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Learning Lean To Lead

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ABSTRACT

LEARNING LEAN TO LEAD

This project sought to see if training frontline nurses and physicians together in Lean methodology improved collaboration between the two disciplines while giving them the tools they need to lead change at the bedside and in their practice. A quasi-experimental pre- and post-intervention methodology was used. The intervention was six, four-hour in-person modules on performance improvement (PI). Respondents completed two surveys, the performance improvement instrument and the Professional Practice Environment Assessment Scale (PPEAS). Surveys were paired for analysis. There was a statistically significant median increase in participants confidence for all questions on the PI instrument post-intervention. Results for the PPEAS showed lower scores post-intervention, however, the results were not statistically significant. This project emphasizes that, with time, training, and support from leadership, frontline nurses and physicians can become confident in applying Lean and performance improvement tools to lead change at the bedside. Improving the professional practice environment will likely need to take place on a larger, organization wide scale to be impactful.

Krystle I. Guenther
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LEARNING LEAN TO LEAD

by

Krystle Irene Guenther

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APPROVED

For the California State University, Northern Consortium
Doctor of Nursing Practice:

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CHAPTER 1: INTRODUCTION

Frontline registered nurses' direct contact with patients puts them in a unique position to design new models of care to improve the quality, efficiency, and safety of health care (Institute of Medicine, 2010). In their report on the future of nursing, the Institute of Medicine (IOM) (2010) issued a call for nurses to lead at all levels (p. 228). To do this, nurses will require strong leadership abilities and skills to improve processes. Leadership, however, is not always innate and many nurses become leaders via experience rather than formal education (IOM, 2010, pp.241-242). Varying entries into practice also creates variability with how nurses are educated in leadership and performance improvement. In order to transform the healthcare environment, frontline nurses will need strong leadership skills to work collaboratively and to be full partners with physicians and other healthcare professionals (IOM, 2010, p.251). In order to foster this collaboration, physicians also need to be skilled in leadership and work side by side with their nursing counterparts.

The American Association for Physician Leadership has included physician leadership as one of its nine essentials; however, many frontline physicians lack necessary leadership skills, as few have had formal education in leadership theory and quality improvement methods and techniques (Angood & Birk, 2014; Angood & Shannon, 2014). In addition, when physicians do find themselves in formal leadership roles, they likely got there as a result of their clinical or academic expertise (Angood & Shannon, 2014) rather than formal leadership education. Furthermore, when there is a focus on training physicians as leaders, these efforts are often aimed toward physicians interested in administrative roles, effectively excluding the frontline physicians that want to stay at the bedside full-time (Dye,

2017). This is unfortunate because frontline physicians' full-time involvement with patients puts them in a position to identify the changes that can make a true impact on quality, patient safety, and the efficiency of care delivered (Angood & Shannon, 2014; Dye, 2017).

To move forward with creating collaborative environments, physician engagement will be essential. Additionally, physicians will require skills that allow them to enable and coach others to be problem solvers versus fixing the problem themselves or utilizing a fix it now strategy (Angood & Birk, 2014). Failure to engage frontline physicians can lead to inefficiencies in new processes, frustration, and burnout; which ultimately can lead to a loss of autonomy and a sense of purpose (Shannon, 2017).

Background

One way to develop the skill of leading change and improving processes is to train frontline nurses and physicians in Lean. Lean methodology can be used to improve processes by offering a structured framework to think and approach problems in a new way. Additionally, Lean has been shown to help, in some organizations, with increasing teamwork and breaking down hierarchical structures (Drotz & Poksinska, 2014).

Lean principles have been applied in healthcare as a means to make health systems more efficient and to provide more effective care (Burke & Hess, 2015; Institute for Healthcare Improvement, 2005). These principles include elimination of waste, improving processes, doing more with less (e.g. less equipment, less human effort, less time), adding value for the customer, and having respect for people (Institute for Healthcare Improvement, 2005; Spagnol, Min, & Newbold, 2013; Womack & Jones, 2003). The Institute for Healthcare Improvement (2005)

identified that when Lean is implemented throughout an organization costs can be decreased, and quality can be improved. By training frontline nurses and physicians in Lean methodologies, they will be better equipped to identify issues, solve problems, lead change, and collaborate better.

Purpose

The purpose of this project was to see if training frontline nurses and physicians together in Lean principles improved collaboration between the two disciplines while giving them the tools they needed to lead change at the bedside and in their practice.

Theoretical Framework

This project required frontline nurses and physicians to change how they collaborated and led change. To guide this work Kurt Lewin's planned change theory was used. Kurt Lewin was a German born social scientist that greatly influenced organizational development and change (Kippenberger, 1998). Lewin developed his planned approach to change during World War Two from experiments in planned change aimed at changing consumer behavior (Burnes, 2004). To provide insight into this, Lewin developed his planned change theory that included four elements: field theory, group dynamics, action research, and the three-step model (Burnes, 2004).

Field Theory

Field theory is an approach to understanding and learning about group behavior in the complex field where it takes place (Batras, Duff, & Smith, 2016; Burnes, 2004). It recognizes that the structure of groups is characterized by the relationships between team members, rather than the individuals—in other words,

individual behavior is a function of the group environment, or field (Batras, et. al., 2016; Burnes, 2004). The field where behavior takes place is maintained by varying forces that either reinforce or change behaviors of the group, creating a 'quasi-stationary equilibrium' (Batras et al., 2016; Burnes, 2004; Burnes & Cooke, 2013). The attempt to identify and analyze the strength of these forces, driving and restraining, that maintain the quasi-stationary equilibrium allows for the understanding of how to bring about planned change (Batras et al., 2016; Burnes, 2004; Kippenberger, 1998; Schein, 1996).

This is what is known today as forcefield analysis, the identification of what forces need to be strengthened or diminished to bring about change. Schein (1996) cautioned against merely adding a driving force since there is often an immediate counterforce to maintain the equilibrium. He suggested it is easier to attempt to decrease or remove the restraining forces; however, this is often challenging due to deeply rooted group cultural norms.

Potential restraining forces for this project include frontline nurses and physicians feeling unprepared to lead change at the bedside, hesitation to lead a group of their peers, feeling a lack of support to improve processes, and a lack of experience collaborating across disciplines. In order to decrease these restraining forces and bring about change, this project was designed to train frontline nurses and physician partners in Lean tools to lead change via in-person training modules. Nurses and physicians were partnered in dyads to encourage collaboration. Additionally, mentoring and coaching was utilized to support the application of Lean tools to their on-unit project. Driving forces included frontline physicians and nurses being frustrated with ineffective workflows, gaining executive leadership buy-in, and gaining unit nurse manager and physician chief

support for time to attend modules and lead the on-unit project. All buy-in was obtained prior to the start of the project.

Group Dynamics

The concept of group dynamics was developed to address two questions: what about a particular group causes it to behave as it does to the forces acting upon it, and, how can these forces be changed to be more desirable (Burnes, 2004)? The idea is that group behavior should be the main focus of change, rather than the individual's behavior, since group decision-making is so powerful, and individuals are constrained by the pressures of the group to conform (Batras, et.al, 2016; Burnes, 2004; Kippenberger, 1998). Thus, this project had in-person training modules that allowed for the group of participants to experience learning to lead change together, versus via online modules in isolation. Additionally, having the nurse-physician dyads lead an on-unit project in their respective unit with their teams provided another opportunity to leverage group dynamics, as the change required group consensus. Since each team knew best what their barriers to change were, they were able to help adapt the change to work on the unit, ultimately, becoming champions of change to help make the project successful.

Action Research

Action research draws on field theory and group dynamics and provides a practical approach for practitioners to facilitate change (Batras, et. al, 2016). Action research is an approach that involves analyzing the current situation correctly, identifying all possible solutions, and choosing the right one (Burnes, 2004). This process requires active participation of the group and success requires recognition that change is necessary, or what is called a felt-need (Adelman, 1993; Burnes, 2004). This process is stepwise and iterative. It can lead to further

research which can, in turn, lead to starting the process over again, all the while learning (Burnes, 2004). The learning from this process feeds into changed behavior (Burnes, 2004).

This step in Lewin's work is analogous to what is called the PDSA (plan, do, study, act) cycle in performance improvement. In practice this can be seen when a group of people recognize an issue and meet to brainstorm how to make a change (felt-need). Solutions to the issue at hand are brainstormed and the group comes to consensus on which solution to try. Once the solution is trialed the group meets to discuss what they learned and to make any necessary changes before the next solution is attempted. This continues until the final changed behavior is discovered and implemented.

For this project, participants learned PDSA cycles as a tool of performance improvement. Additionally, as the dyads led their on-unit project with their teams they used this action research approach. They helped the group recognize why the change was necessary and led the team through the process of analyzing the current state, brainstorming solutions, and implementing the agreed upon solution.

Three-step Model

Lewin's three-step model involves three steps: unfreezing, changing, and refreezing. The first step in the three-step model, unfreezing, refers to disrupting the status quo, or making it possible for people to let go of old ways and see change as necessary (Burnes, 2004; Schein, 1996; Spear, 2016; Wojciechowski, Pearsall, Murphy, & French, 2016). Considering that hospital changes are often implemented in a top-down direction, frontline nurses or physicians may not have necessarily been looked to for ideas on how to improve processes and design performance improvements. Furthermore, participants may have never

participated in a multidisciplinary project or training together. This project was designed for participants to gain the tools they needed to lead change and solve problems at the bedside and to experience collaborating with their nurse or physician colleague, ultimately disrupting this status quo.

