

Seton Hall University eRepository @ Seton Hall

Seton Hall University DNP Final Projects

Seton Hall University Dissertations and Theses

Winter 12-22-2016

A Quality Improvement Initiative Aimed at Reducing Complications Related to IV Fluid Administration in the Acute Care Setting

Katherine Connolly
katherine.connolly@shu.edu

Follow this and additional works at: <https://scholarship.shu.edu/final-projects>

 Part of the [Nursing Commons](#)

Recommended Citation

Connolly, Katherine, "A Quality Improvement Initiative Aimed at Reducing Complications Related to IV Fluid Administration in the Acute Care Setting" (2016). *Seton Hall University DNP Final Projects*. 15.
<https://scholarship.shu.edu/final-projects/15>

A Quality Improvement Initiative Aimed at Reducing Complications Related to IV Fluid
Administration in the Acute Care Setting

By
Katherine Connolly
Seton Hall University

DNP Scholarly Project Committee
Dr. Mary Ellen Roberts - Chair
Dr. Eileen Toughill
Dr. Maureen Schneider

© 2016 (Katherine Connolly)

A Quality Improvement Initiative Aimed at Reducing Complications Related to IV Fluid
Administration in the Acute Care Setting

By
Katherine Connolly

DNP Scholarly Project Committee

Dr. Mary Ellen Roberts - Chair

Dr. Eileen Toughill

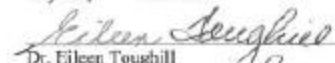
Dr. Maureen Schneider

Approved by the DNP Scholarly Project Committee:



Dr. Mary Ellen Roberts

Date: 9-28-16



Dr. Eileen Toughill

Date: 9-28-16



Dr. Maureen Schneider

Date: 9-28-16

Submitted in partial fulfillment of the Requirements for the degree of

Doctor of Nursing Practice

Seton Hall University

2016

Dedication

I dedicate this work to a loving God, who has blessed me with a kind and supportive husband, two beautiful and remarkable daughters and an amazing mother, who taught me to be the best person I can be and encouraged me every step of the way.

And for my father....

Not all have the privilege of watching their children grow up, but he has always been with me and I know he would have been proud.

Acknowledgements

I owe a world of thanks to my extraordinary doctoral committee. Each of them brought their own brand of knowledge and talent to this DNP project. Champions of the nursing profession in their own right, they have generously shared their experience and scholarly expertise with me.

A special thank you to Dr. Mary Ellen Roberts, Committee Chair and Director of the DNP program at Seton Hall University. I could have not done it without you! Your open door policy and steady mentorship throughout, have meant the world to me. You are a treasured colleague and friend and a tremendous asset to the nursing profession.

Many thanks to Dr. Eileen Toughill for your endless support and encouragement. I truly appreciate your intuitive scholarly mentorship, attention to detail and tell it like it is style. The time you took to refine and guide this work is a testament to the person you are. Your passion for the nursing profession is an inspiration to many and I am honored to call you my colleague and friend.

And to Dr. Maureen Schneider...thank you for welcoming me to your institution with open arms. You are an amazing role model and mentor and I can't thank you enough for your active involvement in this project. Being in your presence was witnessing true leadership in action and I am fortunate to have had the opportunity. You have never hesitated to support another who is trying to move forward in the nursing profession and for that I am forever grateful.

Most importantly, my sincere thanks to all of you....for believing in me.

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY.....	7
I. BACKGROUND.....	8-11
Definition of Terms.....	12
Description and Purpose of Project.....	13
Intended Audience.....	13-14
Goals and Objectives.....	14-15
Significance of the Project.....	15-16
II. REVIEW OF THE LITERATURE	16-26
III. THEORETICAL FRAMEWORK.....	26-29
IV. PROJECT METHODOLOGY.....	29-36
V. PROJECT OUTCOMES.....	36-37
VI. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS.....	37-40
VII. REFERENCES.....	41-47
VIII. APPENDICES	48-51

EXECUTIVE SUMMARY

Purpose: The purpose of this quality initiative is to bridge the gap between evidence and practice related to the management of intravenous (IV) fluids in the hospital setting and to increase awareness regarding important quality issues, highlighting the critical role of nurses in effecting change in the health delivery system.

Significance of Project: The administration of IV fluids is one of the most common interventions in the hospital setting. The associated complication rate is higher than previously believed. Adverse effects impact recovery time, length of stay, cost, patient safety and survival. Related complications are largely preventable and unmet educational needs are well documented. An increase in evidence based management has the potential to improve patient outcomes that affect a number of quality indicators.

Methods: The project was implemented at a mid-size community medical center. An educational initiative developed for bedside nurses was coupled with system level interventions to minimize risk. The content included recommendations from clinical practice guidelines and data from several studies supporting a shift to more conservative fluid management strategies. The sessions emphasized assessment skills and critical thinking to enhance therapeutic effectiveness and prevent complications.

Project Outcomes: The project was well received by nursing staff and leadership. The anticipated effect will be a reduction in the overutilization of IV fluids, resulting in a lower complication rate. An exit survey indicated that the information provided would influence nursing practice at the bedside and the content was subsequently adapted for integration into the hospital's RN orientation program. A prompt in the electronic health record (EHR) to reevaluate the need for IV fluids every 24 hours will be implemented when the facility completes their transition to an updated EHR system.

Clinical Relevance: The assimilation of evidence into practice is an essential component of delivering higher quality healthcare. Nurses have a professional obligation to protect patients from harm and exposure to avoidable risk. Appropriate clinical management of IV fluids and early recognition of complications can prevent adverse events that negatively impact a range of patient outcomes.

Background

Introduction

There is a mounting campaign in the United States to achieve better quality control in the healthcare sector. Spiraling costs over the past several decades have not corresponded with improvements in outcomes. The system remains fraught with medical error, process variation and inadequate assimilation of evidence into practice. Although nursing awareness regarding these issues is increasing, educational deficiencies remain prevalent.

Iatrogenic complications, defined as those resulting from medical intervention, occur at an unacceptably high frequency in the acute care setting (Ransom, Joshi, Nash, & Ransom, 2014). The nursing and medical professions have been under intense pressure over the past several years to improve safety and effectiveness of care. The Institute of Medicine (IOM) has been a prominent force in this movement, promoting greater accountability and cultural change (Institute of Medicine, 2001; Institute of Medicine, 2010). The federal government and private payers have imposed financial consequences for institutions that do not achieve national quality benchmarks. These benchmarks, along with other institutional outcomes data, are publicly available online and are accessible to healthcare consumers (Ransom et al., 2014). In the backdrop of heightened public awareness and compelling market forces, the need for quality improvement initiatives has never been greater. Doctorally prepared nurses are uniquely equipped to advance the quality agenda and facilitate delivery system transformation through education and strategic improvement initiatives (Chism, 2013; IOM 2010).

Clinical Issue

The administration of IV fluids is one of the most common treatments provided in the hospital setting. Although largely viewed as benign with relatively few consequences, the

intervention carries multiple risks, many of which are not well known to providers. An estimated one in five patients will experience complications related to IV fluid administration, with some even resulting in death (Sherratt, 2014). Many cases are related to overcorrection of fluid deficits and are potentially avoidable with appropriate monitoring. These findings have been the impetus to study the topic more intently over the past several years. The Agency for Healthcare Research and Quality (AHRQ) (2013) identified the matter as a quality issue, prompting the publication of clinical practice guidelines in to promote best practices.

Potential Harms

Excessive fluid administration can adversely affect a variety of body systems resulting in delayed recovery, prolonged length of stay, hospital readmission and reduced survival. Select patient cohorts are particularly vulnerable and require closer monitoring to mitigate risk. These include the frail elderly, the critically ill, recipients of surgical procedures and patients with co-morbid conditions such as heart failure, valvular disease or renal insufficiency (Ogbu, Murphy, & Martin, 2015). Complications, however, are not isolated to high risk groups and superfluous administration can affect low risk cohorts as well. Iatrogenic fluid overload requiring diuretic therapy in the hospital setting is not uncommon, imposing additional risk related to pharmaceutical diuretic agents (Bogaev, 2010).

Complications associated with infusion therapy include but are not limited to the following: 1) volume overload, resulting in pulmonary edema and pleural effusions, 2) intestinal wall edema, resulting in constipation, malabsorption and paralytic ileus, 3) mild cerebral edema, causing impaired cognition and increased risk for falls, 4) hemodilutional hyponatremia, increasing risk for delirium and seizures, 5) worsening anemia, further exacerbated by frequent blood draws, 6) impaired wound healing, related to compromised delivery of oxygen and

nutrients , 7) worsening metabolic acidosis, related to hyperchloremia and 8) renal complications, related to interstitial parenchymal edema and renal ischemia (Acheampong & Vincent, 2015; Ogbu et al., 2015; Hilton, Pelligrino, & Scheinkestel, 2008). Clinical manifestations are often insidious and may preclude providers from recognizing a causal relationship. This is partially due to the fact that traditional education has primarily focused on the benefits of therapy with little emphasis placed on potential harm. For example, while the benefits of IV fluids to facilitate renal perfusion are evident in clinical practice, worsening renal function caused by IV fluids often goes unrecognized (Polderman & Varon, 2015).

