STRATEGIES TO DECREASE CAUTI RATES IN HOSPITALIZED PATIENTS: AN INTEGRATIVE REVIEW

An Integrative Review

Submitted to the

Faculty of Liberty University

In partial fulfillment of

The requirements for the degree

Of Doctor of Nursing Practice

By

Katie Nichole Robinson

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Lynchburg, VA

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Scholarly Project Chair Approval:

August 17, 2021

Vickie B. Moore, DNP, FNP Date

ABSTRACT

Catheter-associated urinary tract infections (CAUTI) are proven to be a leading cause of infection within hospital systems and are caused by the use of indwelling urinary catheters. Diagnosis is made through additional urine testing and the infection requires treatment with antibiotics. The question within this integrative review was "What are effective strategies to decrease CAUTI rates in adult patients who are hospitalized?" During this integrative review, several strategies were examined to evaluate their effects on CAUTI rates on hospitalized adult patients requiring urinary drainage devices. Those strategies focused mainly on CAUTI bundles including proper insertion, early removal and external urinary devices. Data was obtained through the Liberty University Online Jerry Falwell Library and articles were selected using Melnyk's Level of Evidence. When these strategies are implemented and utilized properly, CAUTI rates are proven to decrease significantly, most by over 50%. When CAUTI rates are decreased, hospital stays are also shortened, hospital bills are less, patient outcomes and satisfaction are improved, and overall mortality is reduced. Based on the research studies and the evidence-based outcomes included in this integrative review, this was obvious proof that CAUTI rates decrease with the use of CAUTI bundles which include proper insertion and early removal of urinary catheters. In addition, external devices for women and men contribute to a decrease in CAUTI rates.

Keywords: CAUTI Reduction, PureWick, CAUTI Bundles

Dedication

To my son, Brantley Layne, thank you for being the most patient 3-year-old any mama could ever ask for. Thank you for all of the smiles, laughter, hand holding, hugs, kisses and selfless love that you provide to me on a daily basis. Without you, I would not be where I am today, and I cannot thank God enough for blessing me with your sweet soul. I am so proud of the boy you are becoming, and I cannot wait to see where life takes us. Never forget that mama loves you, more than life itself.

To my parents, Mike and Joanne Robinson, thank you for your endless love and support since day one. Dad, for as long as I can remember you have been my biggest role model. You have taught me how to be a leader, how to stand up and speak up for myself and my family and to fight when that's all you have left to do. You have shown me a father's love that every girl dreams of. I cannot thank you enough for all of the days and nights you have spent making sure that we as a family, had and continue to have everything we have ever wanted and needed. Mom, thank you for showing me a mother's love and setting the best example there could ever be. I strive to be half the mother to Brantley as you have been to me. Thank you for showing me true beauty and how to love myself no matter what. Thank you for catching my tears when they need to be shed and thank you for simply being my best friend. You have both encouraged and pushed me to pursue every dream I have had without hesitation, and I can only thank you for the successful woman I have become. You have taught me how to dance through life, like no one is watching and I promise you I will forever do just that. Without you I would be nothing. I love you both, so very much. "Well this time I'm gonna make our dreams come true; Well I love you more than anything in the world; Love, your baby girl"

To my brother, Austin and his wife, Jessica, thank you both for the support and love that you give me. Austin, I cannot imagine life without you. We have been blessed to walk through life hand-in-hand with a one-of-a-kind friendship. Thank you for teaching me to love all things boy and outdoors: it prepared me well for being a boy mama. Thank you for answering the phone whenever I call and being there to catch me when I fall. I promise that I will always be here for you and love you no matter what. Thank you for loving Brantley and showing him the definition of a good man. You will do great things in life; never forget that sissy loves you. Jessica, I am so thankful that God brought you into our family. You are the sister that I never had, and I am so thankful for our relationship that has blossomed. I am so happy for you both as you move into parenthood and I know you will both be amazing. Never give up on each other and love hard. I love all three of you.

To my best friends, Robbie and Candice Oliver, I have to be the luckiest woman in this world to deserve your friendship. Over the years you have loved me, supported me and welcomed me as a part of your family. Robbie, thank you for all the days you allowed me to be your shotgun rider as that time taught me a lot about myself and life. You have taught me what a true friend is, and you have been there even when I didn't deserve you. You make sure that Brantley and I are taken care of and have what we need. You have pushed me through and wiped my tears when the days were dark. You have encouraged me to be confident and love myself. You have without a doubt always had my back and I can't imagine life without you. I've got your six. Candice, while our friendship has grown closer over the last year than ever before, the only regret I have is not pushing for it sooner. Thank you for your encouragement and support daily. Thank you for letting me love your babies as they are my own. Thank you for all of the

weekly dinners you have fixed for us to make my days easier. Thank you for making sure I get time away to breathe and relax. Thank you both for loving me day in and day out. I love you.

