PROVIDING COST EFFECTIVE QUALITY CARE:
A TOYOTA LEAN NURSE-DRIVEN QUALITY IMPROVEMENT PROGRAM

by

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BS in Business Administration, American University, 2007

Submitted to the Graduate Faculty of

Graduate School of Public Health in partial fulfillment

of the requirements for the degree of

Master of Public Health

University of Pittsburgh

2013

UNIVERSITY OF PITTSBURGH

GRADUATESCHOOL OF PUBLIC HEALTH

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ABSTRACT

Healthcare quality is a priority in this country. Interventions addressing this problem have been done frequently leading to entire hospital departments being dedicated to quality. Nurses comprise the largest sect in healthcare. They have direct access to patient safety. They also have firsthand knowledge of the processes that drive quality. Nurses have been underutilized as quality drivers in health care. One solution was a nurse-driven quality improvement program, called "Providing Cost Effective Quality Care," that used Toyota Lean as its model for quality improvement. The purpose of this thesis was to determine if the program's successes and deficits could be identified comprehensively within the context of a theoretical implementation framework.

The objectives of the program were to support ongoing quality improvement initiatives, while increasing nurses' access to continuing education, all to improve the quality of patient care. Two cohorts of nurses attended the training and implemented quality improvement projects. Changes were made between cohorts to increase program effectiveness. Results of the program showed that nurses should be selected based on their knowledge of and dedication to the project at hand, that the training program was an effective way to introduce Lean concepts but should allow for team project time, that the use of a coach was an integral component for project effectiveness, and that a lack of administrative support stunted project uptake and implementation. The findings in this thesis demonstrate that the successes and deficits of the

"Providing Cost Effective Quality Care" program could be described within the implementation framework. Additional research is needed to use the theoretical implementation framework to drive the program planning and a long-term outcomes evaluation is needed to determine effectiveness in improving patient safety.

This program has public health significance because it makes use of nurses, who are on the frontline of patient care. The nurses are in the position to support improving patient safety and quality of healthcare, thereby reducing unnecessary adverse health events. This, in turn, reduces the burden of preventable diseases.

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PREFACE

1.0   INTRODUCTION

Every year the Agency for Healthcare Research and Quality publishes the National Healthcare Quality Report (2012).   The report outlines the state of healthcare quality and healthcare disparities. The most recent report deemed improving patient safety to be a national priority. The report found that while other quality indicators were improving, those of patient safety have remained stagnant, particularly medical errors and medical adverse events (Agency for Healthcare Research and Quality, 2012). Further, nurses' position on the front line of patient care gives them the ability to see the direct effects of errors and adverse events. This provides the opportunity for nurses to improve quality processes (Kliger, Lacey, & Olney, 2010). One approach to addressing this problem chosen by hospital administration in the present study was the Toyota Lean method of quality improvement (Womack & Jones, 1996). Toyota Lean is a system for improving quality outcomes by simplifying processes and eliminating waste (Womack & Jones, 1996). The purpose of this thesis was to determine if the successes and deficits of a Toyota Lean nurse-driven quality improvement program could be comprehensively identified in the context of an evidence-based implementation model (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). The program was called "Providing Cost Effective Quality Care."

This thesis will first provide background on quality improvement initiatives in healthcare. Next, the Fixsen framework of implementation through which the program will be analyzed will be described (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). It will then describe three

quality improvement models, driven by nurses, available in the literature: Transforming Care at the Bedside (Institute for Healthcare Improvement, 2013), Integrated Nurse Leadership Program (Center for Health Professions, 2012), and the Clinical Scene Investigator Academy (Lacey, 2011). Then, it will provide the background on the Toyota Lean model of quality improvement (Womack & Jones, 1996).

The final sections of this thesis will describe the methods and results from the "Providing Cost Effective Quality Care" program, and discuss the program through the context of the implementation framework described. In 2011, a union-management-labor partnership was formed at two hospitals in Southwestern Pennsylvania: hospital administrators, Service Employee International Union (SEIU) Healthcare Pennsylvania representatives, and nurses from hospital-based departments across the two hospitals. SEIU Healthcare obtained a grant from the Pennsylvania Department of Labor and Industry to implement a program called "Providing Cost Effective Quality Care." The goal of "Providing Cost Effective Quality Care" was that the program would support ongoing quality improvement initiatives, while increasing nurses' access to continuing education (Service Employees International Union Healthcare Pennsylvania, 2010). The steering committee, consisting of representatives from all three partners from both hospitals had the ultimate goal that the program would serve as a replicable model for other Pennsylvania hospitals. If these objectives were achieved, it was hoped that there would be a) an improvement in nurses' job performance, b) greater job satisfaction, c) increased knowledge of evidence-based quality of care strategies—all to strengthen patient care.

2.0   BACKGROUND

2.1   QUALITY IMPROVEMENT INITIATIVES IN HEALTHCARE

The Institute of Medicine (IOM; 1999; 2001) wrote two reports that focused on quality and safety in healthcare. The first report, *To Err is Human: Building a Safer Health System*, focused on preventable medical errors (IOM, 1999). The report stated that preventable medical errors not only have patient outcome consequences and are financially costly, but also result in a lack of trust in the healthcare system by patients. One reason stated for the high rate of these errors is attributed to the "silo mentality" of health care where each department or physician acts independently of each other without coordination. In the report, where the IOM described a strategy for reducing this type of error, one of the main recommendations was to improve workflow processes instead of the errors of individual health care workers (IOM, 1999).

The second report, *Crossing the Quality Chasm: a New Health System for the 21st Century*, was published two years later (IOM, 2001). It discussed how the complexity of medicine has increased so much with so many people involved in the care of one patient that the quality and safety of that care has lagged. The report focused on six aims that patient care should be: safe, effective, patient-centered, timely, efficient and equitable. These aims were

described as the key points to redesign the delivery of healthcare, which was the overarching goal of the report (IOM, 2001).

The Patient Protection and Affordable Care Act (PPACA; 2010) brought new changes meant to improve health care quality. Under the PPACA, beginning in October of 2012 Medicare/Medicaid has begun reimbursing hospitals based on patient outcomes, particularly hospital readmissions. A hospital readmission is defined as the event when a patient is discharged from a hospital and then is readmitted within a certain amount of time to that hospital or a similar facility (PPACA, 2010). If a patient is readmitted to the hospital within 30 days for certain medical conditions, the hospital loses part of its reimbursement (PPACA, 2010). Specifically, the medical conditions for which this applies are acute myocardial infarction, congestive heart failure, and pneumonia (Centers for Medicare and Medicaid Services Media Relations, 2011). The purpose of this law was to ensure that precautions are taken with patients to prevent medical mistakes and errors that result in readmission, thereby improving the quality of the patient's medical care (PPACA, 2010).

Nurses make up the largest sect of the health care workforce with over three million today (IOM, 2010). Another IOM report, *The Future of Nursing: Leading Change, Advancing Health* found that the skills of nurses are underutilized, their responsibilities need to be increased, and the healthcare culture should be changed to value their participation (IOM, 2010). The report laid out four key points for the future of nursing. First, the report found that, currently, the scope of practice nurses have for their work varies widely from state to state and reform is needed at the federal level to ensure that nurses are allowed to practice to the full extent of their education and training. Second, nurses should achieve higher levels of education and training through an education system that promotes academic progression such as to a bachelor's

or a master's degree. Third, nurses should be engaged as full partners with physicians and other healthcare professionals in redesigning health care in the United States. The IOM (2010) describes this as advancing healthcare by having nurses identify problems and determine and follow improvement plans, as well as hold places on policy advisory boards. The fourth key point for nursing from the IOM report said that effective workforce planning and policy making require better data collection and an improved information infrastructure (IOM, 2010). The third point is the most relevant to this program. It discusses the role that nurses need to have as leaders and change-promoters with the skills needed to advance the quality of health care. In this role, they take on the responsibility of identifying inefficient processes and implementing change to increase safety and efficiency (IOM, 2010).

While this thesis describes the successes of a Toyota Lean nurse-driven quality improvement initiative, it does so through the context of a program implementation framework. The theoretically-driven framework is used to systematically analyze the program through a series of steps described here.

2.2   FIXSEN FRAMEWORK

Fixsen, Naoom, Blase, Friedman, and Wallace (2005) created an implementation framework for the uptake and maintenance of evidence-based practices based on a comprehensive synthesis of the literature. This model of implementation science outlines a comprehensive framework to promote uptake, establishment, and maintenance of models into practice (Eccles & Mittman, 2006). The specific framework includes the following seven core components: 1) appropriate staff **selection** at all levels of the project and **selection** of the evidence-based program; 2) pre-

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service **training** on the specific evidence-based practice; 3) expert **coaching and consultation** of staff and administration to carry out their newly-acquired skills; 4) **staff evaluation** to assess the use and outcomes of the trained skill and to act as individual feedback; 5) **program evaluation** to assess and provide feedback on key aspects of the performance of the organization or unit around the new skill; 6) **facilitative administrative supports** to support supervisors so that data is used to focus and inform decision making; and 7) **systems interventions** to identify financial, organizational, and human resources to maintain ongoing efforts and to sustain the program (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005).

