2020-2021, from April 1, 2020, through March 2021. Data included patient demographics (age, sex, race/ethnicity, insurance), co-morbidities, type of open-heart surgery, length of stay in the ICU, length of hospital stay, and re-admission to the ICU. If there was a re-admission to the ICU, this would quantify a failure-to-rescue (FTR). The primary outcome measure for this project was the failure-to-rescue rate, or re-admission to the ICU. Secondary outcomes included length of stay in the intensive care unit and length of hospital stay. Demographic and clinical data were collected and averaged (+ / - standard deviation). A decrease in the failure-to-rescue rate in the cardiovascular acuity-adaptable unit would show quality improvement from the traditional staffing unit model.

Data Analysis

Sunnary statistics are reported as median (percentiles) or variable counts (perecent) per category. The primary outcome (failure-to-rescue rates) compared the re-admission rates of caridiovascular surgical patients in an acuity-adaptable unit to the failure-to-rescue rates of cardiovascular surgical patients in a traditional staffing model.

Ethical Considerations

There are no ethical implications in this retrospective study of the acuity-adaptable cardiovascular surgical unit. The IRB Exempt Self-Determination Tool was used to confirm that the study was IRB Exempt.

Stakeholders/Barriers

Key stakeholders for this acuity-adaptable project included the cardiovascular surgical team, consisting of the cardiovascular surgeons, physician assistants, and nurse practiotioners, the Chief Nursing Officer (CNO), critical care nurse educator, critical care clinical nurse specialist (CNS), nurse manager, and the frontline RN staff. If the acuity-adaptable cardiovascular surgery nurses can anticipate the needs of the patients and prevent complications, the patients will have better outcomes from surgery, decreased lenghts of stay, and decreased mortality and morbidity. All registered nursing staff from the CNO to the frontline nurses are key stakeholders as they are providing the excellent nursing care to this

specialty patient population. All stakeholders had to approach the opening of this unit with a shared mental model of teamwork and flexibility for the new staffing model for this unit.

A barrier for the project was timing. April 20, 2020 was the projected opening of the acuity-adaptable CVSU. Due to the COVID-19 pandemic, construction and training of the nursing staff on the unit were expedited to an April 1, 2020 opening. The newly hired team of RNs and monitor technicians (MT) had no opportunity to complete team-building activities. Half of the nurses were new to the organization while the other half were new to the patient population. As the nurse manager and project lead, the shared mental model of flexibility, transparency, trust, and education of the care of the cardiovascular surgery patient were emphasized. The nurse manager and nurse educator provided continuous support and meticulous planning of educational topics and orientation to create a sense of teamwork in a time of unknown. The nurses trusted their colleagues, unit leadership, and the organization to work toward best patient outcomes.

Formative Process Evaluation

While reviewing the implementation of the cardiovascular acuity-adaptable unit, the Gallup staff engagement survey was released. The acuity-adaptable unit scored 4.4 out of 5.0, rendering the highest staff engagement across the organization. The highest scores from the CVSU staff were Q1. “I know what is expected of me” with a score of 4.72 (organizational mean = 4.41) and Q3. “I have the opportunity to do my best” with a score of 4.69 (organizational mean = 4.05). Having a highly engaged nursing workforce helps improve quality outcomes and the patient experience (Dempsey & Assi, 2018). The nurse manager continued to work with the clinical nurse educators and frontline nursing staff to support the new acuity-adaptable staffing model to improve the failure-to-rescue rate in the cardiovascular surgery patient population.

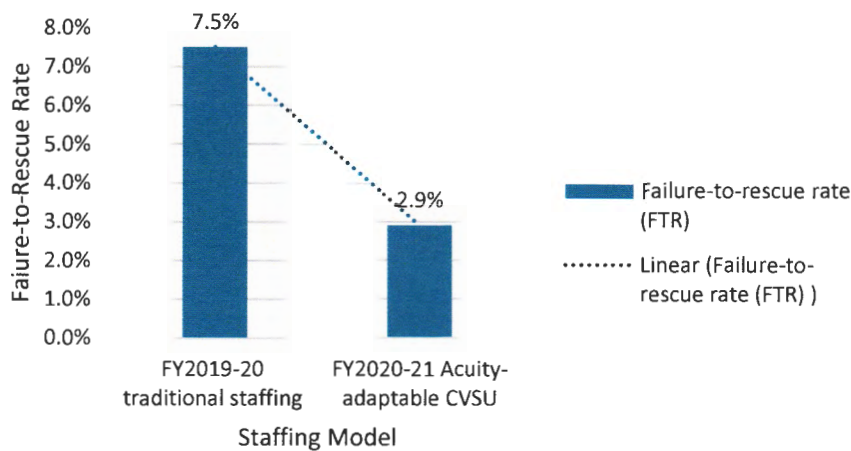
CHAPTER 5: RESULTS AND CONCLUSIONS

Results

From April 2019 through March 2020, 12 out of 160 patients (7.5 % failure-to-rescue rate) recovering from cardiovascular surgery in the traditional surgical stepdown unit were re-admitted to the intensive care unit. From April 2020 through March 2021, 4 out of 144 (2.9% failure-to-rescue rate) recovering from cardiovascular surgery in the acuity-adaptable CVSU were re-admitted to the intensive care unit (Figure 2).

Figure 2.