Contributing Factors

Exploring the reasons why medical and nursing personnel do not manage fluids in a more evidence based framework involves acknowledging a combination of determinants related to the current practice environment. The root causes are multi-factorial and are deserving of analysis if the standard of care is to improve. Most significantly, these include being preoccupied with other responsibilities, time constraints and lack of awareness regarding the potential adverse effects. In many cases, it is simply an attention to detail that is lacking. Critical thinking and best practices are often subverted by task oriented activities dictated by the busy hospital routine. The delivery of healthcare in the modern age is highly complex, data driven and business oriented. These factors have been implicated in hindering clinical judgment and reducing the quality of care. In recognizing the range of stressors with which providers contend on a daily basis, it is important to note that nursing is still an accountable profession. Nurses have a distinct responsibility, to the degree that it is possible, to protect patients from the threat of iatrogenic harm.

Institutions also share responsibility and are accountable for taking action to improve the delivery of care through education and provision of appropriate resources. Balancing quality and cost has presented unique challenges, however, and the pressure placed on health care organizations to consistently demonstrate better outcomes while simultaneously reducing cost has been enormous.

Definition of Terms

Best Practices: Methodologies supported by evidence that produce desired results (Tomey, 2009)

High Reliability: Consistent processes that minimize variation and enhance safety (Chassin & Loeb, 2011)

Outcomes: Effects or consequences related to healthcare delivery (Giddens, 2013)

Pay for Performance: A payment system for hospitals and providers based on the quality of outcomes (Finkler, Kovner, & Jones, 2013)

Process: Actual steps involved in the delivery of care, also known as interventions (Giddens, 2013)

Quality: The degree to which healthcare services produce desired outcomes (Giddens, 2013)

Relative Risk (RR): Risk of event after experimental treatment, expressed as a percentage of original risk (LoBiondi-Wood & Haber, 2010)

Structure: Organizational resources provided by the healthcare setting for the provision of care (Giddens, 2013)

Project Description and Purpose

The aim of this quality project was to address the disparity between evidence and practice related to the management of IV fluids in the acute care setting. The initiative was implemented at a 256 bed community medical center in New Jersey. The program was designed to motivate nurses to be active participants in quality improvement processes. It was welcomed by the Chief Nursing Officer (CNO) and other members of the leadership team who are highly invested in quality improvement and professional development. Three interactive group sessions were scheduled to accommodate a variety of shifts and schedules. The presentations were streamed live via webinar, enabling a number of nurses to participate from remote locations.

The sessions focused on evidence based recommendations for the assessment and management of IV fluids. Although nurses are not direct prescribers of IV solutions or infusion rates, they are the most influential patient advocates on the provider spectrum, making them an ideal target audience for promoting best practices. The IOM report from 2010 states that nurses are expected to assume a leadership role in facilitating partnerships with physicians to improve conditions of patient care (Institute of Medicine, 2010). Increased accountability, critical thinking and patient advocacy are important underpinnings of the project, reinforcing the essential foundations of professional nursing practice. The sessions included an interactive component, providing nurses with an opportunity to express feedback and share ideas. Sustainability efforts for dissemination of evidence into care processes were based on valuable input received from nurses during interactive sessions.

Intended audience

The content was tailored to meet the educational needs of the nursing staff at the implementation site based on information provided by the nursing leadership team. Nursing

workforce demographics were a consideration. Associate degree and diploma prepared nurses comprised 53% of the workforce, with 47% of nursing personnel holding a Bachelor of Science in Nursing degree. Considering that associate degree and diploma programs typically do not emphasize the integration of evidence into practice assumes a need for education that reinforces the importance of evidence based care (Lotz, 2010). The age demographic at the site was somewhat older, with the average age in 2015 being 50 years old. This is similar to the national age demographic, with 53% of the nursing workforce over age 50 in 2014, as reported by the ANA (American Nurses Association, 2014). Nurses were described by the nursing leadership team as being receptive to professional development activities. The characteristics, knowledge level and generational variations of nursing staff combined with organizational priorities guided the development of the educational sessions.

Goals and Objectives

The overall goal of this DNP initiative was to improve patient outcomes by minimizing the overutilization of the IV fluids in one practice setting. The project was designed to facilitate the advancement of the hospital's quality agenda. Expected outcomes related to nursing characteristics that foster the capacity for institutional improvement include: 1) increased awareness of quality issues on national and local levels, 2) an understanding of evidence based practice as it relates to patient outcomes and 3) an understanding of the effect of nursing care processes on institutional outcomes data. Anticipated outcomes specific to the management of IV fluids in the acute care setting include: 1) enhanced self-efficacy regarding assessment and nursing management, 2) integration of practice guideline recommendations and available evidence to minimize complications, 3) earlier recognition of complications, 4) enhanced inter-

professional communication with prescribers and 5) an understanding of the issue as it relates to institutional outcomes, benchmarks and financial reimbursement.

Significance of Project to Nursing

Approximately ninety percent of hospitalized patients receive IV therapy, most of which are continuous infusions (Rosenthal, 2006). The literature is clear in identifying improper management as a significant factor affecting morbidity and mortality in the acute care setting. Complications typically do not arise suddenly and may be avoidable through clinical correlation with physical assessment findings, fluid balance, weight, and trending BUN and creatinine levels. Diuretic therapy required to correct overhydration could be minimized through the application of appropriate assessment techniques and interventions. Supplemental training is needed to facilitate nursing expertise solidly rooted in evidence.

For the first time in the history of nursing, the quality of nursing care is subject to economic consequences in the form of Pay for Performance (P4P) reimbursement. These policies, which affect all healthcare organizations that receive payment from Medicare, have resulted in institutions across the nation losing millions of dollars in annual revenue. The goal of this reimbursement reform was to promote higher quality care while saving the government up to a billion dollars in Medicare expenditures (Ryan, Burgess, Pesko, Borden, & Dimick, 2015). In terms of nursing care, P4P guidelines have primarily focused on hospital acquired complications and thirty day readmission rates for select diagnoses. These include the development of pressure ulcers, catheter acquired urinary tract infections (CAUTIs), central line associated blood stream infections (CLABSIs) and thirty day readmission rates for congestive heart failure (CHF), acute myocardial infarction (AMI), pneumonia, chronic obstructive pulmonary disease (COPD) and joint replacement surgery (www.medicare.gov). Successful outcomes in these areas are highly

dependent upon nursing processes such as optimal bedside care and discharge teaching, significantly increasing nursing accountability. While many view these policies as a source of performance pressure, they also serve as a tremendous opportunity for nurses to demonstrate the benefit and value of skilled nursing care.

The issue of IV fluid management impacts P4P reimbursement in ways that may not be recognized by providers. One example relates to the development of acute heart failure during the course of hospitalization. Irrespective of the reason for hospital admission, these patients are included in the thirty day readmission cohort for heart failure at the time of discharge, increasing the number of cases subject to P4P penalties. Proactive thinking that limits fluid administration to patients at increased risk could eliminate a percentage of these cases, reducing exposure to undue financial risk. Similarly, length of stay and post-operative complication rates may also be affected, reflecting poorly on performance metrics.

According to Donabedian's Quality Framework, as noted in Finkler, Kovenr, & Jones (2013), institutions play an important role in facilitating the integration of updated care processes in the clinical environment to improve outcomes. Although there are an abundance of issues requiring attention, most hospitals are struggling with contracted budgets that limit nursing education efforts. Consequently, academic projects that focus on education and quality improvement are valuable contributors to strengthening the foundation for continuous quality improvement and enhancing patient outcomes.

Literature Review

The topic for this doctoral project was inspired by anecdotal observation from clinical practice revealing a high incidence of preventable adverse events. A comprehensive literature search that included CINAHL, Ebscohost, Science Direct, Google Scholar, the Cochrane

Database, Medline Plus and National Guidelines Clearinghouse has supported this observation. Published data from the past several years have demonstrated poor outcomes in a variety of patient cohorts corresponding with a lack of awareness regarding best practices. Despite the availability of decisive evidence, clinical practice has not changed considerably.

Critique of Empirical Evidence

The following is a review of the evidence as it relates to IV fluid management in patient cohorts commonly encountered in the acute care setting.

Surgical patients are exposed to IV fluids during the pre-operative, intra-operative and post-operative periods. Historically, fluid balance has not been considered a factor related to patient outcomes. Recent research has demonstrated a range of negative effects, favoring more restrictive fluid regimens. Brandstrup, et al. (2003) conducted a multi-center randomized control trial to compare complication rates of a fluid restricted regime versus standard therapy for perioperative patients. The standard regime resembled common practice for IV fluid administration while the restricted regime was targeted at maintaining pre-operative weight. The study randomized a total of 172 patients undergoing colorectal surgery. The overall complication rate for the fluid restricted group versus the standard therapy group was 30% versus 56%, respectively. Cardiopulmonary complications were 7% in the fluid restricted group compared to 24% in the standard group, and wound healing complications were 16% versus 31%, respectively. There were no deaths in the fluid restricted group compared to four in the standard therapy group. Additionally, there was no difference in the incidence of hypotension which is notable since maintaining adequate volume for organ perfusion is one of the principal rationales for prescribing IV therapy in surgical patients. Although the number of subjects was

limited, the findings were dramatic, suggesting that more research is needed and a change in practice should be considered.