Core Implementation Components
to successfully implement evidence-based practices or practices within evidence-based programs

Staff Evaluation

Program Evaluation

Consultation & Coaching

Integrated & Compensatory

Facilitative Administrative Supports

Preservice Training
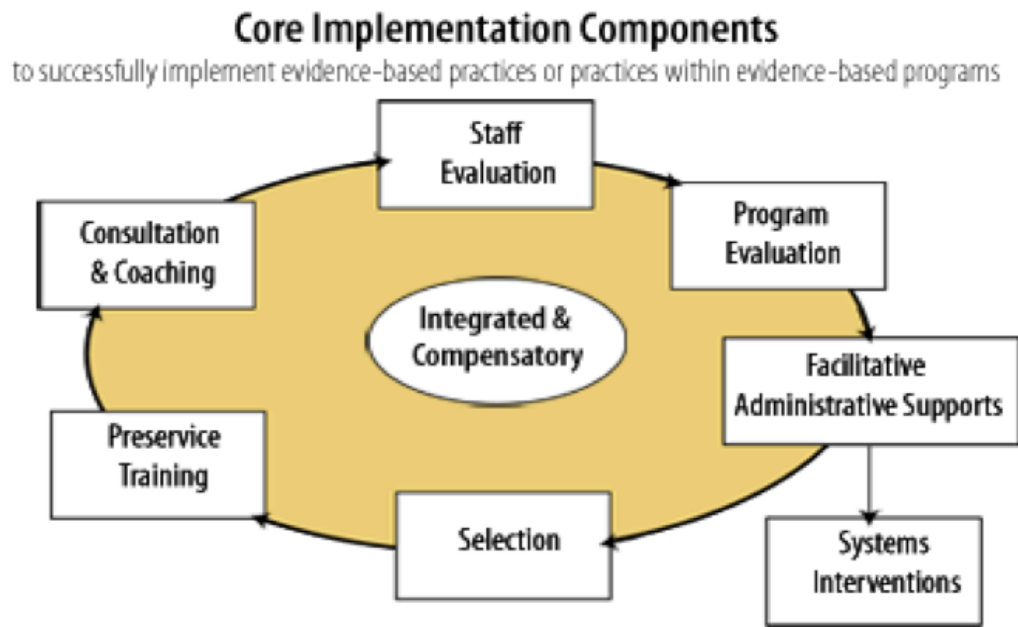
Selection

Systems Interventions

Figure 1 Core Implementation Components

Reprinted from Fixsen, Naoom, Blase, Friedman, & Wallace, 2005

Each of the steps was designed to interact with each other to increase the likelihood that they would influence staff behavior and change the organization in such a way that the evidence-

based practice would be incorporated. The interactive implementation components were also designed to compensate for one another so that a weakness in one component could be overcome by strengths in other components. As shown in Figure 1, the core implementation components are integrated and compensatory. Thus, a project could begin anywhere on the circle (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005).

The implementation framework was not part of "Providing Cost Effective Quality Care." However, the framework described offers a systematic context for analyzing the implementation of a program and for determining if the successes and deficits of the program could be identified within this framework.

2.3   NURSE-LED INITIATIVES

In order to understand the current climate of quality initiatives driven by nurses, a short literature review is given here. Using a Pubmed search of mesh terms "Quality Assurance, Health Care/organization & administration," "Organizational Innovation," "Nursing Staff, Hospital/organization & administration," "Nurse's Role," and "Program Development," there were only three models of nurse-led quality improvement initiatives, found in the literature, that have been piloted, tested, and published in the United States. These were Transforming Care at the Bedside (Institute for Healthcare Improvement, 2013), Integrated Nurse Leadership Program (Center for Health Professions, 2012), and the Clinical Scene Investigator Academy (Lacey, 2011). A brief description of each program including its funding source, breadth of the program, and the fundamental tenets of each program are described.

2.3.1 Transforming Care at the Bedside

The first model was Transforming Care at the Bedside (Institute for Healthcare Improvement, 2013). Transforming Care at the Bedside (TCAB) was an initiative by the Robert Wood Johnson Foundation and the Institute for Healthcare Improvement. It started in 2003 with three pilot hospitals and has since expanded to 147 hospitals throughout the United States plus additional hospitals that used the training resources the program provided (Institute for Healthcare Improvement, 2013). TCAB aimed to improve quality on medical-surgical hospital units (Rutherford, Moen, & Taylor, 2009). TCAB was the only one of the three currently used models that was in hospitals across the country (Kliger, Lacey, & Olney, 2010).

The four components that made up the program were "safe and reliable care", "vitality and teamwork", "patient-centered care", and "value-added care processes" (Institute for Healthcare Improvement, 2013). Safe and reliable care meant that hospitalized sick people were treated fairly, effectively, and efficiently. Vitality and teamwork meant that care teams aimed for excellence while supporting each other's professional development. Patient-centered care was a holistic approach to providing care to the patient by considering the patient's values, continuity of care, and the patient's family. Finally, value-added care processes were those patient processes that flowed continuously (Institute for Healthcare Improvement, 2013). The program involved people from all organizational levels, from the top executives of the hospital system to front-line workers such as nurses (Rutherford, Moen, & Taylor, 2009). While cross-discipline teams were formed, there was a focus to include nurses, specifically (Kliger, Lacey, & Olney, 2010).

If a hospital wanted to be involved in the TCAB process, it had to go through a rigorous application process (Kliger, Lacey, & Olney, 2010). Once a hospital was accepted, all of the

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team members involved in the process went through a brainstorming event, referred to as the "snorkel" or "deep-dive" (Rutherford, Moen, & Taylor, 2009). During this event, current processes were discussed as well as opportunities for improvement. The group determined a certain number of projects to take on. The projects were tackled using a part of the "Model for Improvement" that describes a Plan-Do-Study-Act cycle (Deming, 1994) that involves planning of the project, a small-scale pilot implementation, a data-driven evaluation, and then expanded to other units or areas if ready or changed and repeated if improvement was needed (Rutherford, Moen, & Taylor, 2009).

An important part of TCAB that was added after the initial pilot of the program was that it aimed to foster transformative change (Rutherford, Moen, & Taylor, 2009). Transformative change was described as a process whereby everyone involved in the hospital project must critically analyze previously formed perspectives and assumptions, and create new paradigms that fit the true current situation. One lesson learned from this transformative climate was that managers and administrators throughout the hierarchy of the organization needed to support the projects and to assist and provide resources (Rutherford, Moen, & Taylor, 2009). The authors described this to mean that executives needed to create and enforce policies that supported the innovation, middle managers needed to support and empower nurses to create change, and nurses and other front-line workers needed to collect the data to determine the effectiveness of the changes and new processes. Without the support of all rank levels, the TCAB projects were not effective (Rutherford, Moen, & Taylor, 2009).

The implemented TCAB projects were facilitated by a TCAB design team (Rutherford, Moen, & Taylor, 2009). The design team, consisting of faculty members from the Institute for Healthcare Improvement, created the framework for TCAB and coached the hospital project

teams. They also attended meetings, site visits, and conference calls to aid the hospital teams through the entire Plan-Do-Study-Act process to improve quality outcomes (Rutherford, Moen, & Taylor, 2009).

2.3.2   Integrated Nurse Leadership Program

The second model was the Integrated Nurse Leadership Program (INLP; Center for Health Professions, 2012). INLP was a partnership between the Gordon and Betty Moore Foundation and the University of California at San Francisco. The purpose of the program was to improve hospital patient outcomes by developing nurse professionalism and leadership skills by way of six competency areas: "communication, project management, team building, managing change, leadership, and critical thinking" (Kliger, Lacey, & Olney, 2010). The end goals were to improve patient outcomes and nurse satisfaction resulting in lower turnover rates (Center for Health Professions, 2012). The program started with 16 hospitals in the San Francisco Bay Area and was expanded to include eight more. The first group of hospitals focused on projects aimed at reducing medication errors. The second group's overarching goal was to increase early recognition of sepsis, thereby decreasing mortality rates (Kliger, Lacey, & Olney, 2010).

INLP literature states that the nurses and other frontline staff played an integral role in achieving quality outcomes (Kliger, Blegen, Gootee, & O'Neil, 2009). INLP started with a quality problem determined by frontline staff. A team was then created, consisting of about 25 people, seven to ten of whom comprised a core team who provided the mentoring and coaching for the rest of the team. The teams consisted of front-line workers as well as senior administrators who actively supported the projects (Kliger, Blegen, Gootee, & O'Neil, 2009).

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These teams then completed an eight-session training program at off-campus locations. The team then worked together on quality improvement projects in their respective hospitals with in-hospital mentoring by the smaller core team, and regular meetings. A facilitator from the INLP also acted as a mentor by maintaining contact with the project teams, by attending meetings and consulting on the projects. They used the Plan-Do-Study-Act model (Deming, 1994) to brainstorm new ideas and test initiatives with the goal of expanding the process across the unit and then to other units (Kliger, Lacey, & Olney, 2010).

The initial funding for these projects came from the Gordon and Betty Moore Foundation, with hospital matching funds. The majority of this money was spent to allow nurses paid time off to commit themselves to the project by collecting data and attending meetings, as well as to fund additional staff-time to fill the holes in the schedule (Kliger, Blegen, Gootee, & O'Neil, 2009).

2.3.3   Clinical Scene Investigator Academy

The third model is the Clinical Scene Investigator (CSI) Academy (Lacey, 2011). The CSI Academy was a project funded by a number of institutions including the Health Care Foundation of Greater Kansas City and the REACH Healthcare Foundation (Lacey, 2011).

The purpose of the CSI Academy was to create sustainable change at the bedside that could be expanded and spread to other units in the hospital by nurses (Lacey, 2011). The CSI Academy found that nurses' lack of quality improvement terminology and skill sets lead to their difficulty in being fully involved in quality improvement projects in their hospitals. As such, it was a training program that taught quality improvement terminology and methodology to teams of nurses from the same unit. Also included in the academy were lessons on team building and

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leadership (Lacey, 2011). The changes implemented from the CSI Academy were meant to be piloted and tested on a small scale, in one unit, and then expanded to include other units making the change (Kliger, Lacey, & Olney, 2010).

This model used small teams of two to four nurses chosen by the Chief Nursing Officer (Lacey, 2011). This size team was utilized because it was small enough that each member and the team as a whole was able to maintain ownership of the project without getting disconnected. On the other hand, it was difficult for individuals to create change alone (Lacey, 2011). Along with the team of nurses, an internal mentor and an external mentor were also involved in the project. The internal mentor was a member of the same organization, but of a director level or above. The internal mentor was used to ensure that the team had access to the resources they needed and facilitated project coordination with other units. The external facilitator was from the outside community and should have had experience related to the project. This role was used to offer a larger community-wide perspective of the situation (Lacey, 2011).