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My sincere appreciation is shared with my project chair Dr. Vickie B. Moore. Dr. Moore has led and supported me through every step of this Integrative Review. She has provided me with words of wisdom and prayer without hesitation throughout the entire program. Dr. Moore has spent many hours reading, providing feedback and guidance, and encouraging me through this process. She has been more than willing to use her personal time to meet with me to accommodate my work and personal life schedule. Dr. Moore, thank you so much for your love and support.

List of Abbreviations

Catheter Associated Urinary Tract Infection (CAUTI)

Centers for Disease Control and Prevention (CDC)

Urinary Tract Infection (UTI)

Urinary Catheter Insertion Protocol (UCIP)

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Section One: Formulating the Review Question

Each year thousands of men and women are admitted to the hospital for multiple reasons. It is likely that many of these patients will receive a urinary catheter as part of their treatment regimen. Urinary catheters are used frequently in healthcare: however, their use can lead to serious life-threatening complications (Health Protection Surveillance Center [*HPSC*], 2011). Urinary catheters can cause urinary tract infections and are a common cause of bloodstream infections *(HPSC,* 2011). The risk of infectious complications increases the longer they are in use (*HPSC,* 2011). Indwelling catheters may be placed for multiple reasons, which might include urinary retention, intubation, "sick enough" patients, and even for "convenience." Indwelling catheters are normally needed for critically-ill patients, but they should be evaluated, according to protocol, for early removal. In addition to patients with urinary catheters, there are patients without indwelling catheters that are frequently incontinent and do not get changed as often as they should, leading to problems involving skin breakdown and other complications.

Different solutions are available to address this problem. External devices such as the newer external female catheter (PureWick™) and the condom catheter for males are alternatives for hospitalized patients. These alternative devices allow for decreased bathroom trips, more accurate measurement of intake and output, and assist in reducing catheter-associated urinary tract infections. Catheter-associated urinary tract infections (CAUTI) bundles should also be in place with the use of indwelling catheters. The CAUTI bundles include several components and should be followed per written protocol. When indwelling catheters are needed, they should be evaluated daily for early removal and should never be used for convenience. Cleaning protocols should remain in place to help eliminate infectious organisms. Urinary drainage bags should be dependent to the patient's bladder to prevent backflow of bacteria.

Background

Catheter-associated urinary tract infections are the most common hospital-acquired infections (Lobdell et al., 2012). These infections are acquired through the use of an indwelling urinary catheter and may occur in men, women, or children. They are treated with the use of intravenous antibiotics and raise the cost of a patient's medical treatment (Lobdell et al., 2012). Many different types of bacteria can cause these infections, and the type is determined through a urine culture. After the determination of the bacteria, a more specific antibiotic will be given. If the patient needs to continue with the indwelling urinary catheter, it can be left in place, and the urinary tract infection can be treated. The patient may have a better outcome if the catheter can be discontinued upon initiation of treatment.

Defining Concepts and Variables

The Centers for Disease Control and Prevention (CDC) defines catheter-associated urinary tract infections as the introduction of bacteria to the urinary tract by instrumentation (CDC, 2015). CDC identifies CAUTIs as the most common healthcare-acquired infection that accounts for greater than 30% of infections within an acute care hospital (CDC, 2015). Increased morbidity, mortality, length of stay, and cost are all associated with a CAUTI diagnosis (CDC, 2015). Catheter-associated urinary tract infections are continuously rising within medical facilities across the United States (Kuzow et al., 2019). Approximately 449,334 cases of CAUTIs occur per year (Lobdell et al., 2012). As each day passes, the number of patients with a CAUTI increases by 5% (Lobdell et al., 2012). CAUTI treatment can be expensive, with the average price ranging from $749-$832 per case (Lobdell et al., 2012).