The second step of Lewin's three-step model is changing. In this stage the group is looking for a new way of doing things. Aspects of change are implemented, trialed, and evaluated on a trial and error basis (Burnes, 2004). An attempt is being made to move toward a new level of equilibrium (Kritsonis, 2005). Actions can, and should, include mentoring, coaching, and training (Bishop, 2018; Burnes, 2004; Wojciechowski et al., 2016). Hence, participants of this project received training on performance improvement methodologies and each nurse-physician dyad had a coach/mentor to guide them through applying the concepts they had learned to their on-unit project they co-led.

The third step of the model, freezing, takes place after the change has been implemented and seeks to ensure that the new behaviors become the new status quo (Burnes, 2004). In this stage policies and procedures can be developed and aligned to support sustained change (Batras, et. al., 2016). As the participants of this project completed their on-unit projects they needed to sustain their implemented changes.

Together these four elements intertwine and support each other to effect change. Field theory and group dynamics allow for the understanding of group behavior, the field that it takes place, and how the status quo is maintained. While action research and the three-step model are practical approaches for practitioners to facilitate change.

Summary

Frontline nurses and physicians are positioned to lead change at the bedside, but do not always have the to be successful in this work. An idea to train nurses and physicians together in Lean tools and methods was identified. The following chapter will provide a review of the evidence and gaps in the literature to support this project.

CHAPTER 2: LITERATURE REVIEW

A focused review of recent literature was completed to explore nurse and physician collaboration, nurses and physicians leading change, and the role of Lean in the healthcare. This literature review helped to guide and support this current project. The search for relevant articles was completed using multiple databases and electronic resources including CINAHL and PubMed available through the Fresno State University Henry Madden Library and the Kaiser Permanente Medical Library.

Nurse and Physician Collaboration

Nurse perceptions of nurse-physician collaboration

Aghamohammadi, Dadkhah, and Aghamohammadi (2019) surveyed 126 critical care nurses from three intensive care units in Iran in an effort to determine the status of nurse-physician collaboration and the extent of the nurses' professional autonomy. All respondents held bachelor's degrees and 99.2 percent were female. The Jefferson Scale of Attitudes Toward Physician–Nurse Collaboration (JSAPNC) and the Dempster Practice Behavior Scale (DPBS) were used. The findings from the JSAPNC showed that overall, nurses had a positive attitude toward nurse-physician collaboration (71.4%). While this is a large number, the article does not state if it was statistically significant. There is no mention of the results of the *t*-tests or ANOVA that the authors stated they used to analyze the data. In regard to professional autonomy of the critical care unit nurses, the results of the DPBS showed that most nurses assessed their professional autonomy at a moderate level (73%) with only 27 percent considering themselves to have high professional autonomy. There was no statistically

significant correlation between nurse's attitudes of nurse-physician collaboration and professional autonomy ($p=.203$, $r= .114$).

This study had 126 respondents which is a strength of this study. However; this study only captured the perspective and attitudes of nurses; physicians were not asked to participate. Additionally, only nurses that worked in intensive care units with bachelor's degrees were surveyed, and the respondents were overwhelmingly female, which may not reflect other organizations. Lastly, the cross-sectional design limits the ability to generalize results. It would be have been interesting to know how the three intensive care units compared to each other.

The perceptions of nurses, without including physicians, on nurse-physician collaboration was also seen in a longitudinal study by Boev and Xia (2015). The authors were interested in what the relationship was between nurse-physician collaboration and healthcare associated infections, specifically, ventilator associated pneumonias (VAP) and central line associated blood stream infections (CLABSI). To do this, the authors conducted a secondary analysis of data from a study on nurse perception. They used the Collaboration and Satisfaction About Care Decisions (CSACD) instrument that was embedded within the original study to measure nurse-physician collaboration ($n=671$). These scores were compared to patient outcomes for VAPs and CLABSIs.

The authors found that units with favorable perceptions of nurse-physician collaboration were significantly associated with lower rates of both CLABSI ($p=.005$) and VAP ($p=.005$) (Boev & Xia, 2015), suggesting nurse-physician collaboration and patient outcomes are linked. While this study also did not include the perspective of the physician it does show the potential benefit to patient outcomes when there is better nurse-physician collaboration. This study was strengthened by the use of this data over time (4.25-year study period);

however, it used secondary analysis of data from one institution, limiting generalizability.

This impact of collaboration on patient outcomes was further elucidated in a study by Ma, Park, and Shang (2018). Using the National Database of Nursing Quality Indicators® (NDNQI®) unit-level data were obtained from 900 hospital units from 160 acute care hospital in the United States. The NDNQI® RN survey and patient safety indicators from NDNQI® were used specifically to see what impact nurse-nurse (intra-disciplinary) and nurse-physician collaboration (inter-disciplinary) had on patient safety outcomes. The findings estimated that a one unit increase in the RN-RN interaction scale can decrease the odds of having a hospital-acquired pressure ulcer (HAPU) by 31% and could reduce patient fall rates by 8%. Similarly, a one unit increase on the RN-MD interaction scale can decrease the odds of having a HAPU by 19% and could reduce patient fall rates by 13% (Ma, Park, & Shang, 2018).

A strength of this study is the large number of respondents (n=23,078) for the RN survey across 160 acute care hospitals in the United States. Nevertheless, this was a cross-sectional study that used reported data to assess outcomes, which limits its generalizability and can only assess correlation between the variables which is are limitations of this study. Additionally, this study does not include the perspective of the physician on nurse-physician collaboration. While, this study was unable to suggest interventions to improve collaboration, it does suggest that if work is done to increase nurse-physician collaboration patient outcomes can potentially improve.

A descriptive correlational study of 231 registered nurses at a Magnet hospital was conducted in an effort to explore the relationship between nurse professional values and their attitudes toward their collaboration with physicians

(Brown, Lindell, Dolansky, & Garber, 2015). The Nurses Professional Values Scale–Revised (NPVS-R) and the Jefferson Scale of Attitudes toward Physician–Nurse Collaboration (JSAPNC) were used to gather data. In regard to nurses’ professional values, the total NPVS-R scores ranged from 93.53 to 120.07 (M=107.6 on a scale 26 to 130). Caring and trust were the highest rated factors, with scores of 4.43 (SD=0.46) and 4.41 (SD=0.48), respectively. For the JSAPNC scale the total scores ranged from 47.74 to 59.08 (M=53.41 on a scale of 15-60). Within the JSAPNC subscales nurses rated nurse autonomy and shared education and collaboration as the highest factors contributing to nurse-physician collaboration; the lowest factor was physician authority.

To see if there was a relationship between nurse professional values and their attitudes toward nurse and physician collaboration the authors conducted correlation testing using the two scales. The overall scores of the NSPV-R and the JSAPNC showed a small to moderate positive correlation ($r = .26, p < .01$). This means that the professional values of nurses and their attitudes toward nurse-physician collaboration are related.

A limitation of this study was using a single site to collect data. In addition, this hospital was a Magnet hospital and the hospital had recently been working to prioritize teamwork, collaboration, and interprofessional education, therefore the ability to generalize the results to other hospital is limited. A strength of this study is that they did not only look at the attitudes of nurses’ attitudes of nurse-physician collaboration, but they correlated them with nurses’ professional values. The results suggest that educating the nurses and physicians together can foster collaboration; however, again, this is a study that did not solicit feedback from physicians.

In an effort to glean an understanding of nurse and physician perceptions of teamwork and communication, nurses on a gynecological surgery unit volunteered to complete a survey before and after a quality improvement project to improve partnership, teamwork, and communication on their unit (Streeton et. al, 2016). The intervention of this quality improvement project was the creation of a multidisciplinary collaboration committee (MCC), consisting of nurses, residents, the nurse manager, and clinical nurse specialist. The goal of the MCC was to enhance teamwork through joint projects, to improve patient satisfaction, and to encourage open communication to advance a culture of safety (Streeton et.al., 2016). A post-intervention survey of the nurses showed that teamwork increased from 6.7 to 8.6 and comfort in providing feedback to physicians increased from 3.6 to 7 (Streeton et. al., 2016). Additionally, 86% of patients reported teamwork between nurses, physicians, and other staff as excellent when asked on their patient satisfaction survey (question added after MCC implemented).

Regular meetings with the multidisciplinary group over a 10-month period with positive results is a strength of this study. Limitations to this study included a small sample size pre- (n=13) and post-intervention (n=27). There were no statistical tests reported to know if the increases in both teamwork and providing constructive feedback to physicians were statistically significant, nor were the surveys paired to assess change within participants. Additionally, it is not possible to fully attribute the patient reports of teamwork from the survey question to the development of the MCC. Lastly, while physicians participated in the MCC committee, they were not surveyed for their perspective of teamwork and collaboration, only the nurses were. While this study had limitations, it is encouraging that the unit was able to bring nurses and physicians together and saw positive results in teamwork and communication.