The teams enrolled in a series of nine training sessions that were held once a month (Lacey, 2011). Each session was devoted to different topics while also providing time for the participants to work on their projects. The initial training schedule did not offer this project time, but training evaluations led to the understanding that the nurses had difficulty finding time during their normal work schedules to work on their projects, so the training schedule was modified to offer one full day strictly for project development. The training also offered sessions on program implementation and evaluation, data collection and analysis, and leadership skills (Lacey, 2011).

The three models of nurse-driven quality improvement initiatives described provided background on the current state of these types of initiatives in healthcare today. The program

described in this thesis has its foundation in the Toyota Lean model (Womack & Jones, 1996) of quality improvement. While the program described adds additional aspects to the Lean model, a basic understanding of the Lean model is necessary for analysis of the "Providing Cost Effective Quality Care" program.

2.4   TOYOTA LEAN

In healthcare, the tradition has been that each unit or department acts independently of the others resulting in a "silo" system (Kim, Spahlinger, Kin, & Billi, 2006). In this system, care is often fragmented and only the patient is familiar with every aspect of his/her care (Poksinska, 2010). Lean methodology is a system-wide change process that aims to reduce the individual departments and create a cohesive system (Joosten, Bongers, & Janssen, 2009). One of the ideas of Lean is that of empowering people to create the changes in the processes that are needed to improve quality. That way, processes are improved, patients become safer, and hospital staff have increased job satisfaction (Poksinska, 2010).

Lean, the common name for the Toyota Production System, originated from the Toyota Manufacturing Company that focused on continuous improvement and respect for employees (Womack & Jones, 1996). Lean is a system for improving quality outcomes by simplifying processes and eliminating waste. There is no complete agreed upon definition of what makes up a Lean system (Poksinska, 2010). Womack and Jones (1996) took the Toyota Production System and determined that it can be applied to other fields including service industries like healthcare. They determined five steps that make up a Lean system: define value from the

customer's standpoint, map the value stream, create flow, establish pull, and seek perfection (Womack & Jones, 1996).

2.4.1   Define Value from a Customer's Standpoint

The first widely agreed upon component of a Lean system is that value is defined from the perspective of the customer and that the customer should receive 100% of the value (Kim, Spahlinger, Kin, & Billi, 2006). This creates an issue in healthcare because the direct customer is the patient. However, the patient is less often the one paying for the services. While many other stakeholders, such as insurance companies and patient families, are involved in the processes that occur in healthcare, the patient is the one receiving the ultimate outcomes and so has been deemed the customer for the purposes of Lean. Looking at the process from the perspective of the patient allows for value added time to include time providing both emotional and physical comfort to the patient as well as direct patient medical care (Poksinska, 2010).

A foundational element of Lean is the A3, named such for the size of the paper on which it fits (Kimsey, 2010). Lean culture indicates that everyone should have an awareness of quality improvement projects. The A3 is a visual chart of the problems and continuous improvements targeted. The components of the A3 are the current condition, the problem analysis, the target condition, countermeasures, implementation plan, and learnings and the A3, therefore, is a vital indicator for the state of the process. The A3 is the largest size of paper that fits in a standard copy machine. This is because its purpose is to visually depict, to everyone involved, the process as it evolves (Kimsey, 2010).

2.4.2   Map the Value Stream

Another component of Lean is that of providing value-added activities to the patient while eliminating or reducing non-value added activities (Womack & Jones, 1996). In Lean, the first step in this process is understanding the current condition of the process being analyzed. A current condition value stream map is a visual depiction of the way the process works as shown in drawings and arrows. It should not include any target conditions of the process or explanations as to why the process happens the way it does, but should depict the existing process including any problems, as it is currently occurring (Kim, Spahlinger, Kin, & Billi, 2006). The Value Stream Map also has a time component to show the literal amount of time each part of the process takes. Once the time has been completed, the activities in the process are determined to be either value-added or not value-added activities (DelliFraine, Langabeer, & Nembhard, 2010). The ratio of the time each of these two groups (value-added or not value-added) take is determined; the purpose of the Lean project is to improve this ratio (Poksinska, 2010). It is important to note that the current condition map is not created based on the opinions of one or two people who believe that they know how the system works. Data collection, observation of the process, and asking multiple people who actually participate in the process about how it works are vital steps in the creation of the current condition value stream map (Kim, Spahlinger, Kin, & Billi, 2006).

One of the parts of the culture of healthcare today is that when healthcare workers come across the problem or reason why they can not complete a task the way it was meant to be completed, they find ways of working around it or avoiding it instead of making efforts to fix the problem (Poksinska, 2010). Working around the problem may be helpful in the moment when it is faster than finding a viable solution. However, the problem is often then forgotten about or

not addressed and the next person who comes across the same problem does the same thing. With this repeating cycle, the problems in the process are never dealt with. The value stream map aims to address this problem by visually depicting the situation in a way that allows waste to be seen and eliminated.

Once the current condition value stream map has been created, a brainstorming activity often occurs where discussion surrounds ways to improve the process at hand (Kim, Spahlinger, Kin, & Billi, 2006). The Lean implementers then pick a solution and a similar value stream map for the target condition. This map shows what the process ideally would look like with only value-added activities determined from the brainstorming. The next step, flow, that Womack and Jones (1996) defined is the target condition where the value added activities flow from one to the next without non-value added activities mixed in.

2.4.3   Create Flow

The problem analysis part of the A3 attempts to answer "5 Whys" to identify the root causes of the problem. Countermeasures are those changes to make the process more efficient to achieve the ideal condition. Thus, the A3 creates an implementation plan for the team and helps create a detailed schedule of the tasks needed to reach the target condition.

Lean thinking moves away from processes that are arranged in departments and batches and moves toward continuous flow of creating value (Womack & Jones, 1996). By eliminating the time it takes to repeatedly pick up and put down the product for each step in the process or, in health care, walk from patient room to patient room to deliver medications, then start over and do assessments, and then again start over to bathe patients, and instead do all three tasks with the

same patient first before moving on to the next patient, the flow is increased while the waste is decreased.

A main tenet of Lean thinking is to remove the eight types of waste. They include unused human potential, waiting, inventory, transportation, defects, motion, overproduction, and processing (Kimsey, 2010). For example, if a nurse does not have the medication she needs for the patient in the room by her desk, she has to walk to a medication distribution center. If that center does not have the particular medication, she may need to walk to another distribution center or wait for the medication to be sent from the pharmacy. This example includes three types of waste: waiting, inventory, and motion (Kimsey, 2010).

2.4.4 Establish Pull

Pull system is another part of the concepts by Womack and Jones (1996). Pull is the idea that things should happen and be available on an as-needed basis, instead of requesting the item or service and then waiting for it. From flow, the time needed to produce value is decreased, thereby allowing for a pull system (Womack & Jones, 1996). Pull is seen in the example above where the nurse may need to call the pharmacy for the medication.

2.4.5 Seek Perfection

The fifth component of Lean thinking by Womack and Jones (1996) is that of continuous improvement and perfection seeking. At the point where changes have been made towards the target condition, the process is reevaluated using the same methodology. The original target

condition map becomes the current condition map and a new value stream map is created to improve upon the changes already made (Kim, Spahlinger, Kin, & Billi, 2006).

2.4.6 Lean Tools

Along with the things already mentioned, Lean methodology offers a number of tools including the Rules of Work Design that relate to activities, connections, and pathways; Kanban cards, a visual supply chain management tool to prompt action that lets the preceding process know that something is needed; the 5S, an organization system that includes Sort, Set in order, Shine, Standardize, and Sustain. However, Lean thinking is not just a toolbox that can be used individually. The tools are meant to provide logistical help in creating the culture change needed for complete Lean methodology implementation (Poksinska, 2010).

The IOM reports, the three nurse-driven initiatives, the Toyota Lean model of quality improvement, and the implementation model described above all provide necessary components for understanding the program, "Providing Cost Effective Quality Care." The purpose of this thesis was to determine if the successes and deficits of the program can be identified within the context of an evidence-based implementation model (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). That process is described below.

3.0   METHODS

The "Providing Cost Effective Quality Care" program began in 2011 when a steering committee was organized to oversee the program. Along with executing the grant, the steering committee was responsible for guiding the decisions presented by the Project Director, and for strengthening the partnerships formed by the grant. The project's organization was designed as a three-way partnership between labor unions, workers (hospital nurses), and hospital administration (at Hospital A and Hospital B). Together these three partners were charged with designing, carrying out, and monitoring the project's process. An external evaluator at a partner university provided data for program process measures and made recommendations for the program's success. As well, the steering committee hoped to find ways to institutionalize its successes, and be able subsequently to replicate the partnership model statewide. The steering committee's responsibility to guide decisions was facilitated by having representatives selected from labor, union, and management working together on a common goal. Because of the representation of all stakeholders in the partnership on the steering committee, opportunities were present for the groups to understand each other's priorities and thus improve quality.

3.1   PARTICIPANTS

3.1.1   Nurses

The total number of nurses recruited for the project was 92. There were two cohorts throughout the program. Cohort 1 went through the training beginning in July, 2011. Cohort 2 went through the training beginning February, 2012. For cohort 1, there were 72 total nurses: 44 of them were from Hospital A and 27 were from Hospital B. For Cohort 2, there were 20 nurses total: 11 of them were from Hospital A and 9 were from Hospital B. All of these nurses were enrolled in the training. For Cohort 1, only 18 of the nurses enrolled in the training were also on project teams. For Cohort 2, all of the nurses enrolled in the training were also on project teams.

3.2   PROCEDURES

A theoretical model was used to describe the process of implementation and short-term effects of the "Providing Cost Effective Quality Care" program. As described above, the framework of implementation has seven major components: 1) selection, 2) training, 3) coaching and consultation, 4) staff evaluation, 5) program evaluation, 6) facilitative administrative supports, and 8) systems interventions. The procedures of the program are described in the context of these components, as a means of framing the entire process. A logic model of the "Providing Cost Effective Quality Care" program can be found in Appendix A.