De Silva, et al. (2010) established an interdisciplinary team that included surgeons, anesthesiologists, nurses, nutritionists, intensivists, pharmacists and medical school faculty to address concerns regarding the overutilization of perioperative fluids. They implemented an educational intervention in a large teaching hospital aimed at altering prescribing practices based on available evidence. Comparative analysis of retrospective data after one year revealed substantial reductions in total volume of perioperative fluid prescribed, indicating a decrease of 6.9 liters on average over five post-operative days. This modification in prescribing practices resulted in a significant reductions in hospital length of stay (13 days versus 10 days) and incidence of clinically evident edema (53% versus 36%) with a quicker return of gastrointestinal motility (6 days versus 4 days). The researchers maintained that the sodium load contained in solutions such as normal saline is difficult to excrete for surgical patients and has been identified as a risk factor for post-operative complications.

Silva, et al. (2013) conducted a multi-center prospective cohort study over the course of one year that included 479 patients from four Intensive Care Units (ICU) to examine the effects of liberal versus restricted intraoperative fluid administration. The subjects included in the study underwent major surgery requiring post-operative ICU care. Patients with renal failure, advanced heart failure, diabetes mellitus and short life expectancies were excluded from the study. The mortality rate in the liberal fluid administration group was 18.7% versus 5.9% in the restricted group. The mean intraoperative infusion volume for the non-surviving cohort was 1,950 mL versus 1,400 mL for the surviving cohort. The ranges varied greatly, 1,400 – 3,400 mL for the non-survivors versus 1,000 – 1,600 mL for survivors. Multi-variate analysis of data

indicated that a positive fluid balance was an independent risk factor for death ($p < 0.006$, confidence interval of 95 %). Larger fluid volumes were also associated with a greater number of infections (41.9% versus 25.9%), neurological complications (46.2 % versus 13.2%), cardiovascular events (63.2% versus 39.6%) and pulmonary complications (34.3% versus 11.6%). Of note, all patients receiving greater than 2,000 mL intraoperatively had increased ICU length of stay (4 days vs 3 days) and overall post-operative complication rates. The researchers concluded that excessive intraoperative fluid infusion negatively impacted organ function, infection and mortality rates.

A systematic review and meta-analysis conducted by Schol, Terink, Lance and Scheepers (2016) that evaluated the effects of liberal versus restrictive IV fluid management for patients receiving elective surgery revealed similar findings. A total of 1,397 randomized patients were analyzed. Overall complication rate was the primary endpoint. Associated mortality rate was not evaluated. Meta-analysis revealed a 35% lower overall complication rate in the fluid restrictive group with a lower risk for infection (RR 0.62) and a lower risk for transfusion requirement (RR 0.81). In view of these findings, the researchers concluded that a restrictive fluid policy for elective surgical patients is advisable. This analysis was conducted subsequent to the publication of clinical practice guidelines in 2013 (National Guidelines Clearinghouse, 2013), supporting the assertion that more circumspect clinical management is warranted.

Voldby and Brandstrup (2016) conducted a meta-analysis comparing standard IV fluid therapy versus zero balanced or goal directed therapy for perioperative fluid management for major abdominal surgeries. These targeted regimes, which are weight based and replace fluid according to estimated losses, had lower rates of infection, wound rupture, anastomotic leakage, mechanical ventilation, length of stay and mortality (RR 0.77). The researchers recommended

that oral fluids be encouraged up to two hours pre-operatively in order to minimize IV fluid requirements. In order to prevent aspiration, fasting from solid foods is required for six hours pre-op whereas fasting from liquids is only required for two hours. Evidence suggests that perioperative IV fluids are managed most effectively when fasting is minimized and regimes are targeted to correct dehydration or hypovolemia and deliver glucose to reduce insulin resistance in the post-operative period.

In contrast, one group of researchers concluded that restrictive fluid regimes appeared harmful in patients undergoing major abdominal surgery. A randomized controlled trial conducted by Vermeulen, Hofland, Legemate and Ubbink (2009) in a university hospital setting included patients undergoing major abdominal surgery. The primary endpoint for the study was post-operative length of stay. Based on results from several previous studies, the expectation was that length of stay would be minimized in the fluid restricted group. However, the trial concluded early after enrolling 62 patients when interim analysis revealed a concerning increase in length of stay for the fluid restricted group. The researchers acknowledged that there were some issues with study methodology including protocol violations related to poor documentation of intake, technical issues with infusion pumps and hypotensive events in the post-operative period requiring saline boluses. These findings contradict the reports of multiple studies, indicating that further research is needed to account for variations in patient populations and practice settings.

A number of non-surgical patient cohorts have also been represented in the body of literature. Sepsis, for one, has been studied extensively due to its low survival rate and high monetary burden on the healthcare system. Early diagnosis and rapid infusion of fluids, 30 mL/kg within the first three hours of diagnosis, are crucial to improving survival rates. The Surviving Sepsis Campaign has been instrumental in promoting adherence to these guidelines

and reducing mortality rates in the United States (Levy et al., 2010). Emerging research however, has highlighted the detriments of overhydration subsequent to administration of initial fluid challenges. Studies have linked a positive fluid balance with higher mortality rates in patients with sepsis as an independent prognostic indicator (Acheampong & Vincent, 2015; Sirvent, Ferri, Baro, Murcia, & Lorenzo, 2015).

Polderman and Varon (2015) summarized three well-constructed, multi-center trials demonstrating increased mortality rates in patients receiving unrestrained fluid administration. Physiologically, sepsis is not a disorder of hypovolemia. It is characterized by vasodilation and increased capillary permeability, owing to the reason why a majority septic patients are poorly responsive to fluids and are susceptible to interstitial edema (Marik & Bellomo, 2016). Despite the established benefit of early administration of fluids to enhance organ perfusion, many are calling for a more rational approach to later fluid management, citing overzealous correction as problematic (Besen, Gobatto, Melro, Maciel, & Park, 2015; Marik & Bellomo, 2016; Sirvent et al., 2015). Recommendations to reduce overcorrection include smaller volume fluid boluses, earlier use of vasoconstrictors and closer observation for the presence of extravascular fluid (Polderman & Varon, 2015).

The detrimental effects of positive fluid balances have been described in a variety of other critically ill cohorts. Patients on ventilators demonstrate earlier weaning and lower reintubation rates with more restrictive fluid regimes (Besen et al., 2015). Patients with Adult Respiratory Distress Syndrome (ARDS) have also fared better with more limited regimes (Polderman & Varon, 2015) and isotonic solutions have been cited as a possible trigger for inducing ARDS (David, 2007). Hypotension is a common occurrence in the critical care setting. Guidelines recommend that infusion of isotonic solutions to treat hypotension not exceed two

liters (National Guidelines Clearinghouse, 2013). Retrospective studies however, indicate that the average volume administered for hypotension is five liters (Besen et al., 2015). Fluids should be aggressively reduced in hemodynamically stable patients and the volume of fluid contained in the numerous IV medications administered in the critical care setting should be a consideration (Ogbu et al, 2015).

Heart failure remains the most common diagnosis for hospital admission (Alspach, 2014). According to practice guidelines, fluid administration is not recommended for patients with acutely decompensated heart failure. A Yale-New Haven study reviewed heart failure admissions from a nationwide database of 346 hospitals. Their findings revealed that 11% of acutely decompensated patients received IV fluids during the first two days of hospitalization, significantly impacting outcomes. Patients receiving fluids had double the number of hospital deaths (3.3% versus 1.8%), significantly increased number of critical care transfers (5.7% versus 1.8%) and higher rates of intubation (1.4% versus 1.0%). While some institutions were highly compliant with guidelines, many had unacceptably high percentages of acutely decompensated patients receiving IV fluids, some as high as 71% (Bikdeli et al., 2015). It is important to note that the average percentage of patients inappropriately receiving IV fluids in this study (11%), represents a substantial number in view of the expansive size of the database. These statistics further support the lack of awareness regarding the potential adverse effects of IV fluids, not even recognized in the setting of active diuresis for decompensated heart failure. The researchers acknowledged that although in rare cases fluid administration may be justified in this patient population, the practice is generally contraindicated and should be avoided (Bikdeli et al., 2015).

The elderly are particularly vulnerable to iatrogenic overhydration, attributed to physiologic factors characteristic of the aging process. The potential for circulatory overload is a

significant concern and pulmonary edema is the most frequent complication in this patient cohort (Sherratt, 2014). Impaired cognition related to mild cerebral edema is also common and is often mistakenly attributed to other causes (David, 2007). Fluid induced fluctuations in serum sodium levels that are usually asymptomatic in younger adults can be problematic in the elderly. Even mild hyponatremia should not be ignored as it has been documented as an independent risk factor for falls and hip fracture in the elderly population (Ayus, Negri, Kalantar-Zadeh, & Moritz, 2012). Related effects on fall risk places additional responsibility on nurses for closer fluid monitoring to enhance patient safety.

Financial implications cannot be ignored in the current cost-conscious healthcare environment. One retrospective study conducted by Magee and Zbrozek (2013) analyzed pooled data from more than 600 hospitals in the United States to assess the economic impact of the issue of iatrogenic fluid overload. Retrospective data was generated from 129,839 patients based on ICD-9 diagnosis codes. The study examined all cause iatrogenic fluid overload, including those caused by transfusions, and found the incidence to be 3.2%. Analysis of financial data revealed that hypervolemia related to medical intervention resulted in a 29% increase in length of stay (3.4 days) and an average increased hospital cost of \$14,062, representing a cost increase of 42%. The researchers stated that because it is difficult to measure, the problem is likely grossly underreported, suggesting an even larger financial burden on the healthcare delivery system. This study illustrates the value of data analytics in producing metrics that identify cost and quality issues in healthcare systems. Peripheral access complications such as phlebitis and infection have also been identified as an economic consideration, supporting the removal of IV catheters as soon as feasible in order to minimize associated risk (Dychter, Gold, Carson, & Haller, 2012).