Failure-to-Rescue Rate for Cardiovascular Surgery Patients

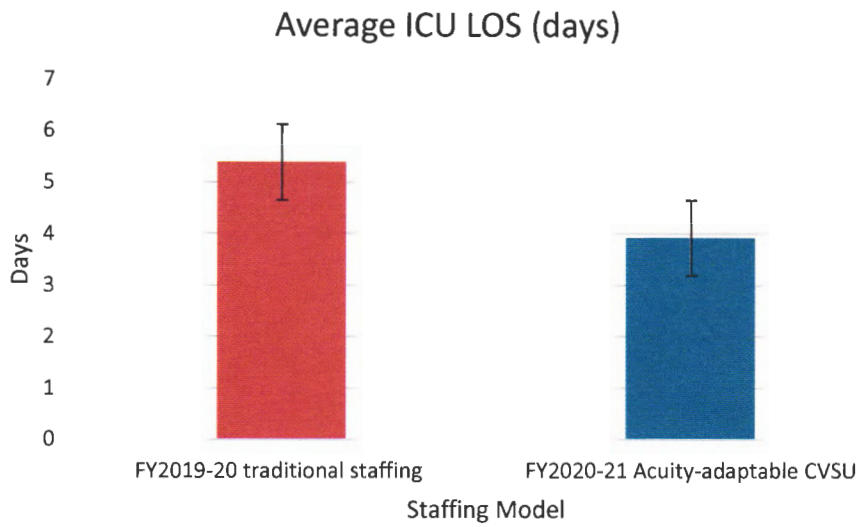


Note: This figure demonstrates the decrease in the failure-to-rescue rate for cardiovascular surgery patients recovering in an acuity-adaptable CVSU compared to a traditional staffing model.

From April 2019 through March 2020, the average ICU length of stay (LOS) was 5.39 days, decreasing to 3.92 days from April 2020 to March 2021 (Figure 3). The average hospital length of stay (LOS) decreased from 14.8 days with the traditional staffing model in FY2019-20 to 12.5 days with the acuity-adaptable staffing model in FY2020-21 (Figure 4).

Figure 3.

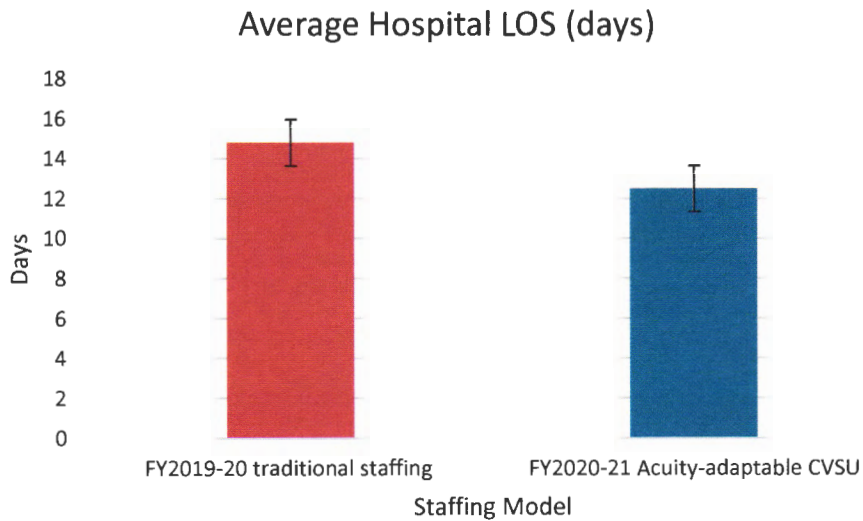
Average ICU Lengths of Stay (LOS) for Cardiovascular Surgery Patients



Note: A comparison of the average ICU lengths of stay for cardiovascular surgery patients. Patients recovering in the acuity-adaptable unit had decreased ICU length of stay. Error bars show standard deviation.

Figure 4.

Average Hospital Lengths of Stay (LOS) for Cardiovascular Surgery Patients

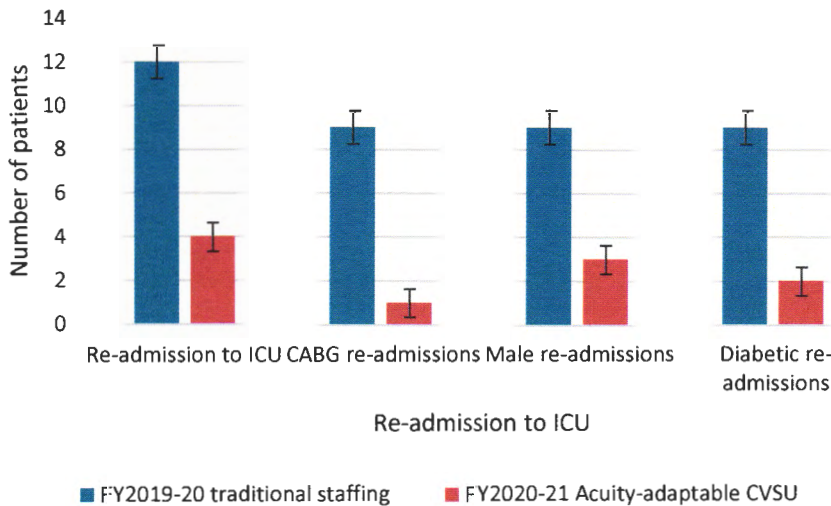


Note: A comparison of the average hospital lengths of stay for cardiovascular surgery patients. Patients recovering in the acuity-adaptable unit had decreased hospital lengths of stay. Error bars show standard deviation.

Of the twelve ICU re-admission patients recovering from open-heart surgery in FY2019-20, nine (75%) were post-operative coronary artery bypass surgery (CABG), diabetic, male patients. Of the four ICU re-admission patients recovering from open-heart surgery in FY2020-21, one (25%) was a post-operative CABG, three (75%) were male, and two (50%) were diabetic (Figure 5).

Figure 5.