3.2.1 Selection

This section describes the methods for the program selection as well as the staff selected for program involvement. In this program, the staff were the hospital nurses. The nurse participants who completed the training were referred to as "Lean nurses."

3.2.1.1 Program

The program chosen was an evidence-based quality improvement model (Toyota Lean) with additional team building components and discussion of the role of the nurse in the health care environment.

3.2.1.2 Nurses

The grant specified that union nurses were to be selected for the project. In addition to their hospitals and profession being designated in the grant, specific nurses were identified or volunteered to join the first 5-Day training cohort because of either their leadership skills or their interest in degree advancement such as attaining either a Bachelor's in Nursing (BSN) or a Master's in Nursing (MSN).

3.2.2 Training

The curriculum for the training program was based on the idea that quality improvement should be led and informed by those closest to the work. The training consisted of three parts intertwined throughout the five days of training. The first part discussed the state of healthcare today from a nursing perspective. Second, Toyota's Lean method of quality improvement

provided a model for creating change based on the idea of providing value to the patient (where value is defined as any action or process that the patient would be willing to pay for) through a process that has zero waste (time, materials, effort and money). The third component of the training discussed issues related to teams and the idea of change in an environment. Throughout these three parts, the philosophy of learning-by-doing was maintained so that hands-on activities, interspersed throughout the lectures, facilitated better acquisition of the new knowledge.

A consulting firm for health care and non-profit organizations brought these three areas together for a 5-Day training program. It was designed to not only cover the three areas as described, but also meet the requirements for an upper-level undergraduate and master's level nursing course on quality improvement. Thus, the course became the cornerstone to meet one of the project's goals of providing opportunities for educational advancement for BSN or MSN attainment.

Training the nurse teams on the process to support quality through performance improvement came through a series of modules called *Improving Healthcare Delivery: Quality, Safety and Performance Improvement Training* compiled by the consulting firm. The first cohort of nurses (Cohort 1) volunteered for training beginning in early July of 2011. The first four days of the 5-Day training program were broken up over a series of two weeks with two full days per week. The fifth day of the program occurred in September after the teams had an opportunity to work on their projects. The second nurse cohort (Cohort 2) began their 5-Day training in February of 2012. The training days occurred weekly.

3.2.2.1 Nursing Perspective and Quality Improvement

The portion of the course that discussed the state of healthcare today from the perspective of the nurse role was authored by the consulting firm. Topics included the aging population, increasing

levels of medical complexity and the continuous rise of healthcare costs. Parts of the Patient Protection and Affordable Care Act (2010) were discussed that allowed nurses to learn how a portion of reimbursement to hospitals will be contingent upon quality and patient satisfaction. The consulting firm used the Institute of Medicine's definition of quality to spark a discussion about the history of quality and its relevance to today, including current approaches to ensuring quality. Quality improvement efforts in the airline industry were used as a model comparison to healthcare quality. The issues in healthcare today were examined from the nursing perspective to understand how external agencies influence quality and work to improve safety in an effort to reduce adverse patient outcomes. All of these topics were presented to help the nurses understand the existing external pressures for themselves and as they are put upon their administration.

3.2.2.2 Toyota Lean

The second major portion of the course detailed Toyota's Lean model of quality improvement. The Lean portion of the class began with an introduction to industrial models of quality improvement. Six Sigma, as an example, was discussed in order to define types of measurements used in determining quality (Chassin, 1998; Linderman, Schroeder, Zaheer, & Choo, 2003). The environment necessary for introducing industrial models of quality improvement was also touched upon. The course then turned to defining a safety culture and the need for continuous dialogue to prevent adverse outcomes. Finally, the Lean model of quality improvement, as described in detail above, was examined. Each Project Team created an A3 for the problem they were addressing and referred back to it throughout the training and project experiments.

3.2.2.3 Teamwork and Conflict Management

The third component of the course was based on ideas about creating an appropriate work culture and managing change. Many of the ideas in this part of the course came from Peter Senge, PhD (1990), author of *The Fifth Discipline: The Art and Practice of the Learning Organization*. Senge described a number of principles to consider when using systems thinking, team learning, and building a shared vision for change. Patrick Lencioni (2002) of The Table Group, LLC., authored the Five Dysfunctions of a Team pyramid. It was comprised of absence of trust, fear of conflict, lack of commitment, avoidance of accountability, and inattention to results. Much of the teamwork section was then built on ways to avoid these dysfunctions such as setting rules of team engagement, importance of trust, and the need to manage conflict. Another concept discussed during this part of the training was Kotter's 8 steps to change management (Kotter, 1996). These steps helped form a plan for change beginning with establishing a sense of urgency and ending with institutionalizing new approaches.

3.2.3   Coaching and Consultation

The role of the coach in the project was to facilitate both the steering committee and the project teams. The coach was an outside mentor from the union with no affiliation with the hospitals, but with experience with Lean implementation. The coach attended project and steering committee meetings, provided guidance for the direction the projects should go and provided resources for the teams with regard to communication between the administration and the front-line workers.

3.2.4 Staff Evaluation

The "Providing Cost Effective Quality Care" program offered short-term, staff evaluation in three forms: course feedback forms, team meeting evaluations, and course feedback forms five months following. Feedback forms were completed for the training component to assess knowledge acquisition and satisfaction. Additional process evaluation was done at team meetings to determine the effectiveness of the team members by monitoring tools used, tension level, and extent to which meeting agendas were followed. The Lean nurses also completed evaluation forms after five months to determine knowledge retention from the training component.

3.2.5 Program Evaluation

The program was evaluated by a university-based external, third-party evaluator. The evaluator monitored program process measures by attending trainings, steering committee meetings as well as project group meetings to analyze attendance, meeting efficiency and effectiveness, and project progress. A small outcomes evaluation targeted the learned Lean behaviors executed in the project teams. Much of the data for both the process and outcomes measures came from observing and recording the project teams' efforts.

3.2.6 Facilitative Administrative Supports

The steering committee's purpose was to provide support for the projects on every level. The partnership between the labor, management, and administrators, who were all represented on the

committee, offered the most basic support. Additionally, the Lean nurses were given paid time off to attend the 5-day training program and the participating team nurses were supposed to be given time to attend team meetings, perform observations, and collect data during their normal working shifts.

3.2.7 Systems Interventions

The funding for this project came from a grant from the Pennsylvania Department of Labor and Industry and The Service Employees International Union (SEIU) Training and Education Fund. The program was meant to be a pilot program. Once determined effective, the intention was to expand, sustain, and replicate the program throughout the state.

3.3 MEASURES

In order to analyze the effectiveness of the Toyota Lean nurse-driven quality improvement initiative, three measures were used: 1) Training Evaluation Survey, 2) Five-Month Follow-Up Survey, and a 3) Qualitative and Quantitative Assessment of Team Projects and Sustainability. These measures are described here.

3.3.1 Training Evaluation Survey

After each day of the five days of training, the Lean nurses completed a follow-up survey to examine their perceptions of the effectiveness of the training in terms of new information, skill,

and/or techniques, and the effectiveness of the teaching methods used (See "Day 3" example in Appendix C). The questions were asked on a Likert scale of one to five with one being strongly disagree and five being strongly agree. The results of this survey are reported in the "Training" implementation component section.

3.3.2 Five-Month Follow-up Survey

At the five-month point a follow-up survey was distributed to Lean nurses in paper and online (See Appendix B). The survey was an abbreviated version of the training evaluation surveys. Follow up surveys were collected from Cohort 1 participants to examine the perceived level of value of the training five months after the 5-Day training. The survey consisted of three questions on a Likert scale of 1-5, with 1 being not at all and 5 being to a great extent. The three questions were: 1) To what extent did the 5-Day training cover the role of the professional nurse to improve patient safety and quality of care?; 2) Overall, how would you rate the effectiveness of the 5-Day training, in terms of new information, skills, and/or techniques that you learned?; and 3) To what extent did the 5-Day training clearly explain the two principles of Lean: reduce waste and standardize work flow? The remainder of the survey was open-ended questions. The results of this survey are reported in the "Staff Evaluation" section.

3.3.3 Qualitative and Quantitative Assessments of Team Projects and Sustainability

The success of the team projects was measured by a qualitative and quantitative assessment. Qualitative and quantitative measures were used to track process outcomes associated with four of the implementation framework's components. The framework components were coaching

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and consultation, program evaluation, facilitative administrative supports, and systems interventions. The teams' achievements were described and determined successful or unsuccessful as evidenced by quantitative assessments of attendance and the Lean tools used and qualitative assessments of attitudes and tension as well as how the teams were progressing. In the coaching and consultation implementation framework component, a journal approach using meeting minutes and direct observation was used to track two of the projects from Cohort 1. The results of these assessments are reported in the sections representing the four framework components mentioned in this paragraph.

3.4   ANALYSIS

For the Training Evaluation Survey and the Five Month Follow Up Survey, descriptive statistics from the surveys were compiled (Kuzma & Bohnenblust, 2005). For the Qualitative and Quantitative Assessment of Team Projects, the analysis was done qualitatively by observations of the team members' behaviors and attitudes about the projects, and a description of the number and type of Lean and team building tools used (Patton, 1990).

4.0   RESULTS

Similar to the procedures section, the results of this program are organized by way of the implementation framework components described above. The implementation framework supports the process of turning an evidence-based program into practice (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). As such, it also provides an ideal framework through which to examine the level of uptake into practice (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). What follows are the results of the staff and project selection, the training, the coaching and consultation, staff and program evaluation, facilitative administrative supports, and the results of the systems interventions for the "Providing Cost Effective Quality Care" nurse-driven Toyota Lean quality improvement program.

4.1   SELECTION

Initially, the nurses for the initiative were chosen by the steering committee based on their interest and dedication to degree attainment being offered through the program. In the first cohort, out of 72 total nurses enrolled, two nurses only completed Day One of the training and one nurse failed to return after the first two days. The methodology for staff selection for the training and project teams was amended from Cohort 1 to Cohort 2. For the second cohort, the selection had changed to selecting those nurses who had demonstrated existing team skills and an

understanding of the process pre-chosen for improvement. The addition of a nurse manager for each project team was also changed for the second cohort.