Perceptions of nurses and physicians regarding nurse-physician collaboration

Bowles et. al. (2016) set out to explore the impact of individual and organizational factors on interprofessional collaboration between nurses and physicians. Using a cross-sectional study design, data were collected using a 14 item interprofessional collaboration (IPC) scale. Responses from nurses (n=54), residents (n=47), and attendings (n=18) at a teaching hospital were analyzed and the results showed that nurse rated IPC lower than both the resident ($p < .0003$) and attending physician groups ($p < .0046$) on both the total scale score and the three subscales ($p < .0001$). These differences were regardless of individual demographic factors, suggesting the differences are based on the participant's profession. Of note, irrespective of the discipline, an organizational factor of heavier workloads (hours worked per week and number of patients per day) identified by the participants translated to higher IPC total scores (Bowles et. al., 2016).

Strengths of this study include robust data analysis to detect differences in scores between professions and what the relationship of the scores had to individual and organizational factors. The cross-sectional study design only allowed for describing IPC perceptions of nurses and physicians at a point in time and is a limitation of this study. Also, this was a single site study at an academic setting, therefore, the findings may not apply to other institutions. Nevertheless, nurses perceive collaboration in practice to be lower than their physician counterparts. Studying the impact of interventions to improve IPC between nurses and physicians at the individual and organizational level would be beneficial.

Guided by the dual-identity model, Caricati et. al. (2015) analyzed the effect of professional commitment and team commitment of nurses and physicians

on IPC. Using the Italian version of the Nurse–Physician Collaboration Scale (NPCS), a five-item professional commitment scale, and a five-item team commitment scale, responses from 263 nurses and 89 physicians were analyzed. Physicians scores on NPCS were found to be higher than nurses ($p < .001$). Additionally, they found higher levels of professional and team commitment positively impacted IPC and low professional and low team commitment led to decreased IPC. Of note, high professional commitment and low team commitment negatively impacted IPC suggesting that team commitment of professionals should be developed.

This study suggests that if team and professional commitments can be strengthened there will be a positive impact on IPC. There was a high response rate (64.2%) which strengthens the results of this work, but the cross-sectional design of this study limits generalizability and the ability to assess causation. Also, only one center was used and, as seen with other studies in this review, there was no intervention to test for the impact of variables on IPC.

While frontline staff were not included in this study, Clausen, Lavoie-Tremblay, Purden, Lamothe, Ezer, and McVey (2017) used a constructivist grounded theory approach to explore how nurse and physician managers working in a formal dyad partnership addressed management issues in the clinical setting. Using semi-structured, individual interviews ($n=36$) and participant observations ($n=142$ hours), data from nurse and physician manager dyads in an urban surgical unit were collected. The results of this study led to the development of a theory on intentional partnering. The theory of ‘intentional partnering’ begins when partners with different interests come together. “It is through the processes of accepting mutual necessity, daring to risk together and constructing a shared responsibility that partners aligned their professional

agendas” (Clausen et al., p. 2160). Participants identified the issue of ‘professional agendas,’ where some participants identified that the benefits of working together did not always line up with their professional agenda (Clausen et. al., 2017). Intentional partnering helped some dyads better align their professional agendas allowing for better collaboration. The use of grounded theory as a study design is a strength of this study as it allowed for robust qualitative data that could be expanded upon to better understand how nurses and physicians work together. While this study included nurses and physicians at the managerial level and above, the idea of intentional partnering supports using the theory as a guide for bringing frontline nurses and physicians together to build and maintain relationships.

Collette et.al. (2017) performed a non-experimental, cross-sectional study to see what the current state of nurse-physician collaboration was at the micro, meso, and macro level in a Magnet hospital. The professional practice environment assessment scale (PPEAS) and the collaborative behavior scale-shortened (CBSS) were used, both of which address perceptions and behaviors for collaboration. Using convenience sampling, 355 nurses and 82 physicians responded to the survey, 32% and 19% response rates, respectively. Consistent with previously mentioned studies in this review, perceptions of collaboration by physicians were higher than those of nurses on the PPPEAS ($p=.037$) and the CBSS ($p<.001$). There were statistically significant differences in the nursing collaboration scores for the PPEAS total score between nursing units, and no statistically significant differences in physician collaboration scores in relation to their primary practice area. A text response question added to the surveys solicited suggestions on how to improve collaboration. Priority areas for improvement were rounding, roles, respect, and communication. The responses were used to develop

a conceptual model of collaborative practice that can potentially be used to foster collaboration.

The addition of the text-based responses strengthened this study as it allowed for more in-depth responses from participants. This study is limited in that there was a low response rate from the physician group. Additionally, this was a single, site cross-sectional study, limiting generalizability. Even so, the results support further study of improving collaboration; and, the proposed conceptual model could be used to guide future work in improving collaborative practice.

Fewster-Thuente (2015) set out to develop a theory to understand how nurses and physicians collaborate. Using grounded theory to conceptualize collaboration, 15 nurses and seven resident physicians were interviewed. This study produced a theory of how collaboration between nurses and physicians occurs. At the core of this theory for collaboration is the theme of “working together toward a common goal” (Fewster-Thuente, 2015, p. 358) and it occurs in two parts: forming the group and creating harmony. To form a group there are four stages: something needs our attention, knowing who to talk to, finding the right person, and coming together. Creating harmony occurred in three stages: exchanging of ideas and information, putting the plan into action, and monitoring progress (Fewster-Thuente, 2015). While this study did not include attending physicians, who may have a different perspective, and occurred at a Magnet teaching hospital limiting generalizability, this theory can prove beneficial to guide collaboration research.

Henkin et. al. (2016) reported on a quality improvement project that was completed to improve teamwork by having nurses present alongside physicians on daily morning rounds. A lack of face-to-face communication on a daily basis was identified as a barrier during a workshop prior to the project. An idea to implement

interprofessional bedside rounds (IBR) was tested and later implemented on the medical unit. A pre- and post-intervention survey method using the teamwork climate items from the Safety Attitudes Questionnaire (SAQ) short form was utilized. Responses were requested from 73 nurses, 73 residents, and 36 attendings and were collected before and after the intervention (72 residents post-intervention). Additionally, the number of pages to physicians were collected 30 days pre- and post-intervention to further assess nurse-physician communication.

Post-survey, there was a 100% response rate from both physician groups, compared to 44% (n=32) pre-intervention and 19% (n=14) post-intervention from the nurses. Nurses per item scores for the SAQ were significantly lower than physicians overall pre-intervention. Post-intervention SAQ items scores did not show a statistically significant difference with the exception of one item, in this clinical area, it is not difficult to speak up if I perceive a problem with patient care (Henkin et. al., 2016). For this item the result was significant ($p=.02$) with nurses scoring it lower than the physician groups. There was not a statistically significant difference in the number of pages to the medicine service pagers ($p= .08$).

The pre- and post-intervention design is a strength of this study as it helped to see if the intervention impacted teamwork, rather than how teamwork was perceived at a point in time. The data collection process did not allow for surveys to be paired, in addition, the response rate of nurses' post-intervention was low, which limited the ability to find a difference and to generalize results. The results were, however, consistent with other studies where nurses score collaboration lower than physicians.

A descriptive study was done to observe how labor and delivery nurses and physicians communicate during critical decisions in addition to how often the communication was supportive of teamwork versus status-based communication

(Matzke, Houston, Fischer, & Bradshaw, 2014). Twenty-nine nurses and 11 physicians participated. Recordings between nurses and physicians in labor and delivery were collected from the hospital operator. Audio was transcribed and 38 conversations were randomly selected, with 30 included in the final analysis. Conversations were judged as effective or ineffective. Then, communication strategies were classified as team centered, other directed, self-directed, or generic communication. The least frequent method of communication between nurses and physicians was team-centered, while other-directed “you do” communication was used most frequently, demonstrating a traditional status-based approach to communication. A strength of using the recordings to theme conversations was that conversations were not influenced by the researchers; however, it used a very small sample and was not designed to capture conversations that happen on the units in real-time.

Nurse and Physician Led Change

Nurses Leading Change

Byers (2015) sought to examine the context of implementing person-centered health policy and what the roles of the front-line nurse were as leaders and champions of change. A survey of practicing nurses in postgraduate nursing programs at a university in Ireland (n=63, response rate 75%) was performed. The survey was developed for this study and questions consisted of a combination of drop-down and open-ended response options. It included demographics, opinions regarding patient involvement in care, the main barriers to patient involvement, and the role of the frontline nurses leading change.

The results suggested that nurses believed patients should be more involved in their care and believed patient centered care had improved over the last 10

years; however, they were not satisfied with the current level, citing barriers such as a lack of time and support, lack of patient desire to be involved in care, and an organizational culture that was not supportive of changing practice. As for leading patient centered care, nurses recognized the positive effects and wanted to be involved in leading this work; however, they identified a lack of time (e.g. documentation takes the nurse away from the bedside as does being short staffed), resource constraints, a lack of leadership support, and communication as barriers to implementing a change toward patient centered care.

A strength of this study is that it attempted to gain the perspective of a broad range of nurses that practiced in different settings. Yet, there are a number of limitations. The survey and the questions are not available for reference in the article. Also, this study does not report any statistical analyses to suggest if results are significant or not; nor does it discuss results of any testing of the survey that was developed (e.g. validity, reliability, or Cronbach's alpha). A small convenience sample of nurses seeking postgraduate education was utilized, therefore, findings may not translate to other settings. This study does support the notion that nurses are interested in leading change, but do not have the resources or support to do this.