Comparison of Cardiovascular Surgery Patient Re-admissions to ICU

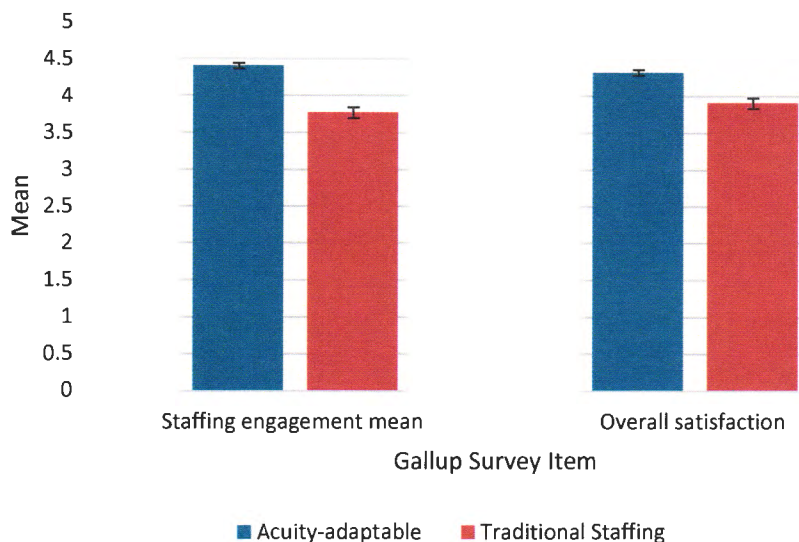


Note: Comparison of cardiovascular surgery patients re-admitted to the ICU. Error bars show standard deviation.

As the project review continued, the staff engagement and shared mental model concept was confirmed when comparing the Gallup staff engagement scores in the two models. In the acuity-adaptable unit, there was a 4.4 engagement mean with an overall satisfaction of 4.32 while in the traditional staffing unit there was 3.77 engagement mean with an overall satisfaction of 3.91 (Figure 6).

Figure 6.

Gallup Staff Engagement Scores



There was an improvement in both patient outcomes and staff engagement in the acuity-adaptable CVSU compared to the traditional staffing model. There were decreases in failure-to-rescue rate, ICU length of stay, and hospital length of stay for open-heart surgery patients recovering in the acuity-adaptable CVSU compared to the open-heart patients who recovered in the traditional staffing model. There was also increased staff engagement and overall staff satisfaction in the acuity-adaptable CVSU. Having a highly engaged nursing workforce helps improve quality outcomes and the patient experience (Dempsey & Assi, 2018).

Discussion

Acuity-adaptable units allow patients to recover in the same accommodation from the time of admission to the time of discharge, regardless of their change in acuity (Shiva Kumar, Somu & Arun, 2017; Kitchens et al. 2018). Zimring and Seo (2012) reviewed six organizations with the acuity-adaptable staffing model and found recurring themes for successful units which include: choosing the right specialty, training the right people, and changing culture through communication. The chief medical officer (CMO) and the chief nursing officer (CNO) chose the cardiovascular surgery specialty population for the acuity-adaptable unit. There was a growing cardiovascular surgery service line with a need for a dedicated unit. There was also an established cardiovascular surgery post-operative pathway. Nurses hired into the unit required previous experience in caring for recovery of open-heart patients. Because of both

their previous open-heart experience and the established pathway, the nurses would be able to recognize signs and symptoms that deviated from the pathway and intervene in a timely manner.

The CMO, CNO, chief cardiovascular surgeon, and critical care nursing director were also key stakeholders who participated in the hiring of the nurse manager. This began the interprofessional relationship and shared mental model for this acuity-adaptable CVSU. This shared mental model, the understanding of relevant knowledge shared by all team members (Manges et al., 2020), was integrated into the entire unit. When the nurses were hired for the acuity-adaptable CVSU, they were informed from their first interview that the new unit had two concepts new for the organization: an acuity-adaptable staffing model and a primary nursing care model, where the registered nurse would care for all aspects of the patient, without the aid of ancillary staff. The nurses hired for the unit had to have an open-mind and be flexible to both ideas. Hendrich et al. (2004) noted that there was an increase in staff turnover during the first year of implementation of the acuity-adaptable care model because of the workflow change. Sosebee et al. (2019) noted that the lack of success of the acuity-adaptable model in a rural community hospital was due to the nursing staff's dissatisfaction with caring for different levels of care. Teams with shared mental models have a common understanding among all team members for problem-solving strategies, information-sharing, and defined roles, focusing on best outcomes for the patient, unit, and organization (Riley et al., 2017). The newly hired staff had the skillset to care for post-open heart surgery patients and had the ability to establish relationships with them because of the primary nursing care. Since the unit staff had a shared mental model in the acuity-adaptable unit, it facilitated effective teamwork and enhanced clinical decision-making in the unit toward best outcomes (Gisick et al., 2018).

Bonuel et al. (2013) describe the acuity-adaptable nurse as a hybrid nurse, a nurse that possesses both critical care and medical-surgical skills and knowledge. The acuity-adaptable CVSU had specific criteria when hiring. Nurses were required to have experience recovering patients from open-heart surgery, from both outside and inside the organization, or telemetry nurses within the organization. The clinical nurse educators and nurse manager worked together to create a new stepdown / cardiovascular telemetry competency to encompass this new hybrid nurse. The communication with the frontline nursing

staff and the transparency since the interview process provided known expectations to these hybrid nurses, requiring critical care knowledge, knowledge of the cardiovascular surgical population, and the skill to manage multiple patients. According to the Gallup-12 staff engagement survey, the number one survey item is “I know what is expected of me” (Gallup INC, 2021). On the 5-point Gallup Score, the CVSU scored 4.72 for “I know what is expected of me;” 4.32 for “Overall Satisfaction;” and 4.4 for “Engagement Mean.” Having a highly engaged nursing workforce helps improve quality outcomes and the patient experience (Dempsey & Assi, 2018).