Multiple types of urinary devices have been identified that can be utilized for urinary incontinence, some may be a better choice than others. The indwelling catheter is a tube that is

place into the bladder through the urethra and provides drainage through a closed collection system (CDC, 2015). These catheters are left in place for extended periods of time to allow continuous drainage (CDC, 2015). Indwelling catheters are placed into one of every five admitted patients (Lobdell et al., 2012). Intermittent catheters are devices where the tube is placed into the bladder through the urethra and removed after drainage is complete (CDC, 2015).

The external catheter for men is otherwise known as a condom catheter and fits on and adheres to the penis. This allows the patient to urinate and the urine drains into a drainage bag (CDC, 2015). With this device there is no penetration of the urethra (CDC, 2015). A new device recently discovered and used is an external device for women known as the PureWick™ (Mueller, 2019). This device is an oblong soft, foam device with silicon covering the backside, and is attached to a drainage tube (Mueller, 2019). This device sits against the female urethra between the labia majora and is connected to wall suction; when the female urinates, it goes into the PureWick™ and is suctioned out into the drainage container (Mueller, 2019). No penetration of the urethra is necessary with this device. With the implementation of the external female urinary catheter there was a consistent decrease in CAUTI rates in each article reviewed. This is believed to be effective because the external female catheter does not enter the urethra, keeping the bacteria outside of the urinary tract. This has also been shown to be the case with condom catheters for males. These devices will assist in protecting patients from UTIs, improving their overall health, and providing more comfort.

Rationale for Conducting the Review

Catheter acquired urinary tract infections are the most common healthcare-acquired infection. The number of CAUTI cases rapidly increases every day. These infections are possibly being caused by inappropriate placement of indwelling urinary catheters and by catheters being

kept in place for extended periods of time. These infections are causing additional medical problems and a decrease in overall patient outcomes. Extended hospital stays can be needed to treat these infections effectively. The cost of healthcare increases with every diagnosis and treatment plan that is made. Many patients lack insurance, and neither they, nor their family members have the financial means to pay for the additional hospital costs associated with an infection and treatment. Many of these infections could be avoided therefore preventing poor outcomes and increased hospital costs. Research has been conducted which resulted in the implementation of CAUTI bundles in an attempt to lower CAUTI rates. In addition to CAUTI bundles, new and existing male and female alternatives to indwelling urinary catheters exist. A further review of the literature would be helpful to compare the alternative devices and the CAUTI bundles to current rates of infection with indwelling urinary catheters. In addition, a search for additional evidence-based strategies for preventing CAUTIs should be conducted.

Purpose of the Project

The purpose of this integrative review is to review possible strategies and alternative devices and compare their use and outcomes to the indwelling urinary catheter. Alternative devices available for use are the condom catheter for the male population and the external (PureWick™) female catheter. Specific strategies such as detailed CAUTI bundles that include proper insertion, proper cleaning, evaluation for early removal, and maintaining dependent drainage bag should be evaluated. Assessment of the need for the indwelling catheter before placement may also prevent unnecessary use. Monitoring orders and placement in the Emergency Room where treatment and care begins may help limit some of the unnecessary placement. Overall, the goal is to search for the most effective strategies to lower CAUTI rates in adult patients who are hospitalized and require urinary support. This includes patients who need

intake and output monitoring and incontinent patients that are non-ambulatory, including ventilated patients. Indwelling urinary catheters often appear to be used for the convenience of the nurses and/or the patient and should be avoided to prevent unnecessary risk of infection.

Review Question

What are effective strategies to decrease CAUTI rates in adult patients who are hospitalized?

Goals

1. To determine if there is evidence to support using a male external catheter or a female external device in hospitalized patients.
2. To investigate CAUTI rates when comparing male external catheters and female external devices to indwelling foley catheters in hospitalized patients.
3. To determine if there is evidence that a CAUTI bundle is effective in preventing CAUTI infections.

Formulate Inclusion and Exclusion Criteria

Inclusion criteria for the integrative review are patients of adult age medically requiring the use of a catheter and immobile, incontinent patients that are male or female. Other inclusion criteria are full-text articles that are no older than five years, articles that are written in English, peer-reviewed, and show a positive outcome on CAUTI rates. All articles used were descriptive studies or quasi-experimental studies. Exclusion criteria for this review were children, non-English articles, non-peer-reviewed articles and articles that do not show improvement in CAUTI rates

Conceptual Framework

For this integrative review, Whittemore and Knafl (2005) was used for the conceptual framework. This framework provides step-by-step guidance for researching and writing the

integrative review. Each step is provided with details about what to do and what should be included. By following this framework, it was easy to stay on topic and task which improved the overall review.