To further illustrate this point, a cross-sectional study by Dy Bupin, Chapman, Blegen, and Spetz (2016) surveyed nurses from nine hospitals using the Individual Innovation Behavior Scale. The scale measures the innovative behaviors of employees at work. The authors wanted to see what nurse's perceptions of innovative behaviors were and compare that between individuals and hospitals. The results (n=251) showed significant differences in innovative behavior related to role (p=.00), specialty certification (p=.01), education (p=.00), hospital size (p=.01), and hospital innovativeness (p=.00). Those that held a

management versus clinical position, those with specialty certification, those holding graduate degrees, and those working at larger and/or more innovative hospitals reported higher scores for innovative behaviors. Nurse managers were more likely to have graduate degrees and may have contributed to the higher scores in both groups.

A strength of this study is that it compared individual innovativeness to multiple characteristics to see if there was a difference. Also, multiple organizations were included, allowing for more robust comparisons. However, the low response rate (5.91%) and the cross-sectional design is a limitation of this study, therefore results may not apply to other settings. Nevertheless, this study signals an opportunity to develop frontline nurses to lead change and be innovative, including furthering education and obtaining specialty certifications.

Fardellone, Musil, Smith, and Click (2014) sought to identify what self-perceived leadership behaviors were present in frontline nurses participating in clinical ladder programs. They utilized a descriptive, correlational, cross-sectional study design using the Leadership Practice Inventory (LPI) to survey 102 nurses across three levels of a clinical ladder program. Responses were received from 73 nurses for a response rate of 73%. Findings revealed the most often used leadership behavior among the nurses was enabling others to act, followed by modeling the way, and encouraging the heart. There were no statistically significant differences across the clinical ladder program levels. Additionally, LPI scores were lower among nurses with more clinical experience. These results suggest it would be beneficial to develop leadership behaviors in more experienced nurses on the frontline. The single site, convenience sample, and the self-administered survey are limitations, although, the high response rate is noted as a strength. This study reports on self-perceived leadership behaviors of

individual nurses but does not allow for knowing how those behaviors are perceived by others.

Morin et.al. (2015) applied a pre- and post-test design to evaluate the program outcomes of the Maternal-Child Health Nurse Leadership Academy (MCHNLA). Dyads of mentors and fellows, from the 2010-2011 (n=32) and 2012-2013 (n=40) cohorts of the MCHNLA, were surveyed regarding program outcomes that included leadership skills, knowledge, and behaviors. Additionally, participants were asked about their involvement in the field and career advancements while in the program.

Results indicated a significant increase in mean scores for both mentor's and fellow's perceived leadership knowledge, leadership skills, and total scores for leadership behaviors from pre-MCHNLA to final follow up in both cohorts. Additional findings included 38.9% of fellows and 27.8% of mentors in the 2010-2011 cohort joined at least one professional organization during the program. Fellows chairing committees increased from 38.9% pre-MCHNLA to 72.2% at final follow-up. There was opportunity to impact patient outcomes as a result of the project required during the 18-month program. One example from the 2012-2013 cohort showed a reduction in length of stay by 1.47 days in the neonatal intensive care unit after implementation of a project to increase infant-driven feeding (Morin et.al., 2015).

This study supports the idea that when trained accordingly, in tandem with applying concepts to an actual unit project, along with mentoring, nurses have the ability to lead change at the bedside. The pre- and post-test design of this program evaluation is a strength as it allows to see if the intervention made significant change. The program in this study is through a professional organization and not the workplace of the fellow, which may limit comparison as the workplace of each

participant cannot be controlled, and participants may have varied experiences that differences in scores may be attributed to.

Flynn and Hartfield (2016) led a small qualitative study to understand what barriers and facilitators there are for frontline staff implementing quality improvement (QI) initiatives. They used a case study design to solicit key stakeholder feedback regarding a hand hygiene initiative implemented by a newly formed unit quality council in a pediatric intensive care unit in Edmonton. Six participant interviews were completed (one registered nurse, one physician, one patient case manager, medical director for QI, clinical QI consultant and director of clinical QI).

Interview findings revealed that a leadership team that supports the frontline to lead change versus leadership directing the change was empowering to staff. This, in turn, could help to create a desire for staff to be involved in quality work. Having a QI consultant to coach and guide, rather than manage the process helped to stay on track, especially since the champions had no experience in QI tools or leading projects. A work culture with strong relationships and a desire to want to improve facilitated implementation. Participants identified a lack of resources and personnel support as a barrier. They expressed that relying on volunteers to champion the work coupled with a feeling by frontline staff that QI is more work, rather than more efficient work, were barriers as well. Participants stated it would be valuable for all frontline staff to have QI training to lead this work going forward.

While this study is limited by its very small sample in one unit, at one hospital, the qualitative study design strengthened it, as it allowed for a deeper understanding of how the stakeholders perceived implementing a QI initiative. Understanding the perceptions, barriers, and facilitators to QI can help make

future initiatives more successful. The results are consistent with those seen in other studies. It would have been interesting to hear from units that do not have a unit quality council to lead change.

Physician led change

The literature was sparse in regard to frontline physicians leading change. A preliminary report to engage physicians in quality improvement efforts had shown signs of success (MacDonald, 2017). The program combined Lean management and IHI's model for improvement and collaborative learning. They believed engaging physicians in improvement work is essential to success as they are drivers of change. Physicians were trained in a new way of thinking and problem solving. Also, a forum of physicians to promote collaboration with colleagues and to promote joy in work was developed. This resulted in four days of training over 20 days and participants were provided resources and time to attend trainings. Tying the change to improving patient care and removing inefficiencies rather than cutting costs helped and starting with early adopters (those that adopt a new practice as soon as it is available) was key.

Oshiro (2015) presented what prevents physician engagement and offered strategies that can help. He first described that increased patient loads, feeling overwhelmed, feeling unsuited to implement change, and a lack of seeing how their behaviors contributed to waste and inefficiencies as barriers to physician participation in improvement work. Strategies that do not work to engage physicians included inspirational speeches to kick off an initiative with no follow-through, appointing physicians to leadership roles without proper training, only focusing on financial incentives, and oversharing best practices which can be overwhelm to already busy care providers. Six strategies were offered to gain

physician buy-in and were based on the IHI Framework for Engaging Physicians in Quality and Safety (2007). The steps included generating a common purpose to improve patient outcomes and decrease wasted time; reframing values and beliefs by making physicians partners rather than customers; segmenting the engagement plan, offering education, and identifying change champions; using engaging improvement methods by using data and making the right this easy to do and try; showing courage and letting physicians know they will be supported from the frontline to the boardroom in their initiatives; and adopting an engaging style where physicians are involved from the beginning, are rewarded, and receive frequent, candid communication (Oshiro, 2015; Reinertsen, Gosfield, Rupp, & Whittington, 2007).

Lean in Healthcare

The implementation of Lean and the context of this implementation can result in varied perceptions among healthcare workers (Holden, Eriksson, Andreasson, Williamsson, & Dellve, 2015). When clinicians are not directly trained on Lean, and don't have control of projects, or the support of their managers to participate in Lean improvements there can be a lack of participation and a negative view of Lean work (Holden et al., 2015). Additionally, managers and staff do not always understand Lean and view Lean as an abstract concept, or something that is discussed, but not understood (Savage, Parke, & Mazzocato, 2016). Conversely, when nurses are trained in Lean and can lead projects in their units, they begin to see that Lean does provide some benefit (Eriksson, 2017).

Case studies of Lean improvement

A number of case study examples of how Lean, Lean six sigma, and DMAIC (define, measure, analyze, improve, control) improve processes are in the

literature. When Lean and Six Sigma were used in combination with simulation, an emergency department's phlebotomy process was able to be improved utilizing a number of process improvements (Huang & Klassen, 2016). The DMAIC process was used in a medical-surgical unit to decrease the amount of time that nursing shift report takes. Prior to the project, nurse shift report on average took 43 minutes; after the improvement report was 30 minutes on average (Hewes & Costilla, 2016). Lean Six Sigma was used to implement corrective measures to decrease hospital acquired conditions (Improta, Cesarelli, Montuori, Santillo, & Triassi, 2018). After the improvement process there was a notable decrease in the percentage of colonized surgical patients, from 0.36 to 0.19 percent (Improta et al., 2018).

The impact of Lean six sigma was also seen in a cardiac catheterization lab. Using Lean six sigma tools, the lab saw significant improvements in decreasing turn time (time when a case is completed to the next one starting), physician downtime, and on-time patient and physician arrivals and start times (Agarwal et. al., 2016). These case studies are examples of how Lean can be a valuable tool to improve patient outcomes and to reduce waste and inefficiencies.

Including frontline staff in process improvement

Hung, Gray, Martinez, Schmittiel, and Harrison (2017) utilized a qualitative study design using the modified Consolidated Framework for Implementation Research designed for process redesigns (CFIR-PR) to examine perceptions of frontline physicians and care staff's perceptions of Lean implementation and their acceptance of the Lean redesigns. Semi-structured, one on one interviews were conducted with frontline physicians, physician leaders, and

operational leaders (n=113); and, 11 focus groups with the medical assistants (MA) were conducted.