The above studies reveal sub-optimal practice patterns that are inconsistent with available evidence. The majority of adverse events are dose related, highlighting the importance of attention to volume status. The nursing literature has advocated for more accurate assessment, adherence to practice guidelines, early recognition of complications, enhanced critical thinking and greater accountability on the part of nurses. Nurses are an integral part of the healthcare team and need to work together with physicians to promote quality. Assessing and questioning the appropriateness of therapy is an acceptable and necessary role of the professional nurse.

There are several nursing scholars striving to educate providers regarding best practices through published works. Scales (2014) describes the importance of fluid management in clinical nursing practice. The article cites several national databases that have implicated mismanagement of IV therapy in hospitalized patients as a factor contributing to negative outcomes. Normal physiologic characteristics of fluid balance and variations related to illness are presented with an emphasis on vulnerable patient aggregates. Proactive assessment and documentation of objective data that facilitate optimal fluid balance management are described with recommendations for best practices.

One nursing dialysis unit set out to develop an educational program aimed at reducing intradialytic complications and hospitalizations related to volume overload. An educational needs assessment revealed a minimal knowledge deficit regarding physiologic concepts but identified more significant gaps in critical thinking skills. A teaching plan using case presentations from the practice setting was developed with the objective of enhancing critical thinking. As a result of the intervention, the unit successfully implemented a hematocrit based blood monitoring system which resulted in a larger number of patients achieving a euvolemic

state, significantly reducing the number of volume related complications and hospitalizations (Dale, 2012).

Kisch and LoVerde (2015) identified the need to expand foundational preparation on the undergraduate level to better equip nurses to manage fluids more critically. The authors point to the lack of guidance regarding educational strategies as a contributing factor to sub-optimal clinical judgement in this area of practice after graduation. The educators developed kinesthetic learning techniques designed to convey complex concepts and recommended them for integration into undergraduate nursing curriculums.

Clinical practice guidelines for managing IV fluids in the adult hospitalized patient provide detailed recommendations and concise algorithms designed to foster best practices. The potential benefit of the guideline, as described by the authors, was appropriate clinical management aimed at reducing morbidity and mortality and improving patient outcomes (National Guidelines Clearinghouse, 2013). The guideline was summarized for the nursing profession by Sherratt (2014) who recognized the gap in knowledge and training that currently exists. Important concepts of the guideline include but are not limited to the following: 1) resuscitative fluid boluses should not exceed 2,000 mL, 2) fluid replacement therapy should be adjusted appropriately for ongoing losses, 3) patients who can meet their fluid and electrolyte needs orally or enterally, should not be receiving continuous infusions, 4) assessment regarding IV fluid need should be reassessed at least every 24 hours, 5) important assessment parameters include blood pressure, heart rate, edema, weight, fluid balance charts and laboratory parameters in the context of the patient's history and 6) the normal bodily daily fluid requirement of 25-30 ml/kg needs to be considered when addressing fluid management (National Guidelines

Clearinghouse, 2013). Discussions with clinicians reveal a common concern that these recommendations are inadequately implemented in clinical practice.

Theoretical Framework

The vision and strategy for this DNP project were guided by the concepts of two quality frameworks: 1) Donabedian's structure-process-outcome model (Finkler et al., 2013) and 2) the Transforming Care at the Bedside (TCAB) initiative (Rutherford, Lee, & Greiner, 2004). The principles of these frameworks will be discussed independently below.

As a physician in the 1960s, Avedis Donabedian had the foresight to understand the challenges of quality control in the healthcare setting. His insight remains relevant today and is applied to quality research and healthcare improvement throughout the world. The framework has been repeatedly tested for validity and is applicable to a multitude of settings and healthcare issues. He understood healthcare from a systems perspective, defining three integrated components of quality: 1) structure, 2) process and 3) outcomes (Finkler et al., 2013). Ironically, in the results oriented discipline of medicine, he was the first to discuss the importance of outcomes, describing how interactions between organizational structure and care processes affect outcomes, which are the end result of care (Appendix A). Structure is defined as the attributes of the organizational infrastructure supporting the delivery of care. Critical components of structure include administrative support, organizational structure, financial resources, personnel, facilities, physical space, and technology (Finkler et al., 2013). Donabedian's principles have served as the framework for several landmark developments in healthcare including the Magnet designation process for nursing excellence and the implementation of benchmarking as a standardized measure of quality (Finkler et al., 2013; Upenieks & Abelew, 2006).

Quality research has produced an abundance of evidence pertaining to process and outcomes, with limited attention to the structural domain (Hamric, Hanson, Tracy, & O'Grady, 2014). A recent shift in philosophy that recognizes the importance of organizational structure in improving quality, underscores Donabedian's foresight in understanding healthcare as an inter-related system. Potential barriers caused by structural inadequacies need to be analyzed and addressed prior to undertaking any quality initiative (Glickman, Baggett, Krubert, Paterson & Schulman, 2007). This DNP project was built upon Donabedian's fundamental principle that innovations in process begin at the structural level. As a PhD prepared registered nurse (RN), the CNO of the selected site has a firm grasp on this concept and has demonstrated leadership in promoting cultural change at her institution. Her direct involvement in this DNP project has illustrated the impact of administrative support for initiatives aimed at improving care processes. In terms of measurable outcomes as a result of the project, structural input such as expanded educational initiatives and technological interventions will be required to sustainably improve nursing workflow processes and critical thinking at the bedside (Chassin & Loeb, 2011).

In 2004, the Robert Wood Johnson Foundation (RWJF) partnered with the Institute of Health Improvement (IHI) to launch the TCAB initiative at 13 major hospital systems (Rutherford, Lee, & Greiner, 2004). The proven success of the initiative and the fundamental attributes of its framework made it a suitable blueprint for project development. The influences of Donabedian's structure-process-outcome model are apparent throughout the TCAB framework. The primary objectives of the initiative were: 1) to promote the application of evidence based standards to improve patient care processes and outcomes and 2) to engage frontline providers in improvement processes (Rutherford, Lee, & Greiner, 2004; Viney, Batcheller, Houston, & Belcik, 2006). These objectives align with important DNP essentials that

delineate the role of the DNP in healthcare as defined by the American Association of Colleges of Nursing (Chism, 2013) and with the objectives of this quality improvement initiative.

Important constructs of the TCAB initiative that have been applied to the development and implementation of this DNP project include: 1) implementing practice enhancements that improve patient safety begin with awareness and education, 2) achieving reliability over time requires a strategic plan to reduce variations in care and treatment error and 3) team-centered problem solving is an effective means to improve care team vitality and generate new ideas for quality improvement (Viney et al., 2006). The importance of care team vitality in achieving goals is often overlooked by upper management in healthcare settings. Nurses frequently report “quality and safety burnout” and feel they do not receive adequate support to improve outcomes. In order to realize improvements in care processes, these factors must be acknowledged and addressed.

Important underpinnings of the TCAB framework include the IOM’s six aims for reinventing the health delivery system. These aims, which are outlined in the 2001 report entitled *Crossing the quality chasm: A new health system for the 21st century* (Institute of Medicine, 2001), have served as a backdrop for the national quality movement. For example, the clinical practice guideline for IV fluid management identifies safety and effectiveness of care as the specific IOM aims the guideline intends to address (National Guidelines Clearinghouse, 2013). Similarly, the IOM has emphasized greater inter-disciplinary collaboration and communication for improving the delivery system (Institute of Medicine, 2001; Institute of Medicine, 2010). Nurses have increasingly functioned in an isolated manner, often referred to as silos (Ransom et al., 2014). This is exemplified by the lack of shared responsibility for fluid management among prescribers and bedside nurses. An emphasis on the significance of effective

collaboration was an important element of the TCAB initiative and should be promoted throughout the healthcare delivery system. The efficacy of inter-disciplinary communication was demonstrated by De Silva et al. (2010) where a collaborative team was effectively employed to reduce the overutilization of IV fluids in one hospital system.

The principles of the aforementioned frameworks were successfully integrated to implement a quality initiative to educate, motivate and empower nurses to effect change in their practice setting. Nurses have the ability to meaningfully impact patient outcomes and should be incorporated as key facilitators of the quality movement (Institute of Medicine, 2010). Education serves as a motivating factor for excellence and is most effective when learning strategies provide recipients with opportunities to achieve attainable improvements in patient outcomes (Artino, 2012).

Methodology

Observations from a lengthy career as a nurse practitioner and clinical educator brought this author to a place of inquiry. What could be done about the persistent cycle of iatrogenic harm related to IV infusions in the hospital setting? With the plethora of quality indicators being measured, is this even recognized as an issue in the acute care setting? Findings in the literature validated these concerns, supporting the need for expanded training and modifications in clinical practice. A scholarly project designed to address this issue was proposed.

After approval from the DNP project chair, the development process for a formal plan was initiated. The selected site for project implementation was a community medical center where advancing a culture of quality improvement was successfully underway. After hearing about the details of the project, the CNO welcomed the opportunity to have a DNP candidate present at her institution and agreed to serve on the scholarly committee as preceptor.

Institutional review board approval was not required as there were no direct patient interactions and the project was exclusively a professional development activity.

Methodology for implementation consisted of the following components: 1) on-site presentations accompanied by live webinars, 2) presentation of institutional quality data demonstrating areas of achievement and needs for improvement, 3) collection of staff input and ideas by means of an exit survey, 4) application of a computer prompt to reassess the need for IV fluids every 24 hours and 5) adaptation of educational materials for the hospital's onboarding RN orientation program.