The "Creating Cost Effective Quality Care" program selected was an evidence-based Toyota Lean model with additional components of the nursing perspective in healthcare and team building skills. Tools used by the Lean nurses from this program included the A3, Value Stream Mapping, Rules of Work Design, 5S, visual cues, and direct observation.

For Cohort 1, the nurse teams chose the quality improvement project to work on once the training started and teams formed. For Cohort 2, the quality improvement project to work on was chosen before the training and before the nurses were selected for the training and the teams.

4.2   TRAINING

After each day of the five days of training, the Lean nurses completed a follow-up survey to examine their perceptions of the effectiveness of the training in terms of new information, skill, and/or techniques, and the effectiveness of the teaching methods used. The questions were asked on a Likert scale of one to five, with one being strongly disagree and five being strongly agree. As shown in Figure 2 titled "Overall Course: Average Rating of Objectives", all nurses agreed or strongly agreed that the course was effective in providing new information to them.

The second question about the effectiveness of the teaching methods was given the highest rating (five out of five) by 75% of the respondents. The other quarter gave it the second highest rating.
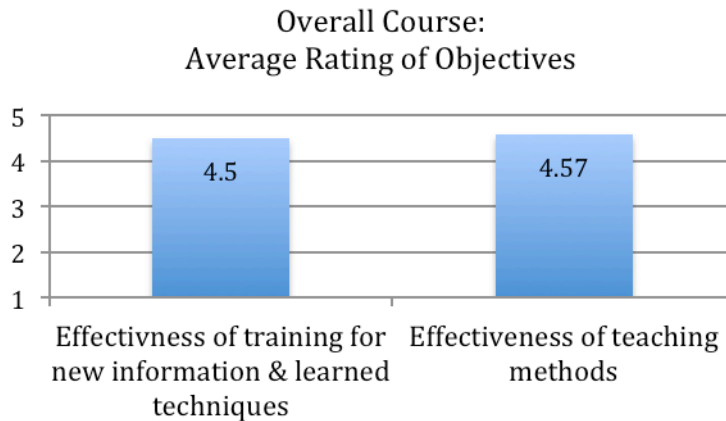
Figure 2 Overall Course: Average Rating of Objectives

Lean nurses were asked how well the program met certain course objectives over the 5-Day training. As previously described, the three content areas of the course were 1) the perspective of nursing in quality, 2) Toyota Lean, and 3) teamwork and systems management. Lean nurses were surveyed at the end of each day on a series of questions, using a Likert scale of one to five, with one being strongly disagree and five being strongly agree. There were 29 questions on course objectives for all five days. Selected questions on key concepts are discussed below by category.

4.2.1 Perspective of Nursing in Quality

Lean nurses were asked how well the program met course objectives regarding the perspective of nursing in health care quality. Eleven questions were asked about this topic. In an effort to highlight key concepts about the perspective of nurses in quality training component, selected questions are chosen for display in Figure 3 titled "Perspective of Nursing in Quality: Average Rating of Objectives."
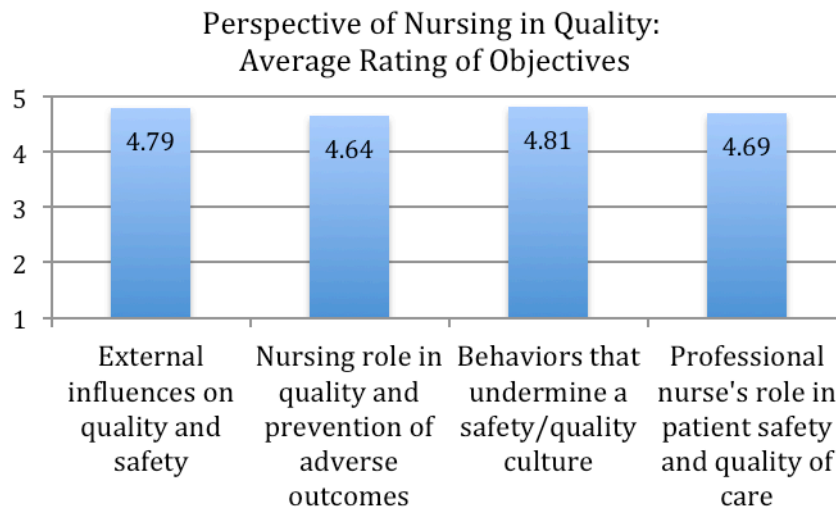
Figure 3 Perspective of Nursing in Quality: Average Rating of Objectives

First, for objective " External influences on quality and safety" there was a mean of 4.79 with 79% rating it the highest (strongly agree.) Second, the objective regarding "Nursing role in quality and prevention of adverse outcomes" had a mean of 4.64 with 64% strongly agreeing that the course met this objective. Third, "Behaviors that undermine a safety/quality culture" had a mean of 4.81 with 80% offering the highest rating. The final objective "Professional nurse's role in patient safety and quality of care" had a mean of 4.69 with 69% awarding it the highest rating.

4.2.2 Toyota Lean

In this portion of the survey, Lean nurses were asked how well the program met course objectives regarding the Toyota lean method of quality improvement. Ninety-nine percent of nurses agreed or strongly agreed that the course met objectives on all twelve questions. In an

effort to highlight key concepts about Toyota lean, selected questions are chosen for display in Figure 4 below titled "Toyota Lean: Average Rating of Objectives."
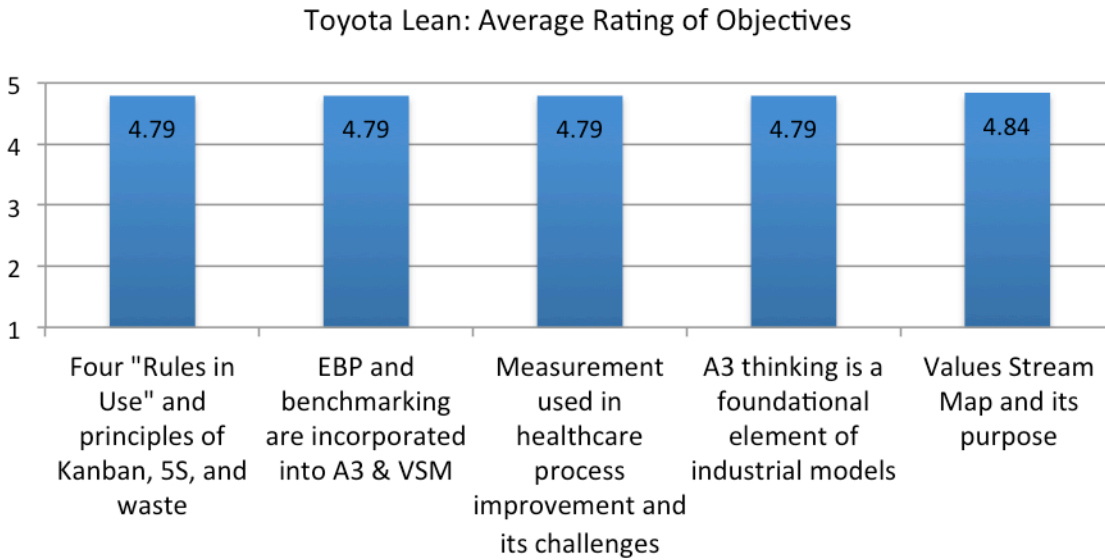

Figure 4 Toyota Lean: Average Rating of Objectives

The first four objectives, "Four 'Rules in Use' and principles of Kanban, 5S, and waste"; "EBP and benchmarking are incorporated into A3 & VSM"; "Measurement used in healthcare process improvement and its challenges"; and "A3 thinking is a foundational element of industrial models" all had individual means of 4.79 with 79% of respondents awarding the highest rating (strongly agree.) The final objective, "Value Stream Map and its purpose," had a mean of 4.84 with 84% giving the highest rating.

Throughout the discussion of Lean, the nurses completed activities that taught or demonstrated these concepts. For example, one such activity was the statapult exercise, in which teams were tasked with launching 30 ping-pong balls across the room. A statapult is a small catapult with a series of adjustments to change the force and direction. The purpose of the exercise was to reduce the variation in the distance each ball went. Each ball that hit outside the

determined range was considered an error. Thus, the lesson learned from the exercise was to standardize processes in order to reduce variation. Lean nurses noted that the hands-on exercises were one of the most beneficial parts of the training program to teach Lean principles.

4.2.3   Teamwork and Systems Management.

For the final areas on the survey, Lean nurses were asked how well the program met course objectives regarding teaching skills of teamwork and systems management. Ninety-nine percent of nurses agreed or strongly agreed on all six questions. In an effort to highlight key concepts about teamwork and systems management, selected questions are chosen for display in Figure 5 titled "Teamwork and systems Management: Average Rating of Objectives."