Lean redesigns were implemented in primary care clinics (n=10) in 3 phases. Findings were grouped in themes. First was the implementation process, which included time and intensity, engagement levels, and the overall approach. Within this theme, the researchers found that physicians, leaders, and clinic staff that were involved in the pilot site implementation were engaged deeply in the work since they had been involved in analyzing the current workflows and in designing changes to be made. This engagement decreased at subsequent roll-out sites due to staff being less involved with redesigning the work and more and felt like changes were top-down, management driven changes, rather than being led by the frontline.

The second theme was related to the inner setting, including the organizational culture, leadership, and access to information. The culture of the clinic and leadership support made a difference in the success of Lean implementation. Leaders that encouraged frontline engagement, were receptive to feedback, and were transparent in their communication had more positive results in regard to the likelihood of Lean implementation's success (Hung et al., 2017).

The third theme was related to individual and team characteristics, including work roles, relationships, and professional identities. The role of the medical assistant (MA) had been redesigned, in addition to physicians and MAs being physically relocated to sit side by side. This required behavior changes from both groups, with physicians that thought of themselves as efficient prior to Lean implementation being the most resistant to change.

This study in the outpatient setting suggests that involving frontline staff in the change and implementation process is required for long term success with

Lean redesigns. Leaders that have strong relationships with their staff will be more successful in leading the changes. The use of an independent research team was a strength of this study and helped to eliminate bias. Additionally, the qualitative design was a strength as it allowed for an in-depth understanding of the perceptions of the participants, in addition to the large sample size. The study is limited in that it is only representative of one organization and to the outpatient setting, therefore results may not be generalizable to other settings.

Two studies reported on the relationship of the Lean maturity of an organization to second order problem solving in nursing teams. Second order problem solving is a problem-solving approach that seeks to find the root cause of the issue identified (Bijl, Ahaus, Ruël, Gemmel, & Meijboom, 2019; Gemmel, Van, Beveren, Landry, & Meijboom, 2019). Gemmel et. al. (2019) found that a unit that had been early adopters of Lean in hospital A (a hospital that had extensively implemented Lean), had nurses that exhibited a higher number of second order problem solving behaviors (71) than another unit that had been a late adopter of Lean in the same hospital (39). Hospital B, which had no organization-wide Lean program, but did have a unit that had adopted Lean themselves, showed only 16 second order problem solving behaviors. This is important as second order problem solving behaviors are essential for organizational learning and improvement.

Bijl et. al. (2019) also studied the relationship between Lean maturity and problem-solving behaviors in nursing teams. They sought to see how Lean leaders stimulate second order problem solving in nursing wards. Participants in this study were chosen from 14 units in a Dutch hospital that were in varying stages of implementing a Lean-based quality improvement program, The Productive Ward-Releasing Time to Care. Each unit had a core team that led this work. There were

three participants from each team: the team leader of the core team, one nurse on the team, and one nurse not on the team, that were chosen from each of the 14 units for a total of 42 participants. Semi structured interviews were completed that covered Lean maturity, second-order problem solving, and Lean leadership. The results showed that the units with more experience in Lean work (higher Lean maturity) had higher second order problem solving by the nurses. Additionally, seven practices of Lean leadership were identified: 1. convincing and setting an example; 2. unlocking individual and team potential; 3. solving problems systematically; 4. showing enthusiasm while actively participating and using visuals to communicate progress; 5. developing self-managing teams; 6. sensing, as orchestrator, what is needed for change; and 7. listening, sharing information and appreciating (Biej et. al., 2019). While Lean requires a large investment of time and effort from leaders at the beginning, as the frontline becomes more mature in this work, leaders will need to relinquish control of the process to the staff in order to better develop second order problem solving (Bijl et. al., 2019).

Summary

The evidence in this review shows that there are a number of gaps in the literature that this project seeks to fill. First, many of the articles reviewed only captured the perspective of nurses in regard to nurse-physician collaboration. This does not paint a complete picture of nurse-physician collaboration. When nurses and physician were both included, nurses consistently rated collaboration lower than physicians. Most of the studies were cross-sectional, only offering a snapshot in time. The pre- and post-intervention design of this study sought to fill this gap, in addition to including the perspective of both nurses and physicians.

The literature also suggests that frontline nurses and physicians feel ill-equipped to lead change and that a lack of dedicated time and resources are not always given to this work. This is a gap that this current study sought to fill by providing training in Lean and having participants apply those concepts to leading an on-unit project. Concerning Lean in healthcare, Lean has shown unit level success via case studies that demonstrated improved efficiency and removal of waste. When staff are engaged in Lean work and are leaders of the change, rather than having changes implemented upon them, there is greater success of the improvement work. Also, Lean can help develop second order problem solving to discover the root cause of issues leading to sustained change, rather than a band-aid approach that misses the root of an issue leading to feelings of chaos. This supports teaching nurse and physician dyads Lean as a way to identify problems and lead change.

CHAPTER 3: METHODS

This chapter consists of the detailed plan used to conduct a quasi-experimental pilot project. This project sought to fill a gap in the literature by using a pre- and post-intervention design that included both nurses and physicians to assess the professional practice environment; in addition, to discover whether training in Lean methods helped frontline nurses and physicians feel equipped to use Lean methods and to lead change.

Setting

This project took place at an acute care hospital in the Sacramento region of California that is part of an integrated health care system. The campus consists of a 340-bed inpatient hospital and clinics offering a wide range of services. The senior vice president (SVP) oversees hospital operations in addition to overseeing health plan services and services provided to members outside of the hospital (i.e. pharmacy, regulatory services, and continuity of care). The SVP partners with the physician in chief (PIC) who oversees the 653 physicians in the geographic area to ensure the best care is provided to every patient.

In the hospital, the chief nurse executive (CNE) reports to the SVP and is responsible for five departments, or service lines, that make up patient care services, one of which is maternal child health (MCH). This department was the focus of this doctoral project. Within MCH are five departments: labor and delivery, mother baby, neonatal intensive care (NICU), pediatric intensive care (PICU), and pediatrics. There are four managers in the MCH building (pediatric intensive care and pediatrics are managed together) that report to the MCH director who reports to the CNE. Each of the departments have assistant nurse managers that oversee the day to day unit operations and additionally, act in the

charge nurse role. The director of MCH oversees patient care services and partners with the assistant physician in chief, who oversees the MCH physicians.

Permission was granted by the executive leadership team (chief nursing executive, chief operating officer, the assistant physician in chief, and the MCH director) to conduct this project. Institutional Review Board approval was obtained prior to commencing the project at both the hospital and California State University, Fresno. This hospital has an entire department dedicated to performance improvement. Many leaders have attended performance improvement training; however, few inpatient, frontline nurses and physicians have participated in these formal trainings, which made this a good setting for this project.

Project Methods

This project was completed over a 12-week period from September 2019 to November 2019. It was a quasi-experimental pilot project utilizing a pre- and post-intervention design. Informed consent was obtained from each of the 10 participants prior to participating in the project (See Appendix A). The intervention was six, four-hour in-person modules on performance improvement (Lean and six sigma), principles, and behaviors. Table 1 shows the content topics of each module. Additionally, this project sought to see if training nurses and physicians together would improve teamwork and collaboration across the two disciplines. The modules occurred every two weeks over a 12-week period.

Participants were also required to identify and co-lead a project that began after the first module. The dyad (one frontline nurse and one frontline physician) project was meant to be small enough that it could be completed during the 12-week project period. Project topics varied by specialty for each dyad. The NICU dyad wanted to decrease time to first breast stimulation post-delivery for mothers

of infants admitted to the neonatal intensive care unit in an effort to increase long-term breastmilk supply, which is the preferred nutrition for premature infants. The labor and delivery and mother baby dyads combined as their project impacted both units. The project was to pilot the use of outpatient Misoprostol and Foley balloon inductions in triage for low risk patients with a goal of shortening hospital stays and increasing patient satisfaction by allowing mothers to rest comfortably at home. Pediatrics selected a project to consistently get pediatric patients up and out of bed to reduce the risk of complications (e.g. atelectasis, hospital acquired pneumonias, constipation). Their aim was to create developmentally appropriate activities for children to participate in that are engaging and motivate patients to ambulate. Lastly, the PICU dyad sought to decrease the time staff spent locating intravenous pumps for patient care as a result of not having a current process for a standard inventory, availability, or the ability to know if a pump is clean and ready for patient use.

Each dyad had a coach (mentor) that met with them between modules to help apply concepts. There were three coaches, one doctoral student, a consultant, and the performance improvement director, all experienced in performance improvement. These coaches were also instructors for the modules.

A pilot project was the best method to use for this project as it was a way to test the intervention on a small scale to see if there were positive results. This was necessary because there was an associated cost to the organization (Melnyk, Morrison-Beedy, & Cole, 2015). The cost was in the form of allowing participants (frontline nurses and physicians) to be away from the bedside for training and to lead a project and required an investment from upper leadership. It was recognized that this project had the potential to develop nurses and physicians to become problem solvers on their units and for the organization to streamline processes and

remove waste. Project support and approval was obtained prior to starting the project.

