Reduction of Catheter Associated Urinary Tract Infections in Neurocritical Care

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On my honor, I pledge that I have neither given nor received any unauthorized assistance on this paper. MBT – April 9, 2023
Abstract

**Background:** Urinary tract infections are the fifth most common hospital-acquired infection. CAUTI increases hospital costs by more than $13,000 per infection, and patients admitted to the intensive care unit have an increased risk of CAUTI five to ten-fold. Neurocritical care patients have a two to five times greater risk compared to all critically ill patients. The purpose of this quality improvement project was aimed at improving nursing knowledge while reducing catheter utilization, catheter days and CAUTI.

**Methods:** This project utilized a pre- and post-test design analyzing nursing knowledge and attitude by way of the validated CAUTICMS survey. The quality improvement intervention consisted of nursing education delivered in lecture format, coupled with bundled care through catheter rounds addressing indication, placement of securement device, necessity of fecal management system and perineal care. Catheter days, catheter utilization and CAUTI were evaluated between 12-week control and intervention groups.

**Results:** A signed Wilcoxon Ranked test was performed analyzing 21 paired surveys. No significant difference was identified. A total of 177 patients were included in the control group with 210 patients during the intervention period. A Mann-Whitney U test analyzed catheter days, and Chi-square assessed catheter utilization, with statistical significance identified in both groups. A paired t-test maintained the null hypothesis for CAUTI reduction.

**Conclusions:** Nursing knowledge and attitude of CAUTI prevention was high during both pre- and post-survey analysis, demonstrating high baseline understanding. Statistically significant reduction of catheter days and catheter utilization were realized. One CAUTI was noted during the intervention period.

**Implications:** Findings suggest a bundled care approach incorporated through a bi-weekly catheter rounding process successfully reduces indwelling catheter days and catheter utilization. Secondary findings included supply chain issues, ineffective equipment and discrepancies in practice between specialties.

**Keywords:** Neurocritical care, CAUTI, indwelling catheter, infection prevention, nursing knowledge
Reduction of Catheter Associated Urinary Tract Infections in Neurocritical Care

Introduction

Urinary tract infections (UTIs) rank as the fifth most common healthcare-associated infection in the United States (Center for Disease Control (CDC), 2021). With indwelling urinary catheters ranking as the most common indwelling device in the acute setting, it comes as no surprise that over 67% of hospitalized patients with urinary tract infections have an indwelling urinary catheter (Nicolle, 2014). This places patients in significant danger; increasing the daily risk of catheter associated urinary tract infections (CAUTI) by 3%-7% (CDC, 2021).

Neurocritical care patients are vulnerable for CAUTI given prolonged immobility and neurogenic bladder associated with many neurologic diagnoses (Patel, et al., 2021). Existing guidelines identify appropriate patient populations for indwelling catheters, but recommendations for alternate external devices are underutilized and provider discretion along with loose interpretation of guidelines leads to inappropriate indwelling catheter placement (CDC, 2019). Nursing knowledge and recognition of measures to mitigate CAUTI are paramount for combatting CAUTI in this specialty population.

Background

In 2015 alone, there was an estimated 62,700 UTIs in the acute care hospital setting, with 12%-16% meeting criteria for CAUTI (CDC, 2021). Formally, a CAUTI is defined as a UTI where an indwelling catheter is in place more than two consecutive days, which must include either the date of, or the day prior to the event (CDC, 2021). The etiology stems from bacteria entering the urinary tract through the indwelling catheter, subsequently causing infection. The attributable causes of CAUTI are diverse, however a few of the most common sources include
improper placement, failure to routinely empty the drainage bag, fecal contamination, irregular or improper perineal cleaning, and back flow of urine from the catheter into the bladder (Elvy & Colville, 2009). Patients at highest risk for CAUTI include those with paraplegia, cerebrovascular disease and female sex (Leticia-Kriegal et al., 2019).