First, for objective "Approach for team building", 71% (mean of 4.71) rated it the highest (strongly agree.) The second objective, "Strategy for commitment", had a mean of 4.53, with 59% rating it 'strongly agree.' Third, "Elements of a successful system for improving quality", also had a mean of 4.53 with 53% rating it the highest. Finally, the last objective, "Types of errors, causes and strategies for reduction", 75% of nurses strongly agreed that the course met this objective (mean of 4.75). Overall, these objectives earned an average response of 4.41 or higher for all questions.
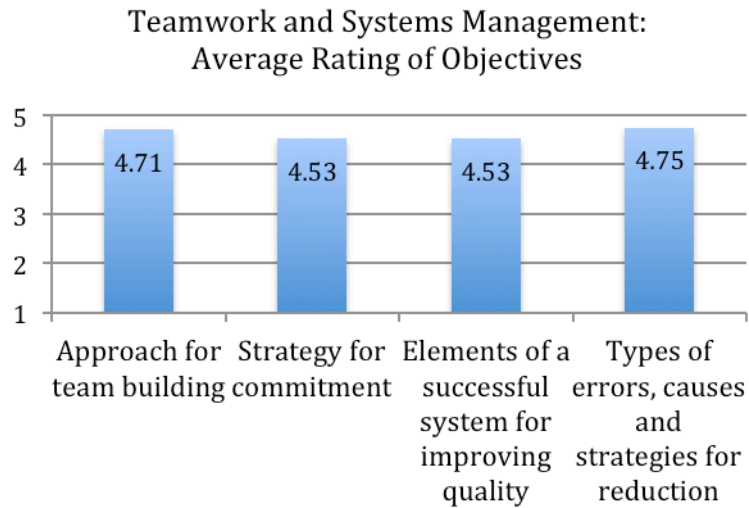
**Teamwork and Systems Management:
Average Rating of Objectives**

	Approach for team building	Strategy for commitment	Elements of a successful system for improving quality	Types of errors, causes and strategies for reduction
Rating	4.71	4.53	4.53	4.75

Figure 5 Teamwork and Systems Management: Average Ratings of Objectives

4.3   COACHING AND CONSULTATION

With Cohort 1, the coach expressed availability to the entire nurse cohort, collectively, at each of the five days of training. The coach made suggestions about how the teams could use the help and resources that a project coach could bring to the table. The Cohort 1 nurses did not make use of this resource until once the team projects had been established, designed, and were in full swing.

For Cohort 2, the coach made clear from the beginning the purpose of a coach's role. Each team was told individually that the coach was available to attend meetings and provide any support that they needed in working on their project. The nurse teams in Cohort 2 used the coach for project guidance from the beginning of the training through project implementation. The project teams from Cohort 2 had faster project initiation and uptake than the teams in Cohort 1.

Two teams created during the training from Cohort 1 described their use of the coaching support. What follows are descriptions of the case studies from these two teams and how they made use of the coach, one from Hospital A and one from Hospital B.

4.3.1   Case Study A: Green Mile

One of the team projects implemented from the training was called the Green Mile. The coach assisted the Lean nurses with the decision to do their quality improvement project about the Green Mile. The Green Mile refers to a storage room at Hospital A down a long stretch of hallway from the operating rooms. It was filled with machinery, surgical equipment and supplies. The Green Mile had become a place where nurses and technicians would throw equipment with no apparent order. The problem became so great that, in one past example, a patient was already under anesthesia and on the operating table when nurses could not immediately find a generator necessary for the surgery. The team recognized that the green mile's disorganization contributed to delayed start times for surgeries, which caused delayed treatment, increased patient risk, and this likely increased costs for the hospital.

The project goal was to create an organized system to ensure that staff would be easily able to find what they needed even with limited time. Under the guidance of the coach, they

began by taking a comprehensive inventory of the room. After staff from all types of surgery identified any key items they wished would be kept safe, the team came in for a full Saturday and used the 5S Lean tool to sort, set in order, shine, standardize, and plan for sustaining the environment. In the standardize step, the team found that by using visual cues for the staff looking for a piece of equipment, such as pictures and tape "parking spaces" for equipment, it decreased the time it took to find something and was easy to put away when finished. Tools consistently used by the Green Mile Team were the A3, 5S, observations, and direct verbal conversations with the team's two main leaders.

4.3.2 Case Study B: Handoff

At Hospital B, the handoff team found that there was no standard way to handoff a patient from one unit to another. The coach helped the team determine this was a project that could be implemented using the Lean tools. The Vocera system used at Hospital B enabled the 'sending' nurse to call into a computer system and leave the transfer patient report as a voicemail for the 'receiving' nurse. However, because there was no standard way of giving report, the receiving nurses often did not get all of the information they needed from the sending nurses or they had to listen to a large amount of unnecessary information before getting

to what was critical. With the coach's guidance, the team decided to focus on handoffs from the beginning of the patient flow: the emergency room (ER).

The team selected staff team members in order to have across-unit representation from the ER and other units. They held weekly meetings with this representation. The intent was to have managers and nurses from both the sending and receiving sides represented on the team so as to not place blame on either side. However, the manager from the ER was the only manager and the only nurse from the sending side of the handoff to regularly come to the meetings.

The coach suggested collecting data about the current condition so the Handoff project team at Hospital B performed an experiment where they listened to Vocera reports from the ER and from other floors to determine what was being said and what was being missed. From this information and with support from the coach, they decided they would create a tool for nurses to follow when giving a patient report, in order to standardize handoffs. They chose the evidence-based SBAR tool for handoff reports with the sections: situation, background, assessment, and recommendation. The team gave a bright blue laminated card to every nurse and left one at every computer, with the SBAR categories and specific instructions. The team reminded the nurses

to use the SBAR for every report. After several weeks, the team

again listened to a number of reports to see the effect of the blue

SBAR cards.

4.4   STAFF EVALUATION

The fourth component of the implementation framework, staff evaluation, was conducted using

an online or paper and pencil survey given five months after the completion of the training for

Cohort 1. The survey was a proxy for staff evaluation in that it measured the Lean nurses'

perceived knowledge retention and understanding from the training. For the five-month follow

up survey, there were 49 surveys emailed or hand delivered, with one undeliverable email for a

total of 48 surveys sent. There were 19 completed surveys for a 40% response rate.

The survey asked Cohort 1 Lean nurses to report their perceived knowledge and

understanding retained after five months. Three questions were asked that began with "To what

extent did the 5-Day training explain… 1) the two principles of Lean (reduce waste and

standardize work flow), 2) the role of nurses to improve patient safety and quality of care, and

training of new information, skills, and 3) techniques for executing a Lean project." The mean

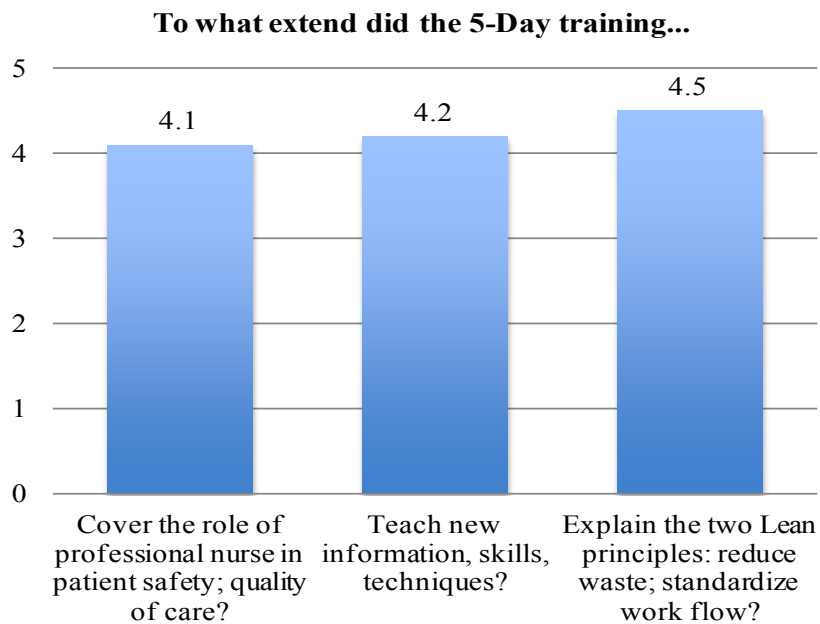results are in Figure 6 below.

To what extend did the 5-Day training...

Figure 6 Five-Day Training Objectives

For the question asking about the "extent to which the 5-Day training covered the nurse's role in improving patient safety and quality of care," two of the 19 respondents gave a rating of two out of five. Seven respondents rated this topic a four out of five and eight rated it five out of five. This led to a mean rating of 4.1 for that question.

For the question asking about the "effectiveness of the training in terms of new information, skills, and techniques learned," ten respondents rated this with the highest possible rating, five out of five. Two of the respondents gave ratings of two out of five resulting in a mean for the question of 4.2.

For the question asking about "how well the training explained the principles of Lean," eleven of the respondents gave a five out of five, the highest rating. Six respondents rated this

question with the second highest number, four out of five. Two respondents gave a rating of three, for a mean of 4.47 for that question.

4.5   PROGRAM EVALUATION

A member of the external program evaluation team attended steering committee meetings, trainings, and team project meetings. An evaluator recorded attendance at steering committee meetings, team project meetings, and the training sessions. Additionally, an evaluator monitored meeting effectiveness by way of tension level and the extent to which the meeting agendas were followed. Selected results from the evaluation of the two case studies follow.

4.5.1   Case Study A: Green Mile

Green Mile had four main project sessions. Each session had a purpose and an agenda. Three team members led this team. These three team members organized the team's work sessions and followed the agenda. An additional number of team members assisted with the project sessions such as the initial organization of the supply room.

4.5.2   Case Study B: Handoff

For the handoff team, the project was ongoing. On average, seven team members attended the first month of team meetings that took place weekly. On average, two team members attended the final meetings that were spaced out with three to four weeks between the meetings. Lean nurses were asked what barriers they experienced to meeting attendance. The barriers to attendance they reported were understaffed units and managers that would not allow the nurses to go during their shift; some who did attend were required to "clock out" for the meetings. The team used at least one lean tool per meeting including direct observation, A3, and Rules of Work Design. Half of the team meetings had agendas and they were followed. Meeting minutes were kept at all meetings.

4.6   FACILITATIVE ADMINISTRATIVE SUPPORTS

The follow-up survey conducted five months post-training of Cohort 1 included questions about the barriers to joining or creating teams. One response to the five-month follow up was a Lean nurse who conveyed the following: "I presented my idea to my manager and was told that [it] did not concern me and that it was cost prohibitive. About three months [later] that idea was done by my manager with no mention of me or that that idea was brought to her attention." Other responses to this question were "lack of time", "lack of passion for the project", "not being asked

to be on a team", "reluctance on the part of direct manager," "independently operating units", and "unit reorganization.