Whittemore and Knafl (2005) presented a very clear layout to follow for a conceptual framework with an integrative review. The first step is to identify the problem, form the question, and identify the goals for change (Whittemore & Knafl, 2005). This is important to help keep the review on track and help narrow down results (Whittemore & Knafl, 2005). The second step is to perform the literature search using the databases desired (Whittemore & Knafl, 2005). It is imperative to try to pick about five keywords and chose articles from those search terms. Data evaluation and data analysis are the third and fourth steps in their framework (Whittemore & Knafl, 2005). This allows the author to read and evaluate the articles found, pull essential data and information and formulate thoughts. It can then be analyzed to obtain results to show the answer to the question of the integrative review (Whittemore & Knafl, 2005). The last step of the framework is the presentation, where the results are placed in a table or model in order to be visualized (Whittemore & Knafl, 2005). Not all results in an integrative review will be numerical, so some presentations may be written out in paragraph form with results (Whittemore & Knafl, 2005).

Section Two: Comprehensive and Systematic Search

Information Sources and Search

In order to gather and compile the best available evidence on effective strategies to decrease CAUTI rates in hospitalized adult patients, a comprehensive search of the literature was performed by the project leader. Databases utilized during the literature review were CINAHL, EBSCO, and Cochran Library. The project leader accessed each database through the Liberty

University Online Jerry Falwell Library. Multiple keywords and keyword combinations were employed in the search process in order to identify pertinent and current literature on strategies to decrease CAUTI rates. The keywords utilized in the search process included: CAUTI, CAUTI Reduction, External Female Catheter, and CAUTI Bundles. Additional search parameters included articles published in the English language within the last five years. After searching several databases with different keywords, several articles were found though information was scarce within the last five years. After the initial literature review, there were 30 articles total that were relevant to the clinical question. Fifteen articles were located through CINAHL, 11 through EBSCO, and four through the Cochran Library.

Abstracts were briefly reviewed to ensure each article contained the correct study information pertaining to the clinical question. Articles were eliminated in this phase when they did not meet the stated criteria. In depth evaluation of the articles was then performed. Eleven articles were removed from the review due to unsatisfactory results to support decreased CAUTI. These articles did not show an increase in rates, but they showed unchanged numbers. After careful appraisal and elimination of the 30 articles found, 17 of them were used to support the clinical questions in the literature review.

Quality Appraisal

The project leader critically appraised the articles for applicability to the Integrative Review and the clinical question. Using Melnyk's Level of Evidence table, 15 articles included within the integrative review are categorized as a level three, quasi-experimental design (Melnyk & Fineout-Overholt, 2019). This indicates that in almost every study there was something new implemented. The results were then measured and compared to the results prior to implementation. For example, in most articles, baseline CAUTI rates are observed and measured.

A change was then implemented in the study, consisting of an external catheter, early removal of an indwelling catheter, or implementation of a CAUTI bundle, including cleaning techniques. After implementation, the results were observed and monitored again. A majority of studies show a significant decrease in CAUTI rates after the implementation of pre-determined bundles. The project leader eliminated several articles, which showed minimal or no reduction in CAUTI rates. This is likely due to a lack of information or a shortened project not allowing sufficient time for the results to change. Also included in the integrative review is one article of level five and six. The article classified as a level five on the Melnyk's level of evidence table consists of three descriptive studies regarding patient preference and success with an external urinary incontinence device. The level six article is a descriptive observational study that shows a decrease in CAUTI rates by using a female external urinary incontinence device known as the PureWick™. The complete Level of Evidence Table and a comprehensive breakdown of each study is included in Appendix A.

Overall through the review of articles, there were few limitations. The major ones that were able to be identified were a small sample size; the project was limited to one unit or one hospital; the project was limited to a short amount of time; or the article lacked significant details such as sample size, population, or results. The small sample sizes or the implementation at one hospital, along with a short timeframe to implement the project, did not allow enough time for the staff to be thoroughly educated, for the study to be implemented, and then time for the intervention to work and show positive results.