CAUTI alone is problematic, and without swift recognition, life-threatening adverse complications may occur. These may include but are not limited to endocarditis, bacteremia, sepsis, and meningitis (CDC, 2021). With an estimated 0.036 excess mortality rate, the financial impact is also quite significant as CAUTI’s are calculated to increase hospital costs by over $13,000 per infection (Agency for Healthcare Research and Quality, 2020). The morbidity and mortality rates, in addition to higher cost of care, highlight the importance of CAUTI reduction and ultimately prevention.

Existing guidelines by the CDC identify appropriate patient populations for indwelling catheters, including acute urinary retention, accurate measurement in critically ill, perioperative of select surgical patients, healing of sacral or perineal wounds in incontinent patients, prolonged immobilization, and end-of-life care (CDC, 2019). Recommendations for alterative external devices are underutilized and provider discretion along with loose interpretation of guidelines leads to inappropriate indwelling catheter placement (CDC, 2019). This practice most commonly occurs in the critical care setting, and more specifically within neurocritical care (NCC).

The NCC population includes ischemic and hemorrhagic stroke, epilepsy, encephalitis, spinal cord and traumatic brain injuries, as well as neuromuscular weakness such as Guillain-Barre, Myasthenia Gravis and Amyotrophic Lateral Sclerosis, just to name a few. These diagnoses pose unique challenges given the high incidence of reduced mobility and neurogenic bladder lending to the utilization of indwelling catheters (Patel, et al., 2021).
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CAUTI in NCC is not unique to a single center, rather a global phenomenon. In a report by the World Health Organization (WHO) in 2018, it was reported that patients with indwelling urinary catheters had an increased risk of 5% of developing CAUTI each day an indwelling catheter remained (Alqarni, 2021). The risk of CAUTI in patients admitted to the intensive care unit increases almost five to ten-fold (Podkovik et al, 2019). And as if that risk was not enough, neurocritical care patients have an additional two to five times greater risk of developing CAUTI compared to other critical care populations (Perrin, et al., 2021). Projections of cost are estimated at $600 to diagnose and treat each infection, totaling almost $131 million in annual nationwide costs (Podkovik et al, 2019).

With a total of 724 acute care beds and 80 intensive care level at the project hospital, 10 CAUTI’s were reported in the first quarter of 2021. In congruence with national statistics, more than 50% of the reported CAUTI’s occurred within the intensive care unit. Even more alarming, 20% of these infections occurred within the neurocritical care population, leading to prolonged length of stay and increased cost of care. In evaluation of these hospital acquired infections within neurocritical care, it was identified that underutilization of external devices, prolonged placement duration, and inappropriate utilization of indwelling catheters led to increased prevalence of catheter-associated urinary tract infections compared to medical critical care.

Aims

Given population specific increased risk, coupled with the knowledge of adverse health outcomes associated with CAUTI, a quality improvement project was designed to evaluate a 12-week evidenced based catheter rounding team for neurocritical care. The project focused on indwelling and external device utilization, indications, foley care, stool diversion, as well as urinary analysis and culture practices. A primary aim appraised nursing knowledge and attitude
of CAUTI precautions both pre- and post-intervention. Additionally, the project evaluated the impact of a 12-week evidenced based rounding team in decreasing indwelling catheter utilization, indwelling urinary catheter days and CAUTI.

Review of the Literature

An exhausted review of the literature identified common themes which mitigate CAUTI in the neurocritical care setting which included a bundled care approach (Richards et al., 2017; Schelling et al., 2015; Titsworth et al., 2012; Vacca & Angelos, 2013), utilization of securement device (Schelling et al., 2015; Titsworth et al., 2012; Vacca & Angelos, 2013), and stool diversion (Perrin et al., 2021; Richards et al., 2017; Schelling et al., 2015; Titsworth et al., 2012; Vacca & Angelos, 2013). These measures combat key complications leading to CAUTI, ultimately improving patient outcomes.

Implementation of a bundled care approach, including education, chart audits and regular rounding on indwelling catheters was demonstrated to successfully reduce CAUTI (Richards et al., 2017; Schelling et al., 2015; Titsworth et al., 2012; Vacca & Angelos, 2013). Additionally, bundled care was effective in reducing overall indwelling catheter utilization, subsequently resulting in an increase in estimated savings (Schelling et al., 2015). This savings was attributed to lower CAUTI rates and subsequent decrease in antibiotic administration and hospital length of stay (Richards et al., 2017; Titsworth et al., 2012; Vacca & Angelos, 2013).