In the CVSU, having the shared mental model of adaptability and flexibility and a structured orientation with knowledge sharing increased engagement and retention of newly hired staff (Clipper & Cherry, 2015). The cardiovascular surgery acuity-adaptable unit improved both patient outcomes with decreased failure-to-rescue rates (2.9%), decreased lengths of stay in the ICU (3.92 days), and decreased hospital lengths of stay (12.5 days); and improved staff engagement with 4.4 staff engagement mean and minimal turnover (4.9%). With the improvements in patient outcomes and staff engagement in this acuity-adaptable staffing model, the overall patient experience and operational budget can improve for the organization.

Creating the same shared mental model for all leaders onboarding new staff may increase staff engagement, decrease staff turnover, and improve patient outcomes for all patient populations. All RN staff in the CVSU had a shared mental model of teamwork and flexibility in the new unit. The same onboarding process must be continued to all newly hired RN staff, starting with the shared mental model. Through didactic classes and hands-on orientation, the nurses will have the skills and competencies to care for the specific surgical population and the teamwork to help anticipate complications to prevent re-admissions to the ICU. To sustain this model, there is a new initiative for a workforce management committee that focus on three components: recruitment, professional development, and retention. Showcasing the benefits of the acuity-adaptable model to this workforce management committee will maintain its sustainability.

The acuity-adaptable staffing plan can be the future of every new unit in the hospital and in the new university hospital. Establishing a shared mental model of flexibility, adaptability, and teamwork from the onset, beginning with the unit interview, continuing during orientation and maintained as part of the daily workflow creates an empowered work environment. Providing specialty didactic educational classes for the specialty patient populations will increase staff knowledge and skill to anticipate complications. Because surgical patient populations have a more defined pathway of recovery, implementing an acuity-adaptable with different surgical populations may provide the best success for continuation of the acuity-adaptable model.

There were limitations to this project. The cardiovascular surgery team added additional members added during this time. The physical presence of the physician assistants and nurse practitioner on the CVSU unit allowed fluid communication and timely interventions with the interprofessional team. The unit started at the beginning of the COVID-19 pandemic in April 2020. The newly hired CVSU nurses had to rely on each other during an unprecedented time of unknown, increasing the level of teamwork and trust in their colleagues. Such factors benefitted the staff engagement and quality outcomes.

Conclusion

The cardiovascular surgery acuity-adaptable unit improved both patient outcomes with decreased failure-to-rescue rates, decreased lengths of stay in the ICU, and decreased hospital lengths of stay, and improved staff engagement with minimal turnover. Having a shared mental model with the interprofessional team, having the mindset of adaptability and flexibility, and a structured orientation with knowledge sharing increased staff engagement of the hybrid acuity-adaptable nurse. With the improvements in patient outcomes and staff engagement, the overall patient experience and operational budget will improve for the organization, aligning with DNP Essential II: Organizational and Systems Leadership for Quality Improvement and Systems Thinking (AACN, 2006). Future projects can include the financial impact of acuity-adaptable units and improvement in unit workflow operations.

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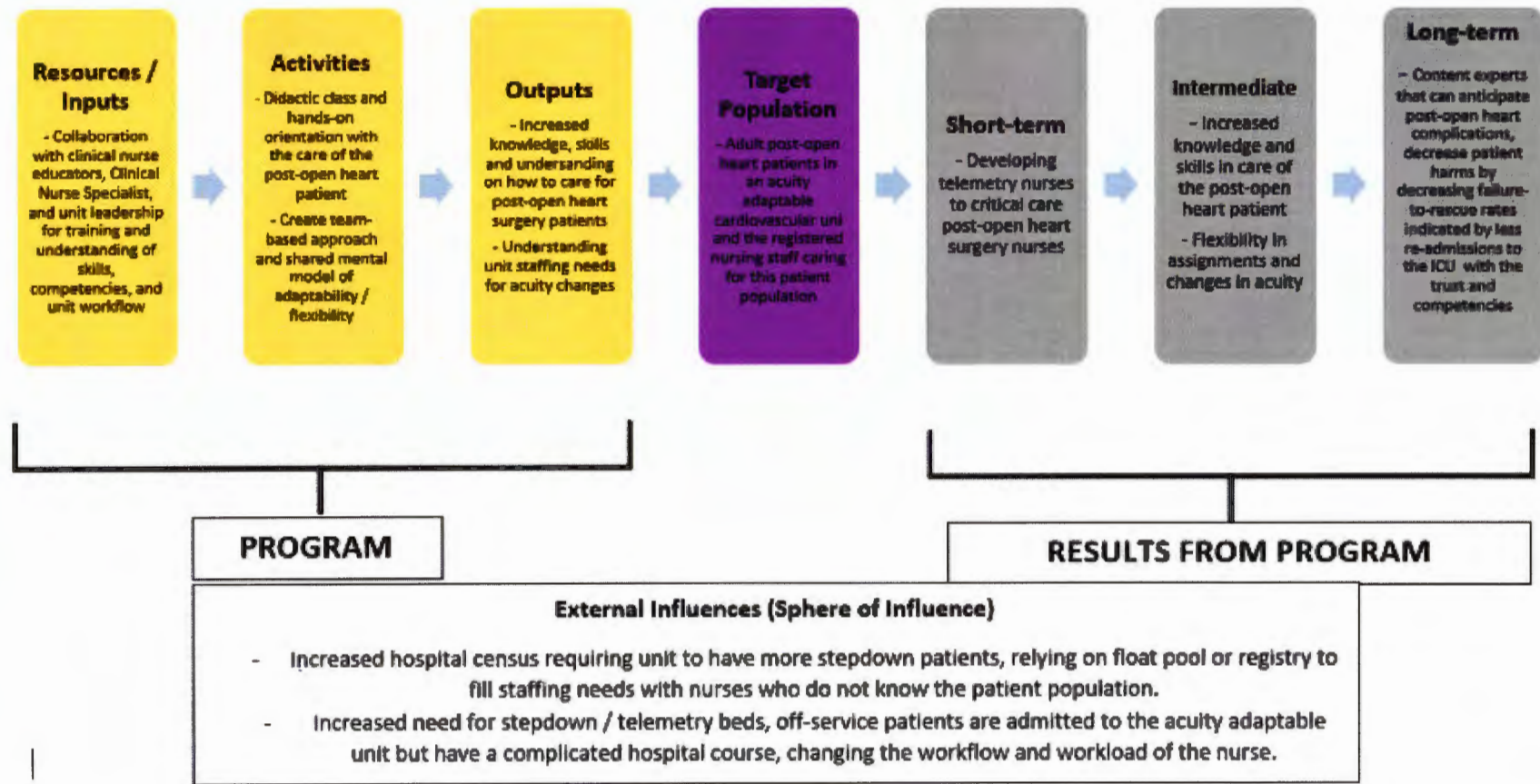
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Figure 1