Risks and Benefits

During the early phases of development, there were concerns by this author regarding possible lack of evidence or interest in the topic. The literature has indicated that this is not the case and suggests an underrepresentation of the issue in the quality movement. An inherent risk related to placing an emphasis on fluid overload includes the concern that heightened awareness could limit hydration and lead to inadequate organ perfusion. Given the well-documented propensity for overhydration in the hospital setting, the risk of inadequate fluid replacement appears to be minimal. The potential risk however, was pointed out to participants, emphasizing the importance of adequate organ perfusion and fluid balance. This phenomenon has been noted with sepsis management, where the emphasis placed on fluid resuscitation during early onset may have contributed to fluid overload in the later phases of the disorder (Marik & Bellomo, 2016).

Probability of success could be impacted by a number of institutional variables. These include physician cooperation, available resources, perceived support, staffing ratios and nursing responsiveness. The literature states that barrier analysis is an essential component to successful

quality initiative development. Tailoring interventions to address organizational and educational challenges from the outset increase the likelihood of goal attainment (Bosch, Van Der Weijden, Wensing, & Grohl, 2007). Although willingness to improve is likely to be present to a substantial degree among nurses, the underlying relationship between the nursing microsystem and organizational structure is an important consideration. Interactions among care providers and structural variables are complex and may be problematic. Attitudes, motivation levels and lack of integration between nursing staff and administration may impose additional risks to successful improvements in care processes (Glickman, et al., 2007).

Analysis of external factors reveal a delivery system fraught with unintentionally created barriers leading to several internal issues. These include contracted budgets, limited educational resources, uncertainty caused by mergers and acquisitions, a focus on short term cost containment as opposed to sustained value and provider desensitization to quality issues. The performance pressure imposed by the system has increased the predisposition for burnout among the nursing workforce giving rise to distinct challenges (Tomey, 2009).

Barriers to the assimilation of evidence based practice are universal in healthcare and have been studied by several nursing researchers. In one large descriptive cross-sectional survey of nurses, Fink, Thompson, and Bonnes (2005) identified the following as most significant: 1) perceived lack of RN authority to change practice, 2) insufficient awareness regarding current research and 3) time constraints that hinder the opportunity to read about current research and clinical recommendations. Successful integration of evidence into clinical practice is also dependent upon the responsiveness of the environment in which it is placed (LoBiondi-Wood & Haber, 2010).

In analyzing potential barriers, it is equally as important to capitalize on personal, organizational and personnel strengths. The project was a unique opportunity to support nurses, empowering them to make changes that improve practice conditions and care processes. Major benefits include improved self-efficacy, shared leadership and a reduction in obstacles that limit information sharing within the practice setting (Glickman, et al., 2007). The presence of administrative support facilitating these efforts was an important organizational strength and is consistent with recommendations from the TCAB initiative (Viney et al., 2006). The following entails a discussion of the development and implementation phases of the DNP project proposed above.

Phase I- Needs Assessment

Evidence based recommendations for more cautious management of IV fluids have not been substantiated in clinical practice. Despite research that has identified the issue as an antecedent to poor outcomes, it remains largely unrecognized as a quality issue indicating an imperative need for provider education.

A needs assessment was conducted on site to gain insight regarding organizational and personnel needs. Preliminary meetings with the hospital CNO, nurse educators, nursing research coordinator, palliative care nurse practitioner and director of the ICU provided insight regarding the characteristics of the target audience and key institutional objectives. Nursing leaders reported a lack of conceptual understanding regarding evidence based practice among bedside nurses. They welcomed a professional development activity that would generate an appreciation for evidence based care and an improvement in the assessment and management of IV fluids. They shared recent incidents that occurred at the hospital involving IV fluids that could have

been avoided. These types of incidents correlate with evidence and clinical observations from the literature, supporting the universal need for supplemental education.

Phase II- Stakeholder Support

Transformative organizations have demonstrated the importance of administrative investment in quality at the highest levels in order to achieve high reliability quality improvement (Ransom et al., 2014). Successful implementation of the project required support on multiple levels. The recent change in senior nursing leadership strengthened the focus on higher education in nursing, evidence based practice and enhanced collaboration to improve quality. This served as a major facilitating factor in moving the project forward. Other important stakeholders included top level management executives such as the chief medical officer, director of nursing informatics, nurse managers and clinical educators. After meeting with each of these stakeholders, they were unanimous in their pledged support. The CNO was the most enthusiastic supporter, exerting her influence to move the project forward. From a logistical perspective, the executive administrative assistant played a major facilitative role and was instrumental to project success.

Phase III- Initial Implementation

At the outset, learning objectives were developed for the educational plan. These included an understanding of: 1) evidence based practice and how it relates to standards of care and patient outcomes, 2) the unintended effects of IV fluids and their impact on various body systems and quality indicators, 3) data from clinical trials that recommend a change in practice patterns, 4) assessment skills for optimal management according to clinical practice guidelines and 5) the importance of inter-professional collaboration in achieving improvements in delivery of care.

Three sessions were scheduled on different dates and times of day to accommodate various shifts and schedules. The program was promoted within the institution with flyers and email invitations. Nurses from all medical-surgical and critical care units were invited and encouraged by nurse managers to participate. A total of 61 nurses attended, representing the Emergency Room, critical care and medical-surgical areas throughout the hospital. The sessions consisted of the following components: 1) a PowerPoint presentation outlining the scope of the problem, available evidence and published practice guideline recommendations as they relate to IV fluid management, with national quality improvement mandates and P4P implications as underlying themes, 2) a presentation of institutional quality metrics regarding important related quality measures for the past two years and year to date for 2016, 3) an interactive session for feedback and information sharing that provided nurses an opportunity to share their insights for improving the quality of care and 4) an anonymous exit survey to assess participants' response to the program and to document additional feedback (Appendix B). Exit survey responses were collated for use by the CNO to further direct the development of quality improvement interventions (Appendix C).

Participants were fascinated by the IV fluid data and recognized the problem as a recurrent quality issue largely overlooked in clinical practice. They were responsive to the opportunity to share information in an informal setting. Viewing institutional quality metrics provided a unique opportunity to observe hospital outcomes such as readmission rates, catheter related infections, surgical outcomes and mortality rates. The visual presentation of the data in the form of graphs and spreadsheets was a motivating factor for nurses. It enabled them to view positive effects over time, primarily attributed to nursing efforts. Although information sharing of this nature is a crucial component of quality advancement, bedside nurses are often unaware

of the implications of their actions in relationship to P4P indicators. Since their inception, the role of nursing in P4P initiatives has historically been poorly assimilated (Scott & Stephen, 2010). This is gradually changing, as successful quality initiatives have demonstrated the positive impact of high level nursing involvement on the quality indicators that P4P programs emphasize (Ransom et al., 2014). Participants provided valuable feedback based on clinical experience that could be utilized to make necessary changes. For example, the pharmacy renewal requirement for IV fluids of seventy-two hours was identified as problematic and recommendations to improve the intake and output screen in the EHR were provided. The sessions were highly participative and the CNO was present and engaged throughout, demonstrating a supportive and democratic leadership style.

Phase IV-Ongoing Implementation

Large scale initiatives that promote evidence based practice and high reliability require an in-depth analysis of institutional attributes and a comprehensive strategic approach. Although this project was limited in scope, it became evident that incremental gains could be achieved at the implementation site. A collaborative effort with nursing leaders combined with the assessment of participant feedback, yielded a sustainability plan for continued improvement. The plan, as it relates to optimal IV fluid management included the following: 1) the content area was adapted for integration into the onboarding RN orientation program, 2) the computer prompt to renew IV fluids will be changed to every 24 hours, consistent with practice guidelines recommendations (National Guidelines Clearinghouse, Dec, 2013), and 3) the Director of the Emergency Department was appointed by the CNO to bring the latest data regarding fluid administration in the management of sepsis to the Nurse Practice Committee to discuss shifting practice patterns and a means to promote more appropriate management. Critical care nurses in

attendance acknowledged the use of excessive infusions after initial boluses for septic shock in the critical care setting and agreed that more education was needed. An invitation was also extended to present the topic at future nursing grand rounds as a way to circulate the information to a larger number of nurses within the system.

Phase V- Project Evaluation/Outcomes

Nurses demonstrated a strong desire for learning and were motivated to improve quality of care in their areas of practice. Many believed the program should be widely disseminated to nursing staff and included in all nursing orientation programs. According to the exit survey, feedback regarding the effectiveness of the program was overwhelmingly positive. Nurses appreciated the activity as a way to enhance professional practice and unanimously believed that it would influence point of care decision making at the bedside. There was ambivalence regarding the implementation of a computer prompt for nurses to evaluate the need for continuous infusions. Eleven percent of nurses surveyed were not in favor of it, with twenty percent believing that it could be somewhat beneficial. A few commented that it should be directed at prescribers indicating that a prompt for nurses would incur additional responsibility that should be addressed by physicians. The number of nursing prompts that already exists was expressed as one reason for reluctance. This feedback is consistent with findings in the literature that implicate computer alert fatigue for inadequate responsiveness as a result of the number of reminders that nurses and physicians are encumbered with on a daily basis (Embi & Leonard, 2012; AHRQ, 2016). Sixty-nine percent surveyed, however, were in favor of a nursing prompt, believing that nurses could effectively join forces with medical staff to minimize complications.