Stool incontinence has been identified in upwards of 84% of patients with CAUTI, and Escherichia coli (E. coli) branded as the predominant organism, solidifying the theory of stool incontinence increasing risk of infection (Perrin et al., 2021; Schelling et al., 2015; Titsworth et al., 2012). Measures to reduce cross contamination, including fecal diversion devices are recommended, and despite contraindications for placement in some clinical situations, the utilization of such devices were indicated in 80.76% of cases (Perrin et al., 2021; Richards et al., 2017; Schelling et al., 2015; Titsworth et al., 2012; Vacca & Angelos, 2013).
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2017; Schelling et al., 2015; Titsworth et al., 2012; Vacca & Angelos, 2013). CAUTI rates were successfully reduced in patients with stool incontinence when stool diversion systems were applied (Perrin et al., 2021; Schelling et al., 2015; Titsworth et al., 2012).

Lastly, literature demonstrated a positive relationship between securement devices and CAUTI reduction by decreasing inadvertent removal and preventing urethral trauma (Schelling et al., 2015). Moreover, these devices prevent kinking of tubing which can result in backflow of urine into the urethra, increasing risk for infection (Vacca & Angelos, 2013). Guidelines strongly recommend utilization of securement devices to reduce urethral trauma, ultimately preventing bacteriuria (Titsworth et al., 2012). Verifying placement of securement devices is often included in bundled care by either chart audits or during the rounding process (Schelling et al., 2015; Titsworth et al., 2012; Vacca & Angelos, 2013).

Translational Framework

Translation of evidence was executed by way of the Knowledge-To-Action (KTA) Model. This framework was designed to translate evidence both for clinicians and non-clinicians alike, making it ideal for the project setting (White et al., 2016). In a dual fashion, KTA combines knowledge creation with action. While each component has multiple phases, there is overlap, making the process iterative with impact on one another (Field et al., 2014). Action phases occur after knowledge synthesis, however, the knowledge gained impacts action phases throughout the process as action may occur both simultaneously and sequentially (Field et al., 2014). At any point throughout KTA, tailoring knowledge and action to stakeholders is imperative to successful knowledge retention.
In knowledge inquiry, research was driven to answer the question of why neurocritical care patients experienced CAUTI. This led to understanding the population specific risks, along with most common causes. An integrative review identified the knowledge tool of bundled care through the utilization of a catheter rounding team to be successful in CAUTI reduction in the NCC population. Opportunity to tailor to the specific needs of the project unit were abundant, as at each step of the knowledge creation process, alterations were made (White, et al., 2016). This provided participants assurance that shared knowledge was specific to the patient population and setting.

Following synthesis of knowledge and evidence, the CAUTI rounding tool was developed for local context (White et al., 2016). After selecting the bundled approach by a catheter rounding team, knowledge was adopted to NCC patients in the surgical trauma intensive care unit (STICU). Barriers included staff buy-in and change resistance were of concern, however recognized and anticipated. These were mitigated by tailoring education and activities to the unit and patient population specifically. Through meaningful education during staff meetings, members had opportunity to learn about the intervention and query for additional understanding. Lastly, staff were integral members of the bi-weekly bedside catheter rounds where knowledge was reinforced.

It is imperative to acknowledge that throughout all phases of the model, feedback was implemented to better knowledge action (White et al., 2016). Providing feedback promoted engagement and encouraged participants to voice any concerns or questions. A possible limitation of KTA is the potential for continual evolution based on feedback. Given the narrow time frame of project implementation and data collection, frequent alterations had the prospect to
increase complexity, however efforts were driven to most effectively adapt to optimize knowledge retention while maintaining feasibility and ensuring successful outcomes.