4.7 SYSTEMS INTERVENTIONS

As seen from meeting minutes and direct observations, systems interventions were identified by the steering committee as money to allow the Lean nurses paid time off to work on projects. Since the program was designed as a grant from the Pennsylvania Department of Labor and Industry and the Service Employees International Union (SEIU) Training and Education Fund, funding continuing from this source was considered a primary outcome for systems interventions. As such, funds for the coach and two nurse projects continued.

5.0   DISCUSSION

The purpose of this thesis is to determine if a Toyota Lean nurse-driven quality improvement program's successes and deficits could be described in the context of an evidence-based implementation model (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). This section will discuss the results in a way that uses the implementation framework to describe the successes and barriers that the program encountered and make recommendations for improvements. Overall, the "Providing Cost Effective Quality Care" program saw moderate success; there are two nurse projects that resulted from the training, coaching, and consultation that were successful as evidenced by the use of Lean tools and philosophy.

5.1   FIXSEN CORE IMPLEMENTATION COMPONENTS

5.1.1   Selection

The selection implementation component refers to recruitment of the program participants and why those individuals are selected (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). The selection of the nurses to be enrolled in the training and project implementation program changed from Cohort 1 to Cohort 2. While one of the goals of the grant was to advance the careers of nurses, a greater goal was to support ongoing quality improvement initiatives. The nurses for

Cohort 1 were chosen based on their interest in degree attainment. However, some of these nurses were not dedicated to the quality improvement projects as evidenced by the low team meeting attendance and the lack of follow through of project responsibilities. This can be interpreted as some of the Lean nurses being only interested in the degree attainment component of the program. For the second cohort, the nurses were chosen based on knowledge and understanding of the topic pre-chosen for improvement and their existing team skills. These nurses were stakeholders in the pre-chosen project and so were more invested from the beginning than the nurses in Cohort 1. Adding a nurse manager to each team for Cohort 2 also increased team morale by the addition of a team member at the management level.

5.1.2 Training

The training proved to be an effective way to engage nurses and teach them the necessary tools to implement their team projects on their hospital units. The hands-on activities that were interspersed throughout the 5-Day Training (such as the statapult exercise described above) were an integral part of the course. They kept the Lean nurses interested by requiring physical movement and activity while building confidence that they, as Lean nurses, had the ability to make positive change in their work places.

The philosophy for the training changed from Cohort 1 to Cohort 2. The first cohort had the first four days of the training within two weeks, then had a break to collect data and work on their team projects, and then came back together to discuss results for day five of the training many months later. While this allowed for a thorough understanding of the concepts and information taught during the training, the greater purpose of the training was to facilitate the

teams while they improved quality processes in their work environments and this arrangement did not provide ample time for the teams to collect data and implement changes.

The delivery and acquisition of knowledge is the necessary first step in changing behavior at the workplace – specifically, creating a team, executing experiments, and effectively improving processes. In Cohort 2, the creation of a team and the initial data collection were facilitated because the training required these efforts during the course of the 5-Day training instead of afterwards. The spread of the training days over six weeks created an environment where data collection, and process trials were possible between the training days such that the teams could then make changes and improvements based on the new knowledge gained during the training days.

An additional change in the training that effectively decreased the start time for the projects was that of providing large amounts of time during the training for the teams to work on their projects. One of the barriers the Lean nurses reported was that of inadequate time to complete the projects. Many nurses felt that their busy units prevented them from attending meetings and fully participating in project responsibilities, which prohibited effective project implementation. During the second cohort, time was provided during the training for the teams to work on their A3, consult with the coach, and learn from the other teams' experiences. This created an environment that facilitated uptake faster than that experienced by Cohort 1.

5.1.3 Coaching and consultation

The training component of project implementation is excellent for teaching new skills, however much new knowledge is learned while actually implementing the project (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). Because of this, the need for a coach to accompany the project

teams along the way offered the likeliest opportunity for success (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). The coach was there specifically to assist the teams in implementing Lean projects. The coach was there to provide support and guidance, to attend team meetings, and to clarify the use of the tools. Because of this, the teams in the first cohort did not make use of the coach as much as they could have. For example, the participants in Cohort 1 were approached by the coach who offered guidance and support instead of the teams soliciting the utility that the coach had. With that, the coach's role was underutilized and the teams struggled to define their projects, know where to start, and how to keep them moving. The changes made to the methods for the coach from Cohort 1 to Cohort 2, including introducing the coach as a resource from the beginning, greatly affected the speed at which the projects came together and were able to make big differences in the units where they were done. In contrast to Cohort 1, the project teams of Cohort 2 solicited the coach's services instead of the coach offering to guide and assist the teams.

The coach was not the only necessary person to create change in the target processes. The necessity of a team member nurse "champion" became apparent for success. The nurse "champion" took on the role of team leader and organizer. The Green Mile project is a good example of this. While the players on this project functioned well as a team, the use of both a champion (nurse) and the coach, were necessary to arrange the days to organize the room and guide the full 5S process. The nurse champion became the go-to person when a staff member wanted to add something new into the room.

Similarly, during the Handoff project, a nurse champion emerged who began arranging and leading the meetings, creating agendas, and assigning tasks. Some meetings were tense, with perceptions that blame was being laid on the ER nurses. This contributed to the low

attendance. Thus, the project champion completed the majority of the work for the project and performed many of the experiments with little help from her team. A few individuals stayed with her and contributed to the process. The nurse champion, guided largely by the coach, consistently used tools taught in the 5-Day training, including the A3 and all its components, rules of engagement, observations (guided by created forms), meeting agendas, email communication, and institutionalization of the new approach.

5.1.4 Staff Evaluation

The staff evaluation component of implementation is an assessment of the use of knowledge and skills learned from the training and project implementation by program staff (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). For "Creating Cost Effective Quality Care," the 5-month follow up survey was used as a proxy for this implementation component. Results of the 5-month follow up survey showed that training appeared to have successfully explained the two principles of Lean (reduce waste and standardize work flow), the role of nurses to improve patient safety and quality of care, and training of new information, skills, and techniques for executing a Lean project. The Lean nurses who completed the survey showed that they retained the knowledge and understanding from the training five months earlier and still had the ability to conduct quality improvement projects. It can be interpreted that the barriers the Lean nurses experienced that prevented them from implementing project teams as effectively as possible were external factors resulting from lacking facilitative administrative support and not incompetent staff.

5.1.5 Program Evaluation

Program evaluation is used to assess the whole program and to ensure that the implementation components continue (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). The outcomes of the evaluation were positive with five major conclusions: 1) it is a viable model, 2) the training should be spread out over a multiple weeks between sessions, 3) a coach and nurse champion are necessary, 4) implementation requires buy-in, and 5) becoming a Lean organization is a long process.

The first conclusion that the program evaluation found was that the "Creating Cost Effective Quality Care" program was a viable model of improving the quality of care. Additionally, the program trained on a gap in nurse knowledge; beyond the clinical tasks of nurses, quality of care at the organizational level can be under their control.

The second conclusion found by the program evaluation was that the 5-Day Lean training model was best delivered over a six-week period where tasks were completed between each class to support project progression. Project team members and a supervisor specifically selected to address a particular problem were a necessary component for program success.

The third conclusion found by the program evaluation was that a Lean coach and a nurse champion were key to individual Project Team success. The nurse champion must possess interpersonal and leadership skills. The Lean coach must meet with all project teams as they progress with their work.

The fourth conclusion that the program evaluation found was that "Creating Cost Effective Quality Care" program implementation required a significant commitment of resources. These resources included active management buy-in and support for supervisors who, in turn, supported Lean nurses.

The final conclusion from the program evaluation was that becoming a Lean organization is a long, and challenging process. The three-way partnerships of union-labor-management for quality improvement may increase the likelihood of institutionalizing the Lean process.

5.1.6 Facilitative Administrative Supports

The facilitative administrative supports implementation component refers to the support for the program by those in leadership roles by maintaining project resources, organization, and focus (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). For the Handoff team of Cohort 1, over time, meeting attendance waned. Facilitative administrative support could have been stronger. Lean nurses reported that they missed meetings due to understaffed units and nurse managers who would not let them go to meetings during their shifts. As such, steering committee members could have reached out to shift supervisors to decrease the barriers reported.

Many Lean nurses described the lack of facilitative administrative support as a barrier to greater project accomplishments. The coach, Lean nurses, and the steering committee reported inconsistent and unclear policies for the Lean nurses to have time off from their units to collect data and attend meetings. Because "time off" policies were not explicit, the nurse managers on the variety of units the nurses came from handled this issue differently. This disparity created confusion about what was appropriate, expected, and required for the Lean nurses in terms of project participation. As a consequence, some Lean nurses did not meet regularly to work on their projects. This finding resulted in a different use of training time for Cohort 2, as described previously, whereby project work happened during the training and nurses managers were part of the teams. This training and team format relieved some of these pressures as the Lean nurses then had built-in time each week for meetings and project development. However, a clearer

understanding of all nurse managers on all units as to what support they should give nurses who are working on projects is an opportunity for improvement, especially since not all nurse managers were trained as part of the program. The implementation framework used here was designed so that strengths in one component area would support weaknesses in others. Despite the opportunity for improvement in this implementation component, the program sustained.

5.1.7 Systems Interventions

The Systems Interventions implementation component refers to strategies to make certain external factors support the Lean work (Fixsen, Naoom, Blase, Friedman, & Wallace, 2005). Examples of external factors are workforce issues, financial support and policy issues. In spite of barriers and slower project uptake speed than Cohort 2, Cohort 1 was successful and made progress. As a result, funding was continued for the second cohort that began later in the year. The coach continued to be funded so that support could be provided to the ongoing team projects.

One of the most beneficial systems interventions in the program design was the inclusion of the healthcare workers' union as a partner. With this, the system where the union and the management are often pulling in different directions were able to come together for the advancement of nursing roles and the increase of patient safety.

5.2   LIMITATIONS TO THE STUDY

There were a number of limitations to the methods used for this thesis. For one, the Fixsen model of implementation used as a framework for "Providing Cost Effective Quality Care" is a theory. While it is a theory with growing support, it remains a theoretical base (Sullivan, Blevins, & Kauth, 2008). The process of implementation that the program experienced was retrofitted into the components of this theoretical framework. Because of this, some aspects of the program were broadened in order to better apply to the framework.