Table 1

<i>MCH Lean Module Content Topics</i>	
Module	Module Content Topics
Module 1	Principles and behaviors Daily management system Using the performance improvement model Writing an elevator speech
Module 2	Understanding improvement Process mapping 8 Wastes 6S
Module 3	Learning Lean
Module 4	KATA Identifying and testing changes Building your team
Module 5	Displaying data Understanding variation
Module 6	Making healthcare more affordable Calculating financial benefits Understanding organizational change Sustaining Improvements

Sample

The sample for this project was a purposive, convenience sample. This nonprobability sampling technique was utilized in an effort to recruit participants that were interested in learning about Lean and leading change. To be included for participation on this project, participants had to be a nurse or physician and they had to work in one of the five units in the MCH department. Additional inclusion criteria for nurses included that they must be members of their nursing unit

council. Nurses and physicians that did not work in MCH and nurses that were not on their unit nursing council were excluded from this project.

It was decided that the chairs of the nursing unit councils would be contacted as potential participants because they would be able to use the committee to work on their on-unit projects. For the physicians, the chiefs identified physicians that were interested in learning about performance improvement. One dyad from each of the five units was approved by the leadership team to participate in this project, therefore the sample size was limited to 10 participants. Nurse managers and the chief physician of each department were contacted to select the frontline nurse and physician that would attend the training.

Data Collection

The instrument used to assess for collaboration was the Professional Practice Environment Assessment Scale (PPEAS) (See Appendix B). This tool was developed to assess not only collaboration, but also mutual respect, effective communication, and collaborative decision making (Siedlecki & Hixson, 2011). The PPEAS was originally developed based on literature reviews and practical experiences of nurses and physicians and was later administered electronically via email to test reliability and validity. There was a 34 percent response rate. The authors used factor analysis, and reliability was tested using Cronbach's α . The internal consistency based on Cronbach's α for the entire scale was 0.86.

The PPEAS consists of four subscales and the Cronbach's α for those were: positive physician characteristics (0.89), positive nurse characteristics (0.77), collaborative decision making (0.73) and positive beliefs (0.86) (Siedlecki & Hixson, 2011). The scale is 13 questions and is quick to complete. Total scores

range from 13-130. Higher scores indicate a more positive professional practice environment. Permission to use this tool was granted by the author to use in this project.

In addition to the PPEAS instrument a tool to assess for Lean and performance improvement knowledge was used. A review of the literature did not identify a tool that tested for Lean and performance or process improvement that fit with this project. A poster presentation titled *Multidisciplinary Quality Improvement Education Across a Pediatric Primary Care Network* at a Children's Hospital Association Conference included a nine question, four-point Likert scale, pre- and post-intervention survey for quality improvement (Huang, Powell, & Cruz, 2019). With permission from the author, these questions were adapted for use in this project. The questions were reviewed by two Lean experts at Kaiser Permanente and it was agreed to change quality improvement to performance improvement to be consistent with the education for this project (See Appendix C). The questions were tested with a group of nurse and physician leaders. The internal consistency based on Cronbach's α for the entire performance improvement scale for the test group was 0.892.

Additionally, participant demographics were collected. Participants were asked for their age, gender, role (nurse or physician), years of experience, and level of education. One of the dyads included a certified nurse midwife, rather than a physician.

Data were collected via paper at the beginning of the first in-person module and at the end of the last in-person module. Surveys were anonymous. Since data were to be analyzed with a paired t-test the researcher needed a way to identify which pair of surveys belonged to each participant. Using subject generated coding can lead to mismatches or the possibility more than one subject generated

the same code (McGloin, Holcomb, & Main, 1996). A method by McGloin, Holcomb, and Mai (1996) was utilized. Participants were assured of their anonymity. Each participant was given the survey and an envelope with three stickers inside. Two stickers had the same random number on them. The third sticker was blank. During the pre-intervention survey the participants took one of the stickers and placed it on their survey. Surveys were returned to the back of the room in a large envelope that was collected after class. The remaining numbered sticker was placed back in the envelope, which was then sealed with the blank label and signed by the participant. All the envelopes were then placed inside a larger envelope which was secured with the pre-survey data in a locked drawer in the primary researcher's office that only she had the key for. When the post-survey was administered each participant received the survey along with their signed envelope. They were able to see that it hadn't been tampered with and, upon completion, placed the second sticker on the post-intervention survey and placed in an envelope in the back of the classroom that was collected at the end of the class.

Data Analysis

Pre- and post-surveys for the PPEAS were analyzed using a paired-samples t-test. A Wilcoxon signed-rank test was conducted to analyze the pre- and post-performance improvement instrument surveys.

In summary, this chapter reviewed the detailed plan that was utilized for this pre- and post-intervention project that sought answer the following research questions:

1. Does educating frontline nurses and physicians in Lean principles and performance improvement increase their ability to identify issues, solve problems, and to lead interdisciplinary projects?
2. Does training frontline nurses and physicians together increase collaboration?

The following chapter will discuss the findings of this project.

CHAPTER 4: RESULTS

This chapter presents the findings of the project. Results of the Performance Improvement (PI) instrument and the Professional Practice Environment Assessment Scale (PPEAS) are presented and discussed. All data analysis was performed using SPSS 25 Statistical Software from IBM.

Results

Demographic Data

Demographic data were collected on the ten project participants (see Table 2). Participants were between the ages of 34 and 53 ($M=42.4$, $SD=5.48$) and had between 2.5 and 20 years of experience in their current role ($M=12.6$, $SD=5.71$). There were five registered nurses, four medical physicians, and one advanced practice nurse. Among the participants there were two males and eight females. One participant held an associate degree, three held a bachelor's degree, two held a master's degree, and four held medical doctorate degrees.

Table 2

<i>Demographic Characteristics of Participants</i>	
Demographic Variable	Number
Age in years, mean (range)	42.2 (34-53)
Gender	
Male	2
Female	6
Role	
Registered Nurse	5
Physician	4
Other	1
Experience in years, mean (range)	12.6 (2.5-20)
Education	
Associate degree	1
Bachelor's degree	3
Master's degree	2
Doctor of medicine	4
Other	0

Performance Improvement Scale

The Wilcoxon Signed-Rank Test was conducted to determine the effect of participants attending performance improvement educational sessions. This test was used because data for this scale were ordinal (Likert items). Ten participants were recruited to attend six, four-hour modules on performance improvement. Participants were surveyed prior to module one and again at the end of module six using a performance improvement four-point Likert instrument (1 = *not confident at all* and 4 = *very confident*) (Huang, Powell, & Cruz, 2019). Surveys were paired within participants. The difference scores were approximately symmetrically distributed, as assessed by a histogram with superimposed normal curve.

Each question yielded a statistically significant median increase (see Figure 1). For question one, “use PI to identify potential system changes, not individual errors”, of the ten participants for this project, eight saw an improvement in their confidence, whereas one saw a decrease in confidence, and one participant saw no change. There was a statistically significant median increase (Mdn = 1) from pre-intervention (Mdn = 2.5) to post-intervention (Mdn = 4), $z = 2.33$, $p = .020$.

Nine out of the ten participants saw an improvement in their confidence post-intervention on question two, “formulate a clear problem statement for a PI project (e.g. SMART aim),” and one participant had no change. The median increase was statistically significant (Mdn = 1) from pre-intervention (Mdn = 2) to post-intervention (Mdn = 3), $z = 2.81$, $p = .005$.

For question three, “determine process, outcome, and balancing measures for a PI project,” nine of the ten participants had an increase in confidence, while one saw no change. The median increase (Mdn = 1) was statistically significant. Confidence increased pre-intervention (Mdn = 2) to post-intervention (Mdn = 3), $z = 3.00$, $p = .003$.

Nine of the 10 participants that participated in this project had an increase in confidence, and one participant had no change in confidence, on question four, “identify potential small tests of change, design, and implement PDSA cycles”. There was a statistically significant median increase (Mdn = 1) pre-intervention (Mdn = 2.5) to post-intervention (Mdn = 3.5), $z = 2.81$, $p = .005$.

All ten participants saw an increase in confidence for question five, “design your next test of change based on the results of your previous PDSA cycle”. For this question there was a statistically significant median increase in confidence (Mdn = 1) pre-intervention (Mdn = 2) to post-intervention (Mdn = 3), $z = 2.92$, $p = .004$.

For question six, “identify appropriate stakeholders for a PI project,” of the 10 participants that participated in this project, eight participants saw an improvement in their confidence, whereas two participants saw no improvement. There was a statistically significant median increase in confidence (Mdn = 1) from pre-intervention (Mdn = 3) to post-intervention (Mdn = 3.5), $z = 2.71$, $p = .007$.

For question seven, “interpret and utilize data to determine whether your change resulted in an improvement”, the intervention elicited an improvement in confidence post-intervention for six of the ten participants, while four saw no change. There was a statistically significant median increase in confidence (Mdn = 1) from pre-intervention (Mdn = 3) to post-intervention (Mdn = 3), $z = 2.33$, $p = .020$.

All ten participants also saw an increase in confidence for question eight, “describe how to use PI tools (process, flow, driver diagram, etc.)”. There was a statistically significant median increase in confidence (Mdn = 1) pre-intervention (Mdn = 2) to post-intervention (Mdn = 3), $z = 2.92$, $p = .004$.

For the last question, question nine, “improve quality of care you provide by participating in PI projects”, seven participants saw an improvement in their confidence post-intervention and three saw no change. A statistically significant median increase in confidence was seen (Mdn = 1) from pre-intervention (Mdn = 3) to post-intervention (Mdn = 4), $z = 2.46$, $p = .014$.