Acuity-Adaptable Logic Model



Appendix A

Kuali Approval Email

Dear Kathryn Kay Camu Anotado Lopez,

The University of California, Irvine (UCI) Human Research Protections (HRP) Program complies with all review requirements defined in 45 CFR Part 46 and 21 CFR 50.3.

Based on the responses provided in Non Human Subjects Research (NHSR): #685 - "Implementing an Acuity Adaptable Model in a Cardiovascular Surgical Unit ", and per the definitions cited below, the activities do not constitute human subject research or a clinical investigation, as applicable. Therefore, UCI IRB review is not required and will not be provided.

45 CFR 46.102(l) defines research as “a systematic investigation, including research development, testing and evaluation, designed to develop or contribute to generalizable knowledge; and 45 CFR 46.102(e)(1) defines a human subject as “a living individual about whom an investigator conducting research obtains (i) Obtains information or biospecimens through intervention or interaction with the individual, and uses, studies, or analyzes the information or biospecimens; or (ii) Obtains, uses, studies, analyzes, or generates identifiable private information or identifiable biospecimens.”

21 CFR 50.3(c) defines a clinical investigation as “any experiment that involves a test article and one or more human subjects and that either is subject to requirements for prior submission to the Food and Drug Administration under section 505(i) or 520(g) of the act, or is not subject to requirements for prior submission to the Food and Drug Administration under these sections of the act, but the results of which are intended to be submitted later to, or held for inspection by, the Food and Drug Administration as part of an application for a research or marketing permit.”

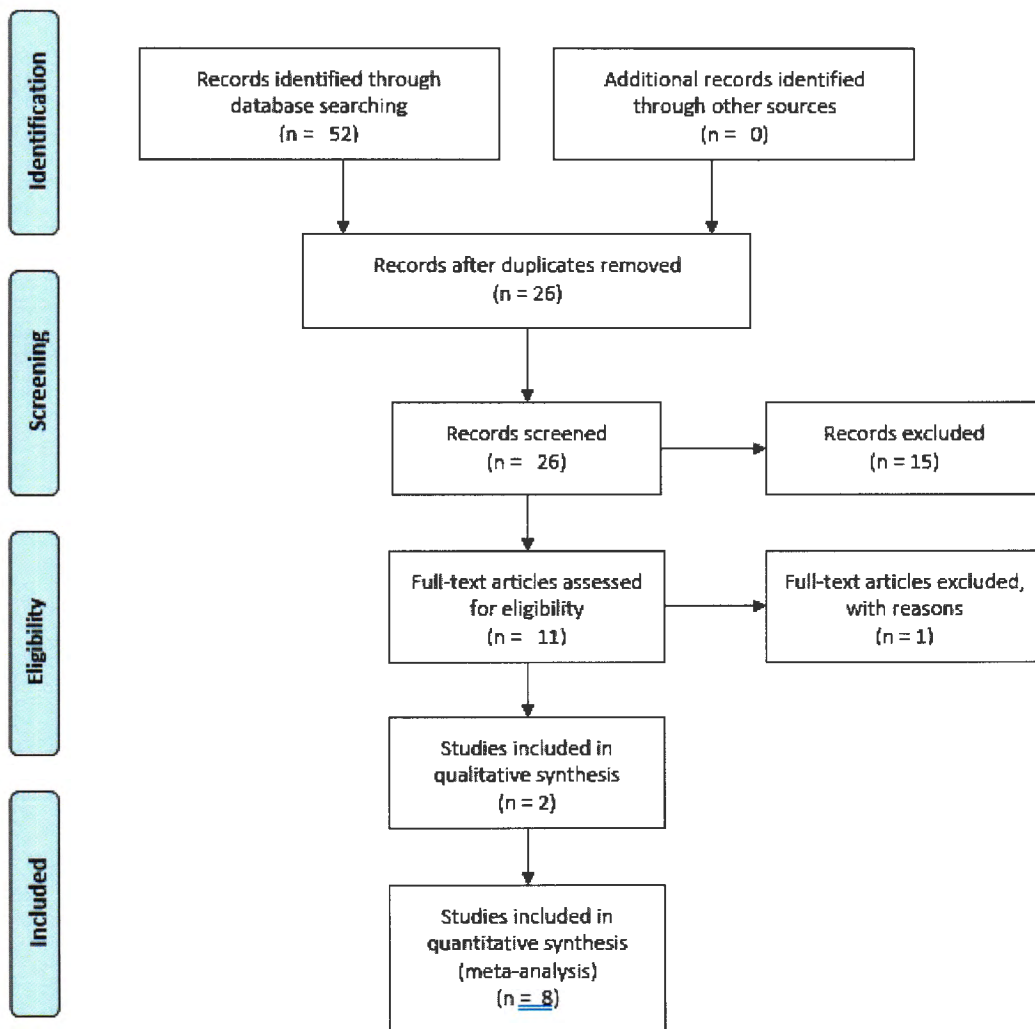
To view the determination for your submission, click here:
uci.kuali.co/protocols/protocols/61b2da5b3ca9e80036ed522d