**Methods**

**Project Design & Setting**

This quality improvement project utilized a pre- and post-intervention design to determine the effect of an evidence based CAUTI bundle. Outcome variables targeted for improvement: 1) nursing knowledge and attitude based on Catheter-Associated Urinary Tract Infections Control Measures Scale (CAUTICMS); 2) indwelling catheter utilization; 3) indwelling catheter days; and 4) CAUTI (Arlin & Bakan, 2020). The pre-intervention time period ranged from July 15, 2023 through October 7, 2023 with the intervention period occurring from October 8, 2023 through December 31, 2023. This quality improvement project was carried out in a surgical trauma intensive care unit (STICU) of a non-academic medical center in the Midwest of the United States.

**Sample**

Permanent nursing staff of the STICU were included in the project. Temporary and float pool nursing staff were excluded from participation given the transient nature of their work. Patients admitted to the Neurocritical Care service as a primary patient were included while patients receiving care by the Neurocritical Care consult team were excluded from the sample.

**Intervention**

Two weeks prior to implementation, meetings with stakeholders reaffirmed the implementation timeline, objectives, and goals. This also served as an opportunity for review of
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project processes and data collection for all involved parties. The CAUTICMS pre-test survey was distributed the week prior to initiation of education session in order to properly represent CAUTI knowledge and attitude. Following conclusion of the pre-test survey, in the week prior to intervention, education sessions with nursing staff occurred during shift huddle. Ten sessions in total were completed on both day and night shift, coordinated with nursing staff schedules to ensure all team members received education.

The quality improvement intervention occurred over the course of 12 weeks with biweekly catheter rounds. During interdisciplinary rounds, a member of the catheter rounding team evaluated each neurocritical care patient in the STICU, meeting at the bedside with nursing. Based on literature findings, topics reviewed during catheter rounds included: type of urinary device, date of placement, indication for indwelling catheter, removal attempts, retention volume, stool diversion, securement device, perineal care, urinalysis and urine culture. The detailed catheter rounding worksheet utilized throughout the project can be found in Appendix B. At the conclusion of rounds the neurocritical care team was notified of any indwelling catheter without an appropriate indication, and orders were placed for removal. Catheter rounding team members included an acute care nurse practitioner practicing in neurocritical care, STICU clinical nurse specialist and STICU nurse lead, thus demonstrating strong medical knowledge of the patient population, as well as rapport with nursing and the neurocritical care team. The post intervention phase had nursing staff completing the CAUTICMS again as a post-test which occurred the week following the end of the intervention.

Instruments

The CAUTICMS (Appendix C), developed by Dr. Arli and Dr. Bakan in 2018 and published in 2020, was administered both prior to the intervention and the week following the conclusion
The CAUTICMS survey was distributed and returned during the pre- and post-intervention time periods, measuring knowledge and attitude of CAUTI prevention measures. Outcome measure assessment and comparison tool was completed by checklist. Data collection was obtained via electronic medical record (EMR) review which was conducted by the DNP student. Additionally, data which was collected during catheter rounds by either the DNP student or STICU clinical nurse specialist was cross referenced with EMR for thoroughness. Information was stored on the secure, two-step verification, hospital network.

Baseline participant and intervention-related data was gathered by the DNP student in the form of a checklist. Baseline data is inclusive of age, sex, diagnosis and intensive care unit length of stay. Urinary device was categorized by indwelling, external or none, along with placement date recorded as month, day, year. If indwelling catheter was noted, indication for catheter placement was documented. Number of catheter removal attempts was recorded, along
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with urinary retention volume recorded in milliliters. The presence of stool diversion and
securement device was documented by simple yes/no. Date of perineal care and type of
cleansers, inclusive of chlorhexidine or soap and water. If urinalysis was obtained, the date along
with infectious or non-infectious status was documented. Additionally, if a urine culture was
collected, record of testing date and organism was included. Outcome data was collected by the
DNP student.