In reference to awareness regarding quality improvement issues, twenty-six percent of participants believed that nurses were not aware or are only partially aware of pressing national

quality issues, confirming the requisite need to disseminate quality information to bedside providers. Ninety-five percent of nurses surveyed felt comfortable bringing suggestions to nursing leadership while five percent felt somewhat comfortable. A summary of exit survey results and feedback was compiled for nursing leaders which will guide future interventions to assist the staff in making improvements in care processes (Appendix C, D).

Summary

The mounting campaign in the United States to achieve better quality control in the healthcare sector has created an environment of heightened accountability. The number of pressing quality issues is vast and institutions are struggling to achieve sustainable improvements. The delivery of high quality care is never incidental and requires a strategic plan capable of exerting cultural change that will permeate the entire system. While nursing leaders are well informed regarding national quality issues, bedside nurses often lack information and are superficially informed. Performance expectations placed on nurses however, have been enormous, creating a stressful environment where critical thinking and high level decision making have diminished over time.

The suspected lack of awareness regarding the effect of IV fluid administration on vital aspects of care has been supported by scientific data. Ironically, the issue appears to go largely unnoticed despite its relationship to a number of quality indicators that have been in the spotlight over the past several years. In examining the effects of this discrete quality issue, several problems that are emblematic of the healthcare sector as a whole have been observed. These include deficient inter-disciplinary communication and poor assimilation of assessments that guide prescribing practices. Importantly, clinical management is inconsistent with emerging data and practice guidelines, demonstrating an unacceptable discrepancy between evidence and

practice. Although practice guidelines are effective tools for addressing these gaps, they are often underutilized in the clinical area. According to the American Nurses Association and the American Association of Colleges of Nursing, bridging the gap between evidence and practice is a priority for the nursing profession and is an essential component to improving the delivery of care (Tomey, 2009).

Conclusions, Recommendations

The experiences encountered during project implementation are a microcosm of the challenges faced by the nursing profession. Several observations that demonstrate the perspective of bedside nurses have provided valuable insight. In the context of IV fluid management, several recommendations for broader dissemination of evidence and improving care processes can be generalized. A summary of these observations and recommendations are discussed below.

Anecdotally, nurses at the practice site identified volume overload requiring diuretic therapy as a recurrent issue. While recognition of complications and knowing when to request diuretic agents is important, it is essential to promote a change in thinking from problem detection to problem prevention. If nurses had greater awareness regarding the potential for overload and employed basic assessment skills and critical thinking, the need for diuretics could be minimized. Studies that provide data analytics regarding iatrogenic overload requiring diuretic therapy would be beneficial. Available data would increase physician and nursing awareness, magnifying the problem as a quality issue and serve as a starting point for addressing the lack of awareness that currently exists (Fransisco, 2011).

One nurse expert recommended that IV fluids be handled like a medication in reference to dispensing, documentation and incident reporting of complications (Sherratt, 2014). This

would serve to control utilization and improve the ability to produce meaningful metrics capable of demonstrating trajectory performance over time, enhancing provider accountability. In terms of cost analysis, extended length of stay is clearly the most significant factor and has been explored in a previously cited study (Magee & Zbrozek, 2013). The overutilization of solutions, IV catheters and tubing incur additional cost burden over time and should be analyzed through enhanced supply and equipment tracking as well.

Creating high reliability institutions requires standardization of processes with low levels of variation. Computer prompts in isolation are ineffective for producing sustainable reliability due to the desensitization that has evolved as the number of alerts has expanded. Electronic interventions must be supplemented with ongoing education, training and competency assessment.

The effectiveness of the renewal date change from every 72 hours to 24 in modifying prescribing practices is unknown and computer prompt desensitization may be an inhibiting factor. This underscores the importance of verbal cues from bedside nurses to prompt discontinuation of fluids as appropriate, based on a cluster of assessment data and patient-specific factors. Education of medical staff is obviously crucial and unintentional oversight may prove to be the root cause of error as opposed to deficient knowledge of scientific evidence.

Although incentives are key drivers for goal attainment, they are difficult to implement for nurses in acute care settings. This is partially due to the fact that performance improvement is highly focused on task-oriented processes. Nurses are often trained on new policies and procedures without being provided with rationales and evidence that are driving practice changes, perpetuating a lack of inclusiveness in the quality improvement agenda. Positive reinforcement for observable gains in patient outcomes are valuable incentives for sustained improvement yet are typically not provided with any degree of consistency. The motivation

inspired by the presentation of outcomes data during the interactive sessions was a testament to the underlying altruistic nature of professional nurses and an indicator of the importance of positive reinforcement in improving nursing morale. Interactions of this nature are likely to continue at the practice site as the application for Magnet status is currently underway and will serve to guide structural improvements on a variety of levels. Incorporating the issue into clinical ladders is an ideal means to incentivize nurses and promote the development of competent informal leaders. One important recommendation that came out the initiative was to utilize a computer training system currently available at the facility and require nurses to complete the training modules for IV fluid management. Lastly, supportive nursing leadership is the most important characteristic for reducing the incidence of adverse clinical events and promoting care team vitality. The evolution of transformational change is observable at the practice site and can be attributed to strong executive nursing leadership.

Large scale recommendations that reach beyond the local system include the following:

- 1) increased exposure of the issue at regional and national conferences to promote widespread awareness of the problem as a safety issue,
- 2) universal integration of fluid management education in RN orientation programs in acute care settings,
- 3) development of inter-disciplinary teams to reduce overutilization,
- 4) hospital guideline and policy adjustments to meet standards for best practices. For example, fluid boluses for hypotension should not exceed two liters,
- 5) enhanced undergraduate education regarding the potential harmful effects of fluids,
- 6) additional medical and nursing research on the topic to direct advancements in care processes and
- 7) according to the TCAB initiative, the greatest need for transformation in healthcare is at the patient's bedside, therefore more programs that increase the involvement of bedside providers in quality improvement initiatives are essential (Viney et al., 2006).

References

Acheampong, A., & Vincent, J. L. (2015). A positive fluid balance is an independent prognostic factor in patients with sepsis. *Critical Care*, 10 (251), 1-7.

<http://dx.doi.org/10.1186/s13054-015-0970-1>

Agency for Healthcare Research and Quality. (2013). Intravenous fluid therapy in adults in hospital. Retrieved from <https://www.guideline.gov/summaries/summary/47754>

Agency for Healthcare Research and Quality. (2016). Alert Fatigue. Retrieved from <https://psnet.ahrq.gov/primers/primer/28>

Alspach, J. G. (2014). Slowing the revolving door of hospital readmission for heart failure. *Critical Care Nurse*, 34(1), 8-12. Retrieved from <http://ccn.aacnjournals.org>

American Nurses Association. (2014). The nursing workforce 2014: Growth, salary, education, demographics and trends [Fact sheet]. Retrieved from www.nursingworld.org

Artino, A. (2012). Academic self-efficacy: from educational theory to instructional practice. *Perspectives on Medical Education*, 1(2), 76-85. <http://dx.doi.org/10.1007/s40037-012-0012-5>

Ayus, J. C., Negri, A. L., Kalantar-Zadeh, K., & Moritz, M. L. (2012). Is chronic hyponatremia a novel risk factor for hip fracture in the elderly? *Nephrology Dialysis and Transplantation*, 27, 3725-3731. <http://dx.doi.org/10.1093/ndt/gfs412>

Besen, B. A., Gobatto, A. L., Melro, L. M., Maciel, A. T., & Park, M. (2015, May 4). Fluid and electrolyte overload in critically ill patients: An overview. *World Journal of Critical Care Medicine*, (2), 116-129. <http://dx.doi.org/10.5492/wjccm.v4.i2.116>

Bikdeli, B., Strait, K. M., Dharmarajan, K., Li, S., Mody, P., Partovian, C., ... Krumholz, H. M. (2015). Intravenous fluid in acute decompensated heart failure. *Journal of the American*

College of Cardiology: Heart Failure, 3(2), 127-133.

<http://dx.doi.org/10.1016/j.jchf.2014.09.007>

Bogaev, R. C. (2010). Cost Considerations in the Treatment of Heart Failure. Texas Heart Institute Journal, 37(5), 557-58. Retrieved from

<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2953230/>

Bosch, M., Van Der Weijden, T., Wensing, M., & Grohl, R. (2007). Tailoring quality improvement interventions to identified barriers: a multiple case analysis. Journal of Evaluation in Clinical Practice, 161-168. <http://dx.doi.org/10.1111/j.1365-2753.2006.00660.x>

Brandstrup, B., Tonnesen, H., Bier-Holgerson, R., Hjortso, E., Lindorff-Larsen, K., Rasmussen, M., ... Pott, F. (2003). Effects of intravenous fluid restriction on post-operative complications: Comparison of two perioperative fluid regimes. Annals of Surgery, 238(5), 641-648. <http://dx.doi.org/10.1097/01.sla.0000094387.50865.23>

Chassin, M. R., & Loeb, J. M. (2011). The ongoing quality improvement journey: Next stop high reliability. Health Affairs, 30(4), 559-568. <http://dx.doi.org/10.1377/hlthaff.2011.0076>

Chism, L. A. (2013). The Doctor of Nursing Practice: A Guidebook for Role Development and Professional Issues (2nd ed.). Burlington, MA: Jones and Bartlett Learning.