Appendix B

PRISMA 2009 Flow Diagram



PRISMA 2009 Flow Diagram



From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Med* 6(6): e1000097. doi:10.1371/journal.pmed.1000097

For more information, visit www.prisma-statement.org.

Appendix C

Table of Evidence

| | SOURCE (AUTHORS/ DATE) | TOPIC | POPULATION OF STUDY | Independent/Dependent Variable (*Primary Outcome) | RESULTS/ CONCLUSIONS | LIMITATIONS |
|----------|------------------------|---|---|---|--|--|
| SOURCE 1 | Chindhy et al., 2014 | Impact of an adaptable acuity unit on the outcomes after cardiac surgery | 2,930 cardiac procedural patients | Length of ICU stay, length of hospital stay, re-admission to ICU rate, hospital mortality and 30-day hospital re-admission rate pre- and post-implementation on an acuity-adaptable unit. | Significant decrease in median length of intensive care unit (ICU) stay (49 [27–99] vs 26 [19–45] h, $p < 0.01$); median length of hospital stay (6 [4–10] vs 5 [4–7] days, $P < 0.01$; readmission rate of ICU (5% vs 2% $P < 0.01$) No significant reductions in hospital mortality hospital readmission <30 days. | Retrospective study in a single-center; disproportionate comparison of pre-AAU vs. post-AAU patients |
| SOURCE 2 | Costello et al., 2017 | Comparison of pediatric cardiac surgery patient outcomes in an adaptable-acuity model vs. a traditional model | 2,363 cardiac surgery patients; 925 patients in the traditional model; 520 in the transitional group, and 918 in the adaptable acuity model | Operative mortality; failure to rescue rate; post-operative hospital length of stay | Adjusted odds of operative mortality in the acuity-adaptable group was 0.55 (95% confidence interval: 0.26-1.18; $P = .12$). Failure-to-rescue rate (i.e. number of deaths in patients with any complication divided by the number of total patients with any complication) decreased from 8.7% to 4.2%; $P = .04$). Post-operative hospital length of stay shorter in the acuity-adaptable group ($P = .07$). | Retrospective study done with treatment at a single-center; multiple system factors occurred concurrently including additional cardiac intensivists, transition to in-house on-call attending and changes to electronic medical record |