A second limitation to the thesis is in the quality of the data collection. The program director and the evaluation team created the surveys used to collect the data discussed in this thesis. While these tools allowed for collection of the data needed for evaluation and program improvement purposes, the surveys have not been tested for validity or reliability. Additionally, much of the data collection was done by the program participants, themselves, and may have been subject to self-report bias.

5.3   FUTURE DIRECTIONS

Future research is possible and necessary for this type of intervention. For one, a similar nurse-driven quality improvement program should be planned and implemented based on the theoretical implementation framework that was retrofitted here. Research is needed in this area to determine the effectiveness of the theory in the implementation of an actual nurse-driven quality improvement program.

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One possible future study would use the implementation framework, prospectively, as part of the program planning process, and have a comparison group that uses the same program, but does not use the implementation model for planning. The study would look to see if the program that did not use the framework for planning had less success and was less sustainable than the program that did use the implementation model. Additionally, further research and evaluation is needed to determine the effectiveness of the program on long-term patient safety outcomes.

6.0   CONCLUSION

The annual quality report by the Agency for Healthcare Research and Quality (2012) deemed improving patient safety a priority. Unlike other quality indicators, those of patient safety have not improved. Frontline staff, particularly nurses, offer an underutilized opportunity to see first-hand the effects of patient care procedures (Kliger, Lacey, & Olney, 2010). The program described in this thesis, "Providing Cost Effective Quality Care," aimed to address this quality problem by implementing a nurse-driven Toyota Lean program through the means of a three-way partnership between a union, management, and labor. The purpose of this thesis was to determine if the program's successes and deficits could be comprehensively identified in the context of an evidence-based implementation model.

The program, "Creating Cost Effective Quality Care" met with moderate success. Its goals were to support ongoing quality improvement initiatives, while increasing nurses' access to continuing education. Results of the program showed that with the appropriate implementation components, it was a viable program. Nurses should be selected based on their knowledge of and dedication to the project at hand and not solely because of their interest in degree attainment. The training program was an effective way to introduce concepts on Lean, the perspective of nursing in quality, and team management, but should allow for team project time built into the training. The use of a coach was an integral component for project effectiveness by way of guidance and support. Finally, inadequate facilitative administrative support stunted project

uptake and implementation, but the strengths of the other components supported this weakness, resulting in project success.

With additional support, nurse driven, Toyota Lean quality improvement programs can meet the goals of improving patient safety and healthcare quality. The Fixsen framework proved to be an effective theoretical implementation model through which to identify the successes and deficits of the "Creating Cost Effective Quality Care" program. Further research is needed to determine if uptake time, outcomes, and program sustainability are affected by the prospective use of the implementation framework from the initial planning throughout the program implementation.

APPENDIX A

PROGRAM LOGIC MODEL

Priorities:	Situation:					
Providing Cost-Effective Quality Care Program **Mission:** The project will demonstrate the efficacy of a joint labor-management model that designs and implements education and training activities to support key quality care improvement strategies while addressing workforce development challenges. SEIU Healthcare PA Mission: Together we work to protect patient care, expand access to quality healthcare for all, and to improve our working conditions. Hospital A Mission: We practice medicine, educate and conduct research as an integrated team of physicians, nurses and support professionals who are committed to improving the health of our patients. Hospital B Mission: To improve the health and well-being of all people in the communities we serve. Stakeholders: PA Department of Labor and Industry SEIU Hospital A Hospital B Patients	- Hospitals are not providing the quality of care that is needed. - There is a concern that nurses perceive few opportunities for advancement. - Stakeholders think nurse education may help improve quality of care through nurse-led quality improvement teams.					

Inputs	**Outputs**		**Outcomes -- Impact**		
	Activities	*Participation*	*Short*	*Medium*	*Long*
Staff: - VP of SEIU Healthcare PA for Hospitals - Quality Care Training Coordinator - Lean Trainer - Hospital HR Representatives Funding provided by PA Department of Labor and Industry for: - Quality Care Training Coordinator - Lean trainer - RN reimbursement for days off from work for cohort training - Classroom materials **Facilities:** - Cohort trainings - Weekly meetings at hospitals - Steering committee meetings	1) Hold steering committee meetings every six weeks 2) Conduct 5-day Quality Improvement Cohort Training for School Credit or CEU's 3) Organize and conduct weekly project meetings at hospitals 4) Coach project teams	Nurses at HVB and AGH Hospital management from HVB and AGH	1a) Steering committee meetings held 1b) Next steps in program planned 2a) Cohort training conducted 2b) Increased knowledge of and skills to use Lean tools 3) Weekly team meetings scheduled and attended 4) Teams coached	1) Decisions of next steps in program implemented 2,3&4) Experiments conducted to achieve ideal condition in respective hospital projects	Healthy labor/ management relationship Educated healthcare workforce Improved patient care Improved nurse satisfaction Improved patient outcomes Program continues

Assumptions	**External Factors**
-Providing nurses with quality improvement tools will enable them to tackle problems they see in their workplace. -Providing nurses with educational advancement opportunities will improve work satisfaction.	- CMS will soon begin paying facilities based on performance measures. - One way for nurses to advance their education and leadership abilities is to attain a BSN or an MSN

APPENDIX B

FIVE-MONTH FOLLOW-UP SURVEY

Improving Health Care Delivery: Quality, Safety and Performance Improvement

Please fill out the following regarding your Lean project team.

	Not at All	→	Some	→	Great Extent	Don't Know	Don't Recognize the Tool
1. To what extent is your team using the components of the A3 process to guide your project?							
a. Mapping the current condition	1	2	3	4	5	DK	DR
b. Mapping the target condition	1	2	3	4	5	DK	DR
c. Experimenting with countermeasures	1	2	3	4	5	DK	DR
d. Creating an action plan	1	2	3	4	5	DK	DR
g. What measures have been taken for experimentation?							

	Not at All	→	Some	→	Great Extent	Don't Know	Don't Recognize the Tool
2. To what extent is your team working on a project to *reduce waste*?	1	2	3	4	5	DK	DR
3. To what extent has your team working on a project to *standardize work to make flow more efficient*?	1	2	3	4	5	DK	DR
4. How do you feel that the two principles of Lean—reducing waste and standardizing work flow (above)—are being applied by your team in your project?							

	Not at All	→	Some	→	Great Extent	Don't Know	Don't Recognize the Tool
5. To what extent is your team using the 5 Functions of a Team to guide your project (Building Trust, Mastering Conflict, Achieving Commitment, Embracing Accountability, Focusing on Results)?							
a. How well are you getting to know your team members personally?	1	2	3	4	5	DK	DR
b. Has your team *created* rules of conduct/engagement/ground rules?	1	2	3	4	5	DK	DR
c. Do team members ask each other for clarification to help prevent assumptions?	1	2	3	4	5	DK	DR
d. Has your team worked to remain focused on the desired outcome?	1	2	3	4	5	DK	DR

	Not at All	→	Some	→	Great Extent	Don't Know	Don't Recognize the Tool
6. To what extent did the 5-Day training cover the role of the professional nurse to improve patient safety and quality of care?	1	2	3	4	5	DK	DR
7. Overall, how would you rate the effectiveness of the 5-Day training, in terms of new information or techniques?	1	2	3	4	5	DK	DR

8. What were the most beneficial parts of the 5-Day program?

9. What parts of the 5-Day training would you change?

10. We understand that serving on a project team takes effort and coordination. What were the barriers to participation you experienced in starting a, or participating in, a project team, following the 5-Day training?

11. How do you hear about, if at all, the additional, free CEU Credits in Quality Improvement for Bargaining Unit RNs?

12. Did you attend any 2-hour CEU credit classes in Quality Improvement for RNs?	YES NO

12a. If *yes*, what barriers, if any, did you have to overcome to attend?
    If *no*, why did you not attend? What were the barriers you experienced?

APPENDIX C

TRAINING EVALUATION SURVEY

Improving Health Care Delivery: Quality, Safety and Performance Improvement

Day 3
July 13, 2011
Evaluation

1. This program met the following stated objectives:

Objective:	5 (Strongly Agree)	4 (Agree)	3 (Neutral)	2 (Disagree)	1 (Strongly Disagree)
Discussed the external influences on quality and safety					
Examined the necessary components of an environment where industrial models can be applied to create continuous performance improvement					
Examined the role of nursing in improving quality and prevention of adverse outcomes					
Examined the Silence Kills and Silent Treatment studies and relates findings to quality of care and safety and the importance of dialogue in ensuring quality improvement and performance in healthcare					
Reviewed change model and defined Senge's core principles					
Articulated Kotter's 8 steps to change management					
Evaluated the concept of Mindset					
Identified the 5 dysfunctions of a team					

2. Overall, how would you rate the effectiveness of this training in terms of new information, skills, and/or techniques that you learned?

	□ Excellent 5	□ Very Good 4	□ Good 3	□ Fair 2	□ Poor 1
Comments:					

3. Overall, how would you rate the comfort and adequacy of the workshop room?

	□ Excellent	□ Very Good	□ Good	□ Fair	□ Poor
Comments:					

4. How appropriate were the teaching methods?

	□ Excellent	□ Very Good	□ Good	□ Fair	□ Poor
Comments:					

5. Please evaluate the speakers' mastery of their content area:

	□ Excellent	□ Very Good	□ Good	□ Fair	□ Poor
Mimi Falbo, DNP, RN	Comments:				
	□ Excellent	□ Very Good	□ Good	□ Fair	□ Poor
	Comments:				
	□ Excellent	□ Very Good	□ Good	□ Fair	□ Poor
	Comments:				

6. Describe what you think was the most useful part of the program for you:

7. Describe the least useful part of the program for you:

8. What additional information do you need regarding these principles and their application to this program and its expected outcomes?

9. Need for additional information on industrial models or future programming:

THANK YOU FOR PARTICIPATING!

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