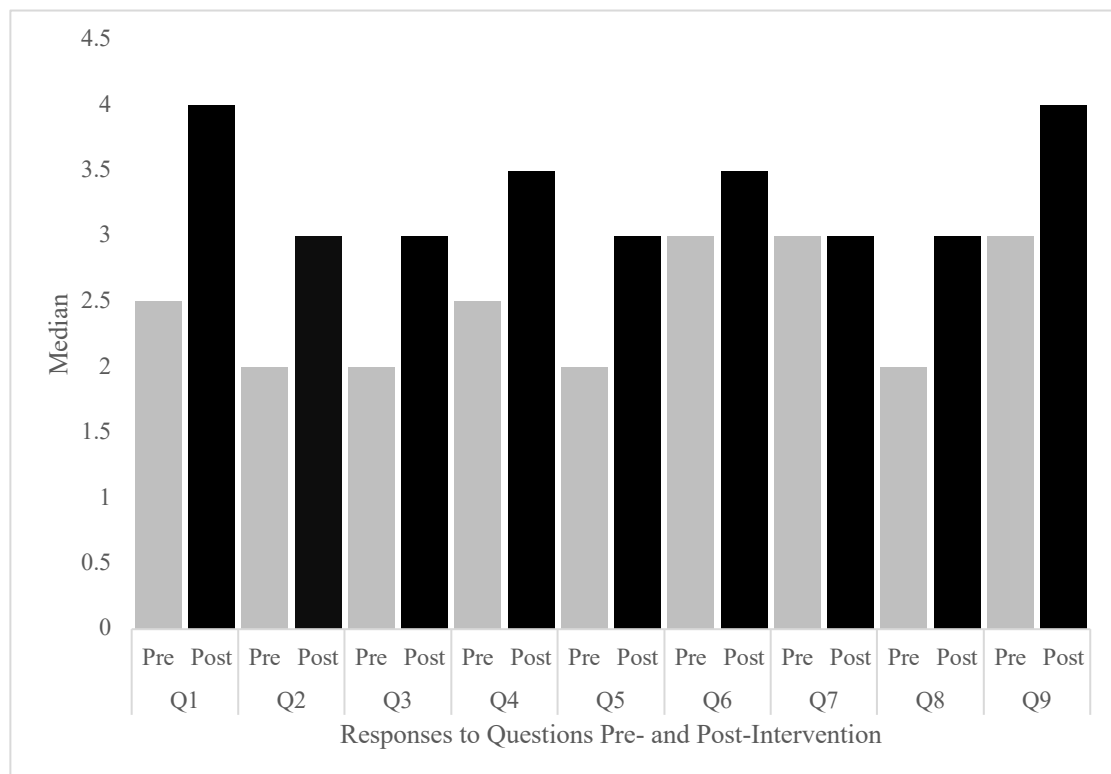


Figure. Performance improvement scale responses pre- and post-intervention

PPEAS

A paired-samples *t*-test was used to determine whether there was a statistically significant mean difference between pre- and post-intervention survey responses using the Professional Practice Environment Assessment Scale (PPEAS) (Siedlecki & Hixson, 2011). The assumption of normality was not violated, as assessed by Shapiro-Wilk's test. Results of Shapiro-Wilk's test for the subscales

and total scale are as follows: presence of positive physician characteristics (P) ($p = .505$), presence of positive nurse characteristics (N) ($p = .937$), presence of positive organizational characteristics (O) ($p = .320$), presence of positive patient care decision-making (D) ($p = .599$), and total score for the PPEAS ($p = .376$).

The results of the PPEAS subscales and total scale scores all decreased post-intervention, though none of the results were statistically significant (See Table 3). There was not a significant difference for the P subscale, pre-intervention scores ($M = 38.4$, $SD = 4.67$) and post intervention scores ($M=36.1$, $SD= 7.99$) conditions; $t(9)= 0.97$, $p > .358$. There was no significant difference for the N subscale pre-intervention ($M =24.9$, $SD = 3.84$) and post intervention scores ($M=24.2$, $SD = 3.05$) conditions; $t(9) = -0.55$, $p > .599$, or for the O subscale pre-intervention scores ($M = 28.1$, $SD = 3.54$) and post-intervention scores ($M= 23.5$, $SD= 6.13$) conditions; $t(9) = -1.95$, $p > .083$. There was not a significant difference for the D subscale pre-interventions scores ($M = 15$, $SD = 2.87$) and post-intervention scores ($M= 14.9$, $SD=2.92$) conditions; $t(9) = -0.12$, $p > .90$. Finally, there was no significant difference for the total PPEAS score pre-intervention score ($M =106.4$, $SD = 10.35$) and post-intervention scores ($M=98.7$, $SD= 17.46$) conditions; $t(9) = -1.33$, $p > .21$.

Summary

The results of this project suggest that training frontline nurses and physicians in performance improvement can result in an increase in confidence to use and understand performance improvement tools. It remains unclear if training frontline nurses together can improve the professional practice environment. It is possible that improving the professional practice environment would need to be a facility-wide endeavor.

Table 3

Paired Samples Test - Paired Differences

Pair	Scale (post-pre survey)	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
1	Positive Physician Characteristics	-2.3	7.51	2.38	-7.67	3.07	-0.97	9	.358
2	Positive Nurse Characteristics	-0.7	4.06	1.28	-3.60	2.20	-0.55	9	.599
3	Positive Organizational Characteristics	-4.6	7.47	2.36	-9.94	0.74	-1.95	9	.083
4	Positive Characteristics of patient care decision-making	-0.1	2.60	0.82	-1.96	1.76	-0.12	9	.906
5	Total All Subscales	-7.7	18.35	5.80	-20.83	5.43	-1.33	9	.217

p-value is significant if < .05

CHAPTER 5: DISCUSSION & CONCLUSION

This chapter consists of a discussion of the project outcomes and conclusions. It includes the discussion, strengths, limitations, recommendations for future projects or research, practice implications, and conclusions.

Discussion

The overall purpose of this project was to see if training frontline nurses and physicians together in Lean principles improved collaboration between the two disciplines while giving them the tools they needed to lead change at the bedside and in their practice. The first question for this project was, does educating frontline nurses and physicians in Lean principles and performance improvement increase their ability to identify issues, solve problems, and to lead interdisciplinary projects? To answer this question the performance improvement (PI) instrument was used.

Performance Improvement Instrument

The results of the performance improvement instrument, pre- and post-intervention, suggest that training frontline nurses and physicians in performance improvement does have a positive effect on participant's confidence to use and apply PI tools, as all nine questions of the instrument showed a statistically significant median increase post-intervention.

Question seven of the instrument, regarding interpreting and utilizing data, had six participants that saw an improvement in their confidence, which was a lower amount compared to the other eight questions. This may be due to the fact that the week before this module was scheduled there was a call for a strike at the hospital and all classes were canceled, including module five of this project. Two

days before the class the strike was called off and the module was rescheduled; however, three participants were unable to attend. This may have impacted the response results to this question as that was the only day that data interpretation was discussed.

Another aspect of this project was each dyad led a performance improvement project on their units where they worked with a coach/mentor to apply their learnings. This could be another reason for the increase in confidence using PI tools. Mentors or coaches are able to help guide frontline staff through the PI process rather than leading the work, which can help to keep projects on track and to increase the confidence of frontline staff (Flynn & Hartfield, 2016; Morin et. al., 2015).

Anecdotal evidence from dyads during their projects, and from post-instruction evaluations after each class module, showed that participants thought the content was very helpful, that they wished they had learned these tools sooner, and they felt confident to continue to apply their newly learned skills to solve other problems in their units and organization. This is consistent with previous studies that reported frontline staff want to be empowered to lead change and that it would be valuable for all frontline staff to have training to lead change from the bedside (Byers, 2015; Flynn & Hartfield, 2016).

PPEAS

The second question of this project asked, does training frontline nurses and physicians together increase collaboration? The results of the PPEAS suggest that training only a small group of frontline nurses and physicians together may not have a positive effect on the professional practice environment. Although, the sample size was likely too small to be powerful enough to detect a difference

(Cohen, 1992). Additionally, many studies reported that nurses rate nurse-physician collaboration lower than their physician counterparts (Bowles et. al., 2016; Caricati et. al., 2015; Collette et. al., 2017; Henkin et. al., 2016) and while this project did not separate the PPEAS for nurses and physicians to compare, as the sample was too small, this could be a reason that the post-scores were lower.

It is also possible that since this was likely the first time many of the frontline nurses and physicians had participated in leading a performance improvement project, in addition to working so closely with another discipline, participants potentially were exposed to their partner's role and realized they did not understand the role as they previously thought, which represents questions on the PPEAS. Additionally, as dyads led projects on their unit they may have been exposed to other nurses or physicians that were potentially not as respectful, collaborative, communicative, or understanding—all of which are items on the PPEAS—leading to potentially lower post-intervention scores. Without statistical significance noted, however, one cannot make valid inference of the results.