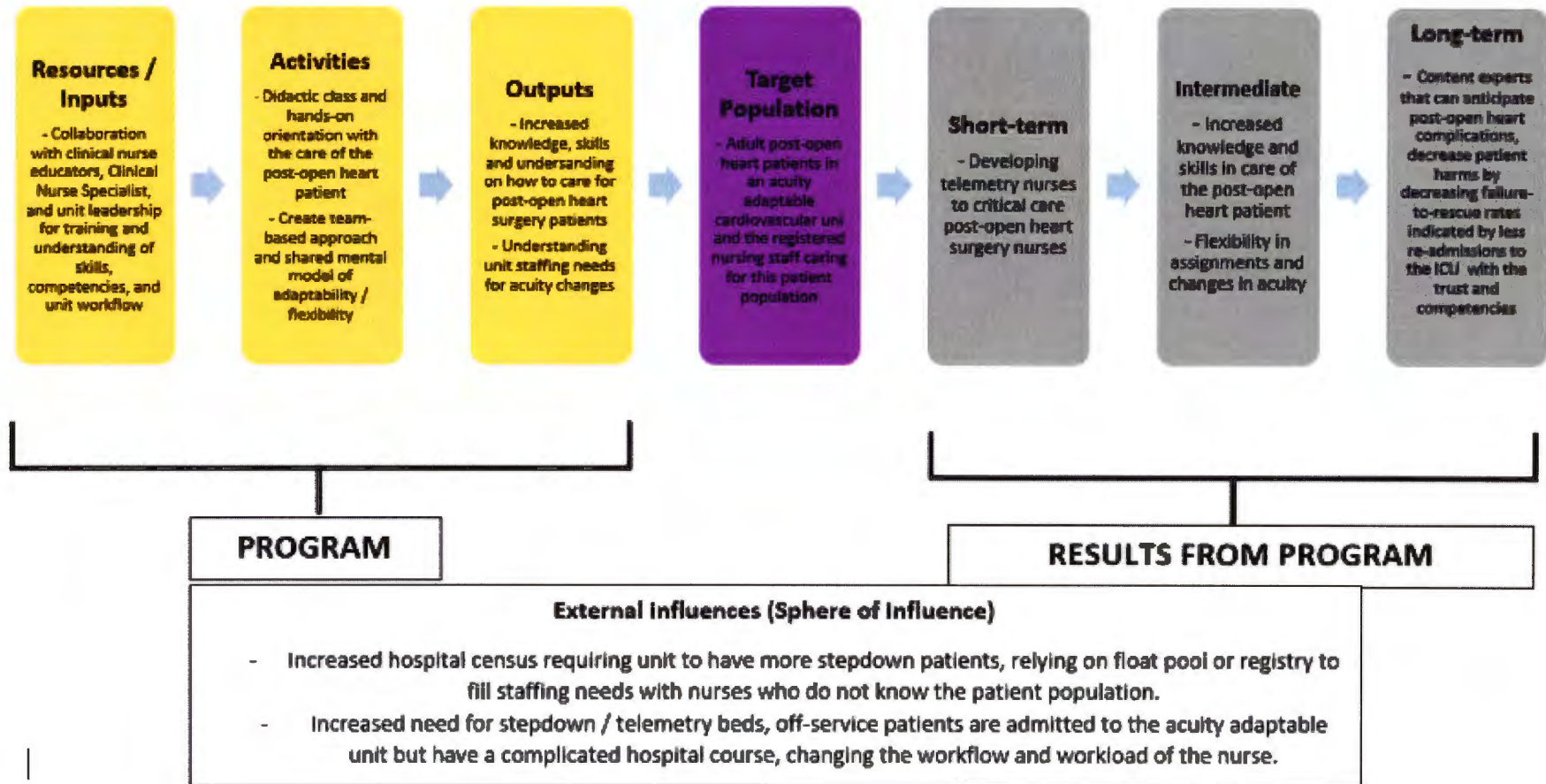
| | | | | | | |
|-------------|-----------------------|---|--|--|---|---|
| SOURCE 3 | Kitchens et al., 2018 | Patients and families' perceptions about care in an adaptable acuity unit mode | 18 low-income patients in a 315-bed urban, county hospital | Room placement in an adaptable acuity unit / perceptions of reduced risk, continuity of care and healing | Adaptable acuity units perceived a healing environment and more confidence in care by proficient staff by staying in one room rather than changing rooms. | Purposive sample of urban residents in a safety-net hospital in a new unit of the hospital; results could differ in a unit that was not newly built |
| SOURCE 4 | Osaki et al., 2013 | Impact of an adaptable acuity unit (AAU) on ventricular assistive device (VAD) patients' outcomes | 195 VAD patients | Placement in AAU vs. traditional room | Significant decrease in median length of intensive care unit (ICU) shorter by five days; hospital stays by 6 days, respectively ($p < 0.01$); hospital mortality (8% vs. 5%, $p = 0.48$); ICU re-admission (10% vs. 5%, $p = 0.19$); hospital readmission rates (18% v. 17%, $p = 0.99$) | Retrospective study in a single-center; disproportionate comparison of pre-AAU vs. post-AAU patients |
| SOURCE 5 | Sosebee et al., 2017 | Patients' perception of care in an adaptable acuity unit (AAU) vs. traditional workflow; feasibility of resources; nurse productivity and motivation to change in AAU | 71 participants in a progressive care unit (PCU) | Room placement in adaptable acuity unit vs. traditional transfers with changes in acuity | Decreased emotional satisfaction in AAU; PEECH scores 58 vs. 62. No evidence to support decreased patient harms; staff satisfaction decreased from taking care of lower acuity patients. | Non-ICU rooms have semi-private rooms; this may differ with adaptable-acuity rooms that have all private rooms |

| | | | | | | |
|-------------|----------------------------|--|---|--|--|---|
| SOURCE 6 | Vendetti, 2015 | Comparison of nurse-sensitive quality indicators and LOS for patients in an AA post-cardiac surgery unit vs. traditional Cardiac ICU (CICU) workflow | 1,120 post-cardiac surgery patients; 726 (64.8%) under the Acuity-adaptable Model | Room placement in adaptable acuity unit vs. traditional transfers with changes in acuity | Median LOS 6 days for AAM; 7 days for CICU patients ($p < 0.0001$); significant higher risk of VAP in the AAM ($p \leq 0.0103$); low incidence of HAPI and CLABSI did not allow for statistical comparison. | No statistical comparison due to low incidence. Multiple system factors occurred concurrently. |
| SOURCE 7 | Zimring & Seo, 2012 | Elements of successful adaptable-acuity units | Six organizational leaders with acuity-adaptable units | None | Themes to acuity-adaptable success: choosing the right specialty, adoption for entire community hospital locations; hiring and training the right people; onboard staff with flexibility; and creation of a culture of communication | Background study for a consultation of a single new hospital. Results varied from smaller community hospitals to academic university hospitals. |
| SOURCE 8 | Paulik Ramson et al., 2013 | Patient satisfaction, nurse satisfaction and patient outcomes in AAU | 168 patients | Patient Satisfaction | Patients who "Rate the Hospital" 9-10 score increased from 62% to 79.7% in AAU; Patients who "Recommend the Hospital" increased from 59.8% to 75.5% | Study completed in four-month span |

| | | | | | | |
|--------------|-----------------------------|--|--|---|---|--|
| SOURCE 9 | Carroll & Frey-Moylan, 2020 | Impact of relationship-based care patient-centered model on pediatric cardiac care adaptable care unit | Multiple integrated acuity-adaptable units | Patient and Nurse satisfaction; patient outcomes | Acuity-adaptable model focuses on relationship-based care and patient-centered care; nurses have specialized knowledge and coordinate care from admission to discharge; environment creates physical comfort, emotional stability, decreased anxiety and the ability to heal because of the continuity of care and elimination of physical room transfer. | Nurses must be knowledgeable, flexible, and collaborative in AAU. |
| SOURCE 10 | Hendrich et al. (2004). | Effect of acuity-adaptable rooms on patient flow and care delivery | 200 post-cardiac surgery patients | Eliminate resource waste; improve providers work environment and personal satisfaction; create exceptional patient experience | Transports were reduced by 90% from previous level; reduction in 70% in medication errors; falls decreased to below national benchmark, less than 2 falls per 1000 days; 3% decrease in patient's dissatisfaction; staff turnover but most were satisfied for learning new technology and skills | Conversion done in critical care however most needed in medical surgical populations |