Analytic Plan

Data analysis was conducted via Version 26 of SPSS. Nursing participant demographics
including years of nursing and ICU experience were examined through descriptive statistics.
Patient participant demographics were also analyzed through descriptive statistics, including age,
gender, and primary diagnosis. The Wilcoxon Signed Rank test was utilized to evaluate nurses’
score on CAUTICMS, evaluating nursing knowledge and attitude of CAUTI prevention.
Assessing the impact of the project on decreasing indwelling urinary catheter days was executed
by a Mann Whitney U test. Evaluation of reduction of indwelling catheter utilization and
reduction of CAUTI was completed by a Chi-square analysis.

Results

Sample Description

A total of 21 nurses completed pre-test/post-test questionnaires regarding nursing knowledge
and attitudes of CAUTI precautions. The average number of years of nursing experience was
equal to 5.8 years, ranging from less than 1 to 15 years of experience. The average number of
ICU years of experience totaled 3.8, ranging from less than 1 to 10 years. A summary of this
sample population can be found in Table 1.
The control group included patients admitted to the Neurocritical Care service from July 15, 2022 to October 7, 2022. A total of 177 patients were included, with an average age of 64.4 years (SD 17.2). Of this population, 94 (52.2%) were female. Ischemic stroke was the predominant diagnosis with 70 (39.5%) patients, followed by intracerebral hemorrhage totaling 29 (16.4%) patients in this population. The intervention group included patients during the 12 weeks of the intervention period, from October 8, 2022 to December 31, 2022, totaling 210 patients. Average age of this population equaled 63.9 years (SD 14.7), with 110 (51.6%) males. Ischemic stroke remained the top diagnosis with 87 (41.1%) patients, followed by intracerebral hemorrhage as the second most common, totaling 32 (15.2%). No statistically significant differences were found between age, sex and diagnosis of the two samples as evidenced by p values of 0.72, 0.28 and 0.95 respectively. Sample demographics can be found in Table 2.

Table 1 Nursing Education Group

<table>
<thead>
<tr>
<th>Demographic Characteristics</th>
<th>(N = 21)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years of Nursing Experience, mean (SD)</td>
<td>5.8 (4.3)</td>
</tr>
<tr>
<td>Years of ICU Experience, mean (SD)</td>
<td>3.8 (2.8)</td>
</tr>
</tbody>
</table>

SD = Standard Deviation

Table 2 Control & Intervention Sample Characteristics

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Control (N = 177)</th>
<th>Intervention (N = 210)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD)</td>
<td>64.4 (17.2)</td>
<td>63.9 (14.7)</td>
<td>0.72</td>
</tr>
<tr>
<td>Sex, n (%)</td>
<td></td>
<td></td>
<td>0.28</td>
</tr>
<tr>
<td>Female</td>
<td>94 (53.1%)</td>
<td>100 (47.6%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>83 (46.9%)</td>
<td>110 (52.4%)</td>
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</tr>
<tr>
<td>Diagnosis, n (%)</td>
<td></td>
<td></td>
<td>0.95</td>
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</tbody>
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REDUCTION OF CAUTI

<table>
<thead>
<tr>
<th>Condition</th>
<th>Pre-Test</th>
<th>Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intracerebral Hemorrhage</td>
<td>29 (16.4%)</td>
<td>32 (15.2%)</td>
</tr>
<tr>
<td>Ischemic Stroke</td>
<td>70 (39.5%)</td>
<td>87 (41.4%)</td>
</tr>
<tr>
<td>Subarachnoid Hemorrhage</td>
<td>11 (6.2%)</td>
<td>18 (8.6%)</td>
</tr>
<tr>
<td>TIA</td>
<td>16 (9.0%)</td>
<td>6 (2.9%)</td>
</tr>
<tr>
<td>Seizure</td>
<td>12 (6.8%)</td>
<td>15 (7.1%)</td>
</tr>
<tr>
<td>Subdural</td>
<td>6 (3.4%)</td>
<td>9 (4.3%)</td>
</tr>
<tr>
<td>Brain Mass</td>
<td>6 (3.4%)</td>
<td>18 (8.6%)</td>
</tr>
<tr>
<td>Other</td>
<td>27 (15.3%)</td>
<td>25 (11.9%)</td>
</tr>
</tbody>
</table>