Strengths

There were some notable strengths of this project. First, participants being given the time, resources, and support to participate in this project and to apply the concepts to their on-unit project was beneficial, especially since there are reports that a lack time and resources have been reported as barriers to frontline staff leading change (Byers, 2015; Flynn & Hartfield, 2016; MacDonald, 2017). Additionally, including frontline nurses and physicians together in the project allowed for the perspective of both disciplines to be captured. This is important as it is often only the nurse's perspective of nurse-physician collaboration that is captured (Aghamohammadi, Dadkhah, and Aghamohammadi, 2019; Boev & Xia,

2015; Ma, Park, & Shang, 2018; Brown, Lindell, Dolansky, & Garber, 2015; Streeton et. al, 2016). Furthermore, the pre- and post-intervention design of this project was a strength as well, as many of the reports in the literature have been descriptive or cross-sectional (Aghamohammadi, Dadkhah, and Aghamohammadi, 2019; Boev & Xia, 2015; Bowles et. al. 2016; Caricati et. al., 2015; Collette et. al. 2017; Ma, Park, & Shang, 2018; Brown, Lindell, Dolansky, & Garber, 2015).

Lastly, as seen in a study by Flynn and Hartfield (2016), the use of a coach can help participants stay on track with PI projects and can aid the participants in gaining a deeper understanding of Lean and PI tools, as many of the participants did not have previous experience with these concepts. The use of coach in this project was valuable in helping the participants engrain the concepts into their project and into their practice and was a strength of this project.

Limitations

This pilot project was an initial snapshot to see if this interprofessional training would be successful and whether it will be continued. The time period that this project had to be completed in was 12 weeks, which limited the ability to see the conclusion and impact of the unit-based projects that were led by the dyads, as all participants had not concluded their on-unit projects by the end of the project period. The design of this project was a limitation as well, as the use of only quantitative data collection did not allow for identifying whether participants felt this training was valuable or whether there were any barriers or facilitators to this work.

Likewise, the small sample size for this project and the use of convenience sampling limited the generalizability of this work. While all questions of the PI instrument showed a statistically significant result, one must be cautious as the

power of such a small sample size limits the ability to generalize results. In terms of the PPEAS, limited statistical power due to the small sample size in this project ($n = 10$) may have played a role in limiting the significance of the statistical tests used. G*power revealed that on the basis of the mean, within subjects comparison effect size observed in the present project ($d = 0.42$), an n of approximately 47 would be needed to obtain statistical power at the recommended .80 level (Cohen, 1992); however due to this being a pilot project for this facility, a sample size of greater than 10 was not possible.

Recommendations for future projects or research

Future projects should focus on a more system-wide approach to develop the skills of frontline nurses and physicians to lead change at the bedside; and also, to work to understand and improve the perceptions of the professional practice environment. Another recommendation would be to add a qualitative portion to the design. This would allow for a more in-depth understanding of what the barriers and facilitators are to participant's confidence in using Lean tools. Additionally, it would provide an opportunity to understand how to improve the professional practice environment. One could even add the perspective of hospital leadership to identify and understand if this work is valuable, what their personal experience with Lean and PI work is, and what their suggestions are to develop frontline staff to be problem solvers and leaders of change at the bedside.

The time commitment of the training for this project is significant, therefore the training could potentially be scaled down in order to feasibly get the content to more frontline staff, as it is difficult to release nurses and physicians from the bedside for lengthy trainings. This project did not include a control group; therefore, future projects could focus on expanding the training to more

participants and disciplines on a unit. That unit could then be compared to other units to see if there is a difference in change led by the frontline participants in the intervention and control units. Lastly, there needs to be time to assess the conclusion and the impact of the dyad led projects, this time should be factored into future projects.

Practice implications

This project highlights the need to train frontline providers in Lean and performance improvement. This pilot project suggests that training can increase participant's confidence in using Lean and PI tools. With this confidence frontline providers can lead unit and system changes to transform the healthcare environment. If developing the frontline to lead change is an organizational priority, then support to continue this work should be provided. In terms of the professional practice environment, organization wide initiatives will likely be necessary to be successful.

Conclusion

The project emphasizes that, with time and support from leadership, frontline nurses and physicians can become confident in applying Lean and performance improvement tools to lead change at the bedside. These skills can empower staff to identify and lead change and to challenge the status quo. These leaders will be the change agents necessary to transform the healthcare setting. Additionally, improving the professional practice environment will need to take place on a larger, organization wide scale to be impactful. The results of this project suggest that one class is not enough for nurses and physicians to see an improvement in their professional practice environment.

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APPENDICES

APPENDIX A: CONSENT

Fresno Consent Form to Participate in Study

Study Title: Learning Lean to Lead

Principal Investigator: Krystle Guenther (916) 846-4072

Department of Nursing, California State University, Fresno

This is a research study to learn if training frontline nurses and physicians in performance improvement increases their ability to identify issues, solve problems, and to lead interdisciplinary projects; in addition, if collaboration is increased when nurses and physicians lead a project together. You were selected as a possible participant in this study because you have been identified as a frontline employee that has the potential to impact change on your unit.

If you decide to participate, it is important that you understand the time commitment and can attend all sessions. The intervention is 6, 4-hour, in-person modules on performance improvement (Lean and six sigma), principles, and behaviors. You will take a survey at the beginning of module 1 and again at the end of module 6. Modules will be every 2 weeks from 8:30-12:30 and will start September 5, 2019. Participants will identify and co-lead a project to begin after the first module. The dyad (one frontline nurse and one frontline physician) project should be small enough that it can be completed during the twelve-week period. Each dyad will have a coach that will meet with them between modules to help apply concepts. CEUs and CMEs will be provided, and you may use education leave to be compensated for your time.

Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. If you give us your permission by signing this document, we plan to disclose the survey results in an article for publication. Your survey responses will not be able to be individually identified.

Your decision whether or not to participate will not prejudice your future relations with California State University, Fresno or Kaiser Permanente. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without penalty. The Committee for the Protection of Human Subjects at California State University, Fresno has reviewed and approved the present research.

If you have any questions, please ask us. If you have any additional questions later, Krystle Guenther (916) 846-4072, will be happy to answer them. Questions regarding the rights of research subjects may be directed to Dr. Kris Clarke, Chair, CSU Fresno Committee on the Protection of Human Subjects, (559) 278-2985.

You will be given a copy of this form to keep.

YOU ARE MAKING A DECISION WHETHER OR NOT TO PARTICIPATE. YOUR SIGNATURE INDICATES THAT YOU HAVE DECIDED TO PARTICIPATE, HAVING READ THE INFORMATION PROVIDED ABOVE.

Date _____

Participant

Print Name

Signature

Investigator

Print Name

Signature

APPENDIX B: PPEAS



Positive Professional Practice Environment Assessment Scale (PPEAS)

For each of the following statements, rate your perceptions on the environment where you currently practice on a scale from 1 to 10, with 1 indicating that you strongly disagree with the statement and 10 indicating that you strongly agree with the statement

			1	2	3	4	5	6	7	8	9	10
P	1	Physicians demonstrate respect for nurses at the facility where I work										
P	2	Physicians demonstrate respect for nurses on the unit where I work										
P	3	In general I believe Physicians understand the role of the nurse										
N	4	Nurses demonstrate respect for physicians at the facility where I work										
N	5	Nurses demonstrate respect of physicians on the unit where I work										
N	6	In general I believe that nurses understand the role of the physician										
D	7	Physicians and nurses discuss patient care decisions in the area where I work										
D	8	Physicians and nurses discuss patient care decisions in the facility where I work										

For each of the following statements indicate (X) the extent to which each of the following affects patient outcomes, from 1 = insignificant or negligible affect to 10 = significant or major affect

			1	2	3	4	5	6	7	8	9	10
O	9	Physicians demonstrate respect for nurses at the facility where I work										
O	10	Physicians demonstrate respect for nurses on the unit where I work										
O	11	In general I believe Physicians understand the role of the nurse										

On any given day, how would you rate (X) the following nurse/physician or physician/nurse interactions, from 1 = poor to 10 = excellent

			1	2	3	4	5	6	7	8	9	10
P	12	The quality of nurse/physician or physician/nurse collaboration										
P	13	The quality of nurse/physician or physician/nurse communication										

P = Positive Physician Characteristics N = Positive Nurse Characteristics
 O = Positive Organizational Characteristics D = Positive characteristics of patient care decision-making

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APPENDIX C: PERFORMANCE IMPROVEMENT
INSTRUMENT

Performance Improvement Instrument

Performance Improvement (Used with permission) *	Not at all confident (1)	Not very confident (2)	Confident (3)	Very Confident (4)
1. Use Performance Improvement (PI) to identify potential system changes, not individual errors	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Formulate a clear problem statement for a PI project (e.g. SMART aim)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Determine process, outcome, and balancing measures for a PI project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Identify potential small tests of change, design, and implement, PDSA cycle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5. Design your next test of change based on the results of your previous PDSA cycle	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
6. Identify appropriate stakeholders for a PI project	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Interpret and utilize data to determine whether your change resulted in an improvement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Describe how to use QI tools (process, flow, driver diagram, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
9. Improve quality of care you provide by participating in QI projects	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

On a scale of 1-4 please rate your confidence in your ability to:

*Huang, E., Powell, M., & Cruz, D. (2019, March). *Multidisciplinary quality improvement education across a pediatric primary care network*. Poster presented at the Children's Hospital Association Quality and Safety Conference. Atlanta, GA. Adapted by Krystle Banfield, MS, RN, CCRN, April 2, 2019.