Appendix D

Acuity-Adaptable Logic Model



Appendix E

Acuity-adaptable Monthly Activity Report

MONTHLY CVSU ACTIVITY REPORT

Month: **November**

Year: **2021**

| DATE | 0700-1859 | | | | | | | | | 1900-2359 | | | | | | | 2400-0700 | | | | | | | | | |
|------|-------------|-------|------|---------------|-----------------------|--------|-------------|-------|------------|--------------|-------------|-------|------|----------------|----------------------------|------------------|-----------|-------------|------|-------|-------------|-----------|--------------|-----------------|--------|-----|
| | #SDU & TELE | | | #OF BEDS CVRD | Total # RN being used | BRK RN | ADMIT/TX In | TW/DC | Sitter HRS | 7 PM CENS US | #SDU & TELE | | | # OF BEDS CVRD | Total # RN being used NOCs | NOT REC MEDIC/MY | BRK RN US | #SDU & TELE | | | Admit TX In | TW/DC Out | 8 AM CENS US | Sitter HRS-NOCS | BRK RN | |
| | #SDU | #TELE | #M/S | Total | Total | BRK | Total | Total | HRS | | #SDU | #TELE | #M/S | Total | Total | Total | Total | | #SDU | #TELE | #M/S | Total | Total | Adit | Total | BRK |
| 1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 4 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 17 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 22 | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| 24 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 26 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 27 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 29 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 30 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 31 | | | | | | | | | | | | | | | | | | | | | | | | | | |

Appendix G

GALLUP Survey Questions

Gallup Q¹² Items

Questions

| Questions | | Total N |
|-------------------------------------|---|---------|
| Q00: Overall Satisfaction | | |
| Q01: Know What's Expected | | |
| Q02: Materials and Equipment | Q00: On a five-point scale, where 5 means extremely satisfied and 1 means extremely dissatisfied, how satisfied are you with your organization as a place to work? | 74 |
| Q03: Opportunity to do Best | Q01: I know what is expected of me at work. | 75 |
| Q04: Recognition | Q02: I have the materials and equipment I need to do my work right. | 74 |
| Q05: Cares About Me | Q03: At work, I have the opportunity to do what I do best every day. | 75 |
| Q06: Development | Q04: In the last seven days, I have received recognition or praise for doing good work. | 71 |
| Q07: Opinions Count | Q05: My supervisor, or someone at work, seems to care about me as a person. | 74 |
| Q08: Mission/Purpose | Q06: There is someone at work who encourages my development. | 73 |
| Q09: Committed to Quality | Q07: At work, my opinions seem to count. | 75 |
| Q10: Best Friend | Q08: The mission or purpose of my organization makes me feel my job is important. | 74 |
| Q11: Progress | Q09: My associates or fellow employees are committed to doing quality work. | 74 |
| Q12: Learn and Grow | Q10: I have a best friend at work. | 73 |
| | Q11: In the last six months, someone at work has talked to me about my progress. | 75 |
| | Q12: This last year, I have had opportunities at work to learn and grow. | 75 |

Q12 Mean

The Gallup Q12 score represents the average, combined score of the 12 elements that measure employee engagement. Each element has consistently been linked to better business outcomes.

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Appendix H

Data Collection Repository for Cardiovascular Surgery Patient Outcomes

The same data collection instrument was used for the outcomes for the cardiovascular surgical patients recovering in the acuity-adaptable CVSU and the cardiovascular patients recovering in the traditional staffing unit.

| Acuity-Adaptable Outcomes for Cardiovascular Surgical Unit (April 2020 - March 2021) | | | | | | | | | | | | | | |
|--|---------|-----|--------|------|-----------|----------|--------------|----------------|-------------------------------|---|-----------|------------------|------------|--------------|
| Pt | Surgery | Age | Gender | Race | Insurance | Diabetic | Hypertension | Hyperlipidemia | Coronary Artery Disease (CAD) | Number of admitted days prior to CV surgery | LOS CVICU | Re-admit to ICU? | LOS (CVSU) | LOS Hospital |
| 1 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | |
| 6 | | | | | | | | | | | | | | |
| 7 | | | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | | | |
| 10 | | | | | | | | | | | | | | |

Appendix H

Legend for the Data Collection Storage Instrument for Card

| Legend | | |
|-------------------------|----------------------|------------|
| Gender | 1 = Male | 0 = Female |
| Age | Number of years | |
| Race | 1 = Caucasian | |
| | 2 = African-American | |
| | 3 = Hispanic | |
| | 4 = Asian | |
| | 5 = Other | |
| | 6 = Mixed | |
| Insurance | 1 = Medicare | |
| | 2 = MediCal | |
| | 3 = CalOptima | |
| | 4 = Private | |
| | 5 = None | |
| Diabetic | 1 = Yes | 0 = No |
| Hypertension | 1 = Yes | 0 = No |
| Hyperlipidemia | 1 = Yes | 0 = No |
| Coronary Artery Disease | 1 = Yes | 0 = No |
| Heart Surgery | 0 = Valve | |
| | 1 = CABG | |
| | 2 = Dissection | |
| | 3 = Aneurysm | |
| | 4 = Other | |
| LOS | Number of days | |
| Re-admit to ICU? | 1 = Yes | 0 = No |
| | 2 = N/A | |