Dale, W. (2012). Education on fluid management and encouraging critical thinking skills. Journal of Nephrology Nursing, 39(6), 510-512. Retrieved from ebscohost.com.exproxyshu.edu

David, K. (2007). IV Fluids: Do you know what's hanging and why? Retrieved from www.modernmedicine.net

DeSliwa, A. N., Scibelli, T., Itobi, E., Austin, P., Abu-Hilal, M., Wootton, S. A., & Stroud, M. A. (2010). Improving perioperative fluid management in a large teaching hospital:

Pragmatic studies on the effects of changing practice. *Proceedings of the Nutrition Society*, 69, 499-507. <http://dx.doi.org/10.1017/S0029665110003824>

Dychter, S. S., Gold, D. A., Carson, D., & Haller, M. (2012). Intravenous Therapy: A Review of Complications and Economic Considerations of Peripheral Access. *Journal of Infusion Nursing*, 35(2), 84-91. Retrieved from <https://shu.ilead.org>

Embi, P. J., & Leonard, A. C. (2012). Evaluating alert fatigue over time to EHR-based clinical trial alerts: findings from a randomized controlled study. *Journal of the American Medical Informatics Association*, 12(1), 145-148. <http://dx.doi.org/DOI:10.1136/amiajnl-2011-000743>

Fink, R., Thompson, C., & Bonnes, D. (2005). Overcoming barriers and promoting the use of research in practice. *The Journal of Nursing Administration*, 35(3), 121-129. Retrieved from <http://ovidsp.tx.ovid.com.ezproxy.shu.edu>

Finkler, S., Kovner, C., & Jones, C. (2013). *Financial Management for Nurse Managers and Nurse Executives* (4th ed.).

Fransisco, P. (2011). The quest for quality: Turning data into information. *Nursing Economics*, 29(2), 101-103. Retrieved from www.nursingconomics.net

Gardner, G., Gardner, A., & O'Connell, J. (2013). Using the Donabedian framework to examine the quality and safety of nursing service innovation. *Journal of Clinical Nursing*, 23, 145-155. <http://dx.doi.org/10.1111/jocn.12146>

Giddens, J. (2013). *Concepts for Nursing Practice* (1st ed.). [Elsevier/Pageburst]. Retrieved from <https://evolveebooks.elsevier.com/>

Glickman, S. W., Baggett, K. A., Krubert, C. G., Peterson, E. D., & Schulman, K. A. (2007). Promoting Quality: The Healthcare Organization from a management Perspective. *International Journal of Quality Healthcare*, 19(6), 341-348. Retrieved from www.medscape.com

Hamric, A. B., Hanson, C. M., Tracy, M. F., & O'Grady, E. T. (2014). *Advanced Practice Nursing: An Integrative Approach*, 5th Edition (5th ed.). [http://dx.doi.org/ISBN: 978-1-4557-3980-6](http://dx.doi.org/ISBN:978-1-4557-3980-6)

Hilton, A., Pelligrino, V., & Scheinkestel, C. (2008). Avoiding common problems associated with intravenous therapy. *The Medical Journal of Australia*, 189(9), 509-13. Retrieved from www.mja.com.au/journal/2008

Institute of Medicine. (2001). *Crossing the quality chasm: A new health system for the 21st Century*. Retrieved from <http://www.iom.edu/reports/2001/crossing-the-quality-chasm-a-new-health-system-for-the-21st-century.aspx>

Institute of Medicine. (2010). *The future of nursing: Leading change, advancing health*. Retrieved from Institute of Medicine of the National Academies: <http://iom.edu/Reports/2010/The-Future-of-Nursing-Leading-Change-Advancing-Health.aspx>

Kisch, T., & LoVerde, J. (2015). Nurses as educators: Fun with fluids. *MedSurg Nursing*, 24(3), 189-193. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=c8h&AN=2013037115&site=nrc>

Levy, M. M., Dellinger, R. P., Townsend, S. R., Linde-Zwirble, W. T., Marshall, J. C., Bion, J., ... Angus, D. C. (2010). The Surviving Sepsis Campaign: Results of an international guideline-based performance improvement program targeting severe sepsis. *Critical Care Medicine*, 38(2), 367-374. <http://dx.doi.org/10.1097/CCM.0b013e3181cb0cdc>

LoBiondi-Wood, G., & Haber, J. (2010). *Nursing Research: Methods and Critical Appraisal for Evidence Based Practice* (7th ed.). St Louis, MO: Mosby, Inc.

Lotz, K. S. (2010). The ABCs of evidence based practice. *Teaching and Learning in Nursing*, 5(3), 95-97. <http://dx.doi.org/10.1016/j.teln.2010.01.004>

Magee, G., & Zbrozek, A. (2013). Fluid overload is associated with increases in length of stay and hospital costs: Pooled analysis of data from more than 600 US hospitals.

ClinicoEconomics and Outcomes Research, 5, 289-296. Retrieved from

<https://www.dovepress.com/clinicoeconomics-and-outcomes-research-i735-j29>

Marik, P., & Bellomo, R. (2016). A rational approach to fluid management in sepsis. *British Journal of Anesthesia*, 113(3), 339-349. <http://dx.doi.org/10.1093/bja/aev349>

medicare.gov. (n.d.). <https://www.medicare.gov/hospitalcompare/linking-quality-to-payment.html>

National Guidelines Clearinghouse. (2013). www.guideline.gov/content.aspx?id=47754

Ogbu, O., Murphy, D., & Martin, G. S. (2015, August). How to avoid fluid overload. *Current Opinion in Critical Care*, 21(4), 315-321.

<http://dx.doi.org/10.1097/MCC.0000000000000211>

Polderman, K. H., & Varon, J. (2015). Do not drown the patient: Appropriate fluid balance in critical illness. *American Journal of Emergency Medicine*, 33, 448-450.

<http://dx.doi.org/10.1016/j.ajem.2015.01.051>

Pressler, S. J., Subramanian, U., Perkins, S. M., Gradus-Pizlo, I., Kareken, D., Kim, J., ... Sloan, R. (2011, March). Measuring Depressive Symptoms in Heart Failure: Validity and

Reliability of the Health Questionnaire. *American Journal of Critical Care*, 20(1), 146-152.

<http://dx.doi.org/10.4037/ajcc2010931>

Ransom, S. B., Joshi, M., Nash, D. B., & Ransom, S. (2014). *The Healthcare Quality Book: Vision, Strategy and Tools* (3rd ed.). Chicago, IL: Health Administration Press.

Rosenthal, K. (2006, July). I.V. ROUNDS: Intravenous fluids: The whys and wherefores. *Nursing*, 36(7), 26-27. Retrieved from http://www.nursingcenter.com/journalarticle?Article_ID=652137

Rutherford, P., Lee, B., & Greiner, A. (2004). *Transforming Care at the Bedside* [IHI Innovation Series white paper. Boston: Institute for Healthcare Improvement; 2004]. Retrieved from www.ihf.org

Ryan, A. M., Burgess, J. F., Pesko, M. F., Borden, W., & Dimick, J. (2015). The Early Effects of Medicare's Mandatory Hospital Pay-for-Performance Program. *Health Services Research*, 50(1), 81-97. <http://dx.doi.org/10.1111/1475-6773.12206>

Scales, K. (2014). Clinical Update: IV fluid therapy. *Nursing Standard*, 28(23), 19. Retrieved from proquest.com.ezproxy.shu.edu

Schol, P. B., Terink, I. M., Lance, M. D., & Scheepers, H. C. (2016). Liberal or restrictive fluid management during elective surgery: a systematic review and meta-analysis. *Journal of Clinical Anesthesia*, 35, 26-39. <http://dx.doi.org/10.1016/j.jclinane.2016.07.010>

Scott, M., & Stephen, R. (2010). Effective Cost Modeling for Service Line Planning. *Healthcare Financial Management*, 64(5), 64-70, 72. Retrieved from <http://web.bebcohost.com.ezproxy.shu.edu>

Sherratt, R. (2014). NICE guidelines on giving intravenous fluids. *Nursing Times*, 110(6), 12-13. Retrieved from www.nursingtimes.net

Silva, Jr, J. M., de Olivira, A. M., Nogueira, F. A., Vianna, P. M., Filho, M. C., Dias, L. F., ... Malbouisson, L. M. (2013). The effect of excess fluid balance on the mortality rate of

surgical patients: a multicenter prospective study. *Critical Care*, 17(R288), 1-7.