Synthesis of Results

The primary purpose of this Integrative Review was to investigate effective strategies that can be utilized to decrease CAUTI rates in hospitalized adult patients and show the most recent

evidence-based information on CAUTIs. In addition, the project leader investigated evidence to support the use of male and female external devices in hospitalized patients and if infection rates differ with these devices compared to indwelling foley catheters. The project leader synthesized the reviewed articles for conclusions to answer the clinical question regarding strategies to decrease CAUTI rates. The key themes that were noted in the literature include decreased CAUTI rates using male and female external devices, early removal of indwelling catheters, and implementation of a CAUTI bundle which includes frequent cleaning and dependent urinary drainage bag. Most articles provided information that supports more than a 50% decrease in CAUTI rates during the study. Information is presented in the literature that shows patient preference to use the external devices due to improved comfort and convenience.

Section Three: Results

Themes of Individual Studies

There are several strategies that have been studied and can be used to reduce CAUTI rates in hospitalized adult patients. CAUTI bundles that vary depending on study including indwelling catheter insertion techniques and early removal of indwelling catheters are one strategy that is focused on closely. Increased use of external catheters such as condom catheters and the PureWick™ are the other large focus for strategies to reduce CAUTIs.

CAUTI Bundle

CAUTI bundles can consist of different components but still show an overall decrease in CAUTI rates. Wilkerson et al. (2020) explain that there is a 19% decrease in CAUTI rates after implementation of a CAUTI bundle that consists of a urinary retention assessment pathway, inpatient rounds to assess device needs, preventing insertion of catheters in the emergency department, and providing proper education on catheter care and maintenance. Mundle et al.

(2020) discuss a bundle that consists of a nurse-driven removal algorithm, education to staff regarding roles and responsibilities, indications and retention management, and a reminder developed into a screen saver that showed a 79% reduction in overall CAUTI rates. Kulik et al. (2020) show a 95% decrease in CAUTIs after implementing a new insertion protocol, an unnecessary testing protocol, nurse-driven removal policies, and holding nurses accountable for catheter care and maintenance. John et al. (2018) discuss a "Take CAUTIon" project that includes daily rounds to assess catheter needs, a cart with materials for catheter maintenance and removal, a pharmacologic and non-pharmacologic plan for patients with urinary retention, urinalysis policy, and the use of a buddy system during catheter insertion. This CAUTI bundle showed a 33.3% CAUTI reduction which exceeded their 25% reduction goal (John et al., 2018). Elkbuli et al. (2018) show that a 5-S bundle implemented over four years has an 80% average CAUTI reduction. Staff, stabilization, support, spot, and stop are the 5-S within the bundle (Elkbuli et al., 2018). Kuzow et al. (2019) discuss a CAUTI decrease of 61% by implementing a bundle that consists of catheter necessity review daily for each patient, increased use of signs to bring awareness to high-risk patients, and utilization of external catheters.

Indwelling Catheter Insertion

Some articles show that there are multiple insertion techniques that effect CAUTI rates. Sultan et al. (2018) note that CAUTI rates are significantly increased by more than four times when inserted by medical students compared to nurses. Insertions completed by surgical residents still hold double the CAUTI rates than when inserted by nurses (Sultan et al., 2018). Fletcher-Gutowski and Cecil (2019) show a decrease in CAUTI rates after implementing a two-person urinary catheter insertion protocol (UCIP) that utilizes a checklist and two properly trained personnel with at least one being a registered nurse. In two units, the CAUTI rates

decreased from one to zero, and in the third unit, rates decreased from two to one (Fletcher-Gutowski & Cecil, 2019). Ohanian and Gaines-Hill (2019) explain that CAUTI rates decreased by 70% in six months after reducing catheter insertion within the emergency department. Scanlon et al. (2017) describe a formed algorithm for catheter insertion that includes utilizing a bladder scanner to assess bladder volume, identifying urinary retention, and establishing guidelines for catheter maintenance and removal. Following 12 months of implementation within an ICU, there was a 46% decrease of CAUTIs and an 89% decrease after 18 months (Scanlon et al., 2017).

Early Indwelling Catheter Removal

Early removal of indwelling catheters is shown to reduce CAUTI rates in several studies. Allen et al. (2019) note an 80% decrease in CAUTI rates after implementing the "Every Line Every Day" project. This project provides daily patient assessment for the necessity of a catheter by the infection prevention specialist who collaborates with nursing leadership (Allen et al., 2019). Adriane et al. (2020) explain that adding indwelling catheters to "safety rounds" within a hospital to assess the need, the potential for removal, and to discuss alternative options holds a 57% CAUTI reduction. Haley (2018) found an 83% reduction in CAUTI rates after implementing a nurse-driven catheter removal protocol that provided criteria allowing nurses