SD = Standard Deviation

Aim 1 Findings – Knowledge & Attitude

A total of 21 paired CAUTICMS surveys were obtained. Mean pre-test score totaled 4.7 with mean post-test score equaling 4.6. Given sample size, a Wilcoxon Signed Rank test was executed, retaining the null hypothesis of no statistically significant difference in knowledge and attitude of CAUTI prevention measures from pre-test to post-test period, as evidenced by

\[ p = 0.051 \]

Aim 2 Findings – Catheter Days
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The second aim of the study compared catheter days of the control group compared to the intervention group with statistical analysis completed by a Mann Whitney U test. Mean catheter days totaled 1.1 with a standard deviation of 2.6 days. With a \( p = 0.022 \), the null hypothesis was rejected, supporting a statistically significant difference in reduction of catheter days between the control and intervention groups.

Aim 3 Findings – Catheter Utilization

A chi-square goodness-of-fit test indicates there is a statistically significant difference in the proportion of patients without catheters from the control (62%) to intervention (73%) time period. With expected values of 68% in both populations, \( \chi^2 \) equaled 5.06 with df of 1 and \( p = 0.02 \).
Aim 4 Findings – CAUTI

A fisher’s exact test was utilized to determine an association of CAUTI between the control and intervention period. There was not a statistically significant association between the control and intervention group as evidenced by $p = 0.54$.

Discussion

Despite an incidence of CAUTI during the intervention period, it is imperative to highlight the significant reduction of catheter days and utilization. It is known that rates of CAUTI substantially increase each day an indwelling catheter remains in place, therefore making it critical to highlight a reduction in mean catheter days from 1.20 to 0.99 (SD 2.7 and 2.5 respectively) for this project. The neurocritical care population has the highest rate of catheter utilization and risk of CAUTI in comparison to other critical care services given the associated diagnoses, therefore making the reduction of catheter utilization with the intervention evermore noteworthy with 73% of the patients without catheters compared to 62% in the control group.
While no statistically significant difference was appreciated in nursing knowledge and attitude through the project, it is essential to examine the nursing workforce. Nonparametric testing was executed given limited number of participants. This highlights the evolution of bedside nursing. With travel nursing becoming ever more lucrative, challenges arise in maintaining permanent bedside staff. While this project does not examine this impact, it would be remised not to mention how this may influence the project outcomes given temporary staff was excluded. Moving forward, quality improvement projects must be inclusive of transitory staff as the landscape of the bedside nurse has evolved.

The project was not without limitations. These were comprised of high nursing turnover, increased utilization of travel and float pool nursing staff, as well as overnight cross coverage of the neurocritical service by the medical intensivist team. Statistical analyses of nursing knowledge and attitude was limited given the low number of paired surveys, secondary to high nursing turnover during the study period. Additionally, while the CAUTICMS survey was a valid and reliable instrument, the application of the survey and the appropriateness for the setting could be challenged.

Further impact to the project included utilization of devices, most notably male external catheters, and bladder scanner. New male external devices were piloted during the project period which may have contributed to the increased utilization of external devices. Following a success pilot period, these devices are now available throughout the project institution. Given the reduction of indwelling catheter use there was an associated increased utilization of bladder scanning and straight catheterization techniques for retention. This rise highlighted the inconsistent and unreliable nature of the bladder scanner, leading to necessary replacement.
Additionally, with a higher volume of straight catheterization, impact was realized on supply chain for straight catheterization kits availability.

This project provides additive value to a rapidly growing specialty. Findings of this project are in alignment with existing literature, albeit the volume of literature is limited. With critical care medicine being one of the fastest growing specialties within medicine and a complex, co-morbid aging population, it is critical to employ quality improvement practices. Whether it be neurocritical care practitioners, medical, pulmonary, surgical or cardiac critical care, the findings of this project are applicable and transferrable.

**Conclusion**

Neurocritical care patients are inherently high risk for CAUTI given the associated diagnoses. Nursing knowledge coupled with a bundled care approach are proven efforts to minimize infection, with the potential to reduce hospital length of stay and cost of care. Incorporating catheter status during both formal daily rounds and interdisciplinary rounds, as well as including catheter indication, placement of securement device, fecal management and perineal care ensures proactive action to mitigate possible infection. The measures executed in this quality improvement project were successful at reducing indwelling catheter utilization and catheter days. As with any quality improvement initiative, care team members of every level are essential to successful implementation and sustainability. Creating meaningful, lasting change for neurocritically ill patients is possible by intentional action for CAUTI reduction.

**Dissemination**

The findings of this project will be shared at the project site’s CAUTI & CLABSI Infection Prevention Committee meeting and further disseminated at Trauma Surgical Critical
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Care and Intensivist section meetings. Poster submission is planned for Society of Critical Care Medicine, International Stroke Conference and Neurocritical Care Society Annual Meeting. Additionally, manuscripts will be revised in accordance with the following journals for publication consideration; Critical Care Medicine, Stroke, Neurocritical Care Journal and Journal of Neuroscience Nursing.

Sustainability

On a service line level, catheter rounds have been made standard procedure during interdisciplinary bi-weekly rounding. Additionally, during daily bedside rounds, catheter status and necessity is discussed along with other invasive lines and drains. Through collaboration with the Department of Quality at the project site, dashboard metrics will be built within the electronic medical record which will allow ease of tracking catheter data. This data will then be analyzed on a quarterly basis, following trends and providing opportunity to intercede within areas of increasing indwelling catheter utilization rates. Critical care service lines with lowest rates of CAUTI, catheter days and catheter utilization will be honored at the project site’s yearly Quality Improvement event, highlighting success and organization wide recognition.


CAUTI IN NEUROCRITICAL CARE


https://doi.org/10.4037/ccn2017742.

http://dx.doi.org/10.1016/j.ajic.2015.04.184.


http://dx.doi.org/10.4037/ccn2013998.
Appendix A

Figure 1. Knowledge-to-Action Model in Reducing CAUTI in Neurocritical Care

Adapted from White et al., (2016)
### CAUTI in Neurocritical Care Rounding Worksheet

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Sex (M/F)</th>
<th>Diagnosis</th>
<th>ICU (days)</th>
<th>Type of Urinary Device [Indwelling, External]</th>
<th>Placement date (mm/dd/yyyy)</th>
<th>Indication</th>
<th>Removal Attempts</th>
<th>Retention Volume (mL)</th>
<th>Urine Diversion (y/n)</th>
<th>Secrecment Device (y/n)</th>
<th>Pelvic Care [Gloves/Headrest, Spong, Mesh, None documented]</th>
<th>Urinalysis (y/n) of collection, i/v</th>
<th>Urine Culture (y/n) of collection, organism</th>
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CAUTI Rounding Worksheet
Appendix C

Below are some statements about urinary catheter insertion and care. Please select the option most suitable to you.

<p>| | | | | | |</p>
<table>
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<tr>
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</thead>
<tbody>
<tr>
<td>1. Before and after the procedure, I wash my hands or use hand sanitizer</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>2. I wear sterile gloves when inserting a catheter</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. I pay attention to aseptic technique when inserting the catheter</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. I use sterile materials when inserting a catheter</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. I clean the periurethral area with povidone iodine while inserting the catheter</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. I use the appropriate diameter catheter</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. I maintain the closed drainage system in the catheter application</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. I make sure the catheter is below the level of the bladder</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. If the catheter is clogged, I would rather irrigate than replace it</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10. Before attaching a new drainage bag, I am sure to clean the connection point with 70% alcohol or povidone iodine</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11. When emptying the drainage bag, be careful not to leave the system open, and empty from the tap at the bottom</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12. I always empty the drainage bag before patient transport</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13. While taking a culture or sample, I disconnect the system and allow urine to flow directly into the sterile container or syringe</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14. I take care in maintaining a closed system while obtaining a culture/sample</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15. I prevent the drainage bag from touching the ground</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Catheter-Related Urinary System Infection Control Measures Scale

Note: A high score from the scale indicates good knowledge and attitude. Item 13 should be reverse scored
CAUTI IN NEUROCRITICAL CARE