<http://dx.doi.org/10.1186/cc13151>

Sirvent, J. M., Ferri, C., Baro, A., Murcia, C., & Lorencio, C. (2015). Fluid balance in sepsis and septic shock as a determining factor of mortality. *American Journal of Emergency Medicine*, 33, 186-189. <http://dx.doi.org/10.1016/j.ajem.2014.11.016>

Tomey, A. M. (2009). *Guide to Nursing Management and Leadership* (8th ed.). Retrieved from www.evolveelsevier.com/pageburst

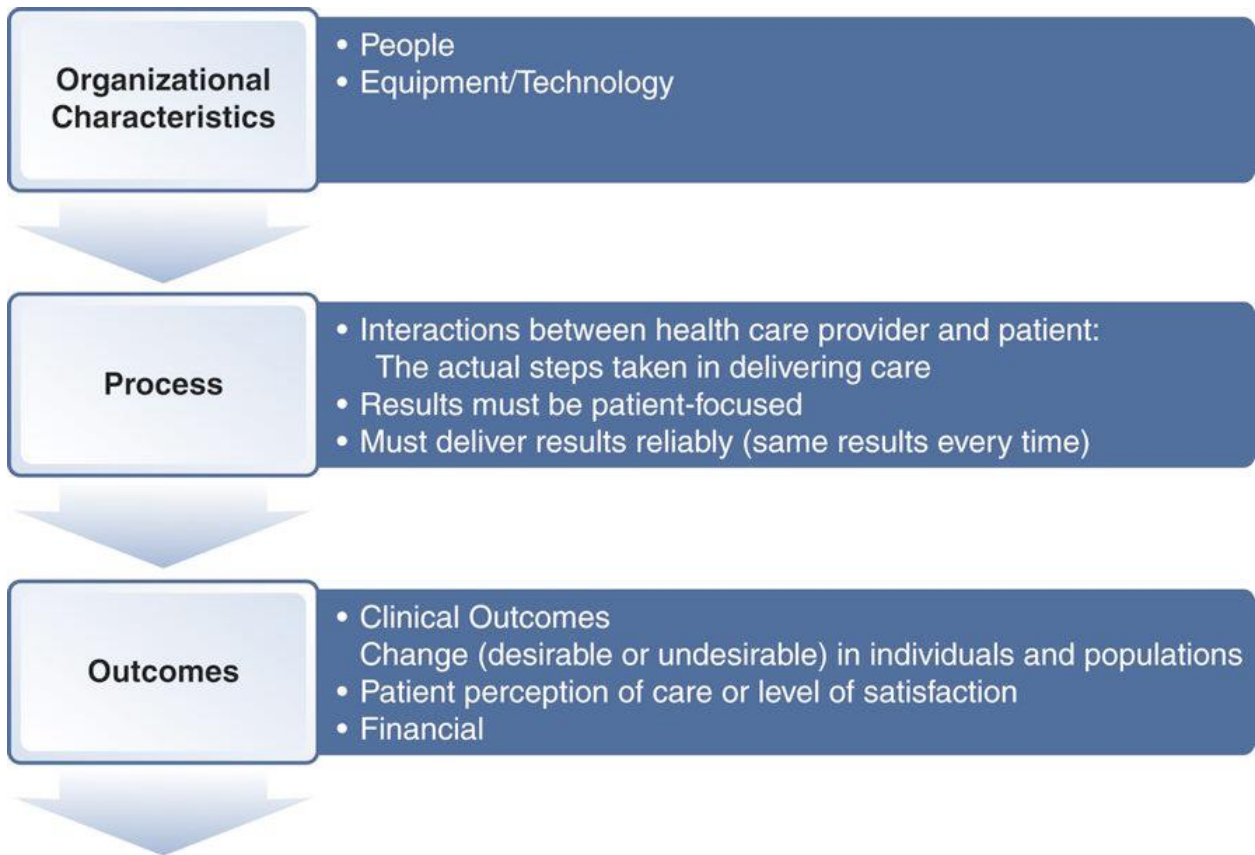
Upenieks, V. V., & Abelew, S. (2006). The magnet designation: A qualitative approach using Donadedian's conceptual framework. *Health Care Management*, 25(3), 243-253. Retrieved from <http://www.ncbi.nlm.nih.gov>

Vermeulen, H., Hofland, J., Legemate, D., & Ubbink, D. (2009). Intravenous fluid restriction after major abdominal surgery: a randomized blinded clinical trial. *Trials* 2009, 1(50). <http://dx.doi.org/10.1186/1745-6215-10-50>

Viney, M., Batcheller, J., Houston, S., & Belcik, K. (2006). Transforming care at the bedside: Designing new care systems in an age of complexity. *Journal of Nursing Care Quality*, 21(2), 143-150. Retrieved from www.nursingcenter.com

Voldby, A. W., & Brandstrup, B. (2016). Fluid therapy in the perioperative setting—a clinical review. *Journal of Intensive Care*, 4(27), 1-12. <http://dx.doi.org/10.1186/s40560-016-0154-3>

Appendix A



Donabedian Model of Structure-Process-Outcomes

(Giddens, 2013)

Appendix B

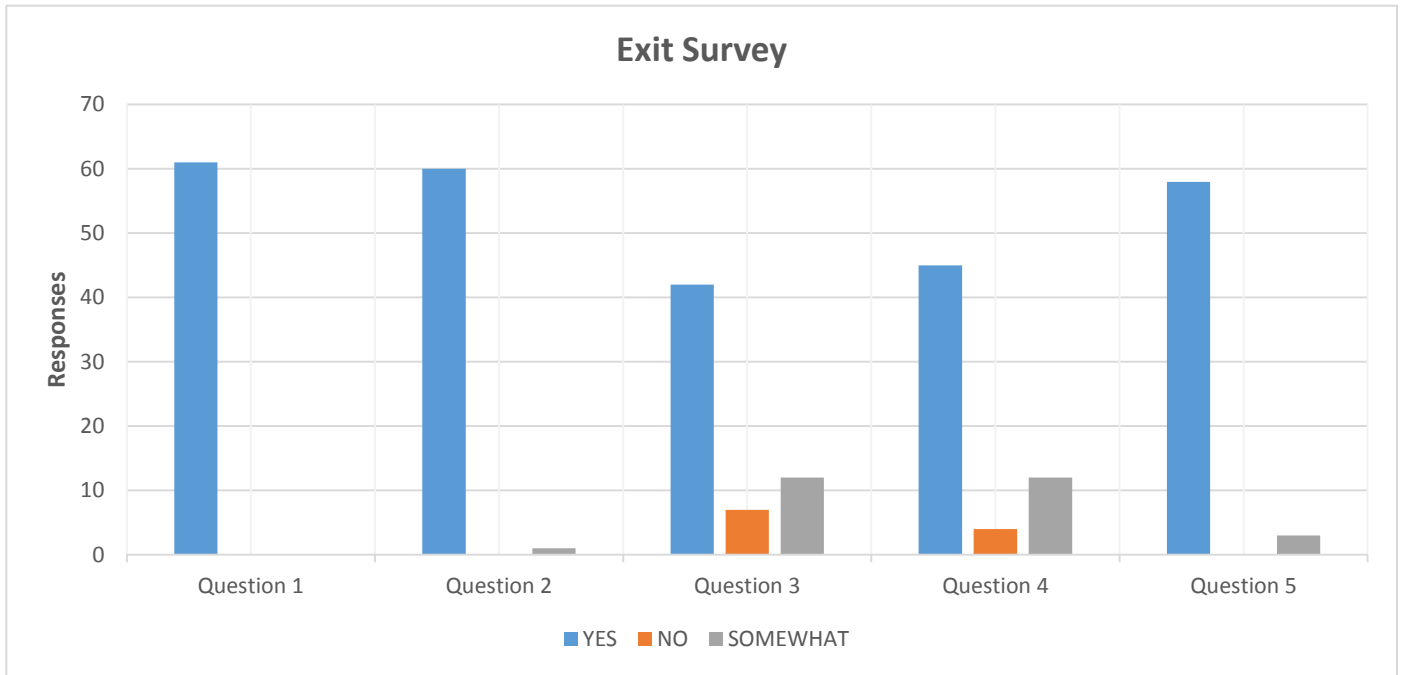
Program Exit Survey

Please Check Yes or No	YES	NO	SOMEWHAT
1) Do you believe programs of this nature help to enhance professional nursing practice?			
2) Did you gain any knowledge today that will influence your nursing care?			
3) Do you think a simple computer prompt asking nurses to evaluate the necessity of IV fluids q 24h could minimize patient complications?			
4) Do you believe bedside nurses are aware of the pressing quality issues affecting their profession?			
5) Do you feel comfortable bringing suggestions to nursing leadership and/or administration that could improve patient care?			

Additional comments or suggestions: _____

Thank you!

Appendix C



SURVEY ITEMS

- 1) Do you believe programs of this nature help to enhance professional nursing practice?
- 2) Did you gain any knowledge today that will influence your nursing care?
- 3) Do you think a simple computer prompt asking nurses to evaluate the necessity of IV fluids q 24h could minimize patient complications?
- 4) Do you believe bedside nurses are aware of the pressing quality issues affecting their profession?
- 5) Do you feel comfortable bringing suggestions to nursing leadership and/or administration that could improve patient care?

Appendix D

ADDITIONAL FEEDBACK FROM PARTICIPANTS LISTED ON EXIT SURVEY

- Very informative about how overused IVF are and the (-) effects they can cause
- Was very amazed that IVF can increase/decrease quality of care
- Nurses have enough computer prompts, MDs need to be more aware of lab values, etc. when reordering fluids
- Nurses are unaware of how IV fluids affect quality
- Very informative, I took notes to share with me nursing unit and future orientees
- A computer prompt to assess the need for IV fluids would only be helpful with support from MDs
- Feel comfortable bringing suggestions to nursing leadership and administration but need support from leadership to implement and move forward
- I gained new knowledge that will improve patient care
- Reviewing data and evidence based standards was great
- We need to reinstall the I&O intervention screen because nurses forget to document it when it does not come up
- This program was very informative
- Very eye opening and a good refresher for IV therapy
- Very informative, septic patients are often overloaded with fluids
- Even better than a computer prompt for nurses would be a stop prompt for MDs for IV fluids q 24 hours as opposed to q 72 hours
- Computer prompt for MDs only!
- Excellent presentation and quality results were encouraging
- This presentation should be reviewed by all staff
- Excellent presentation, but it adds another responsibility on nursing that should be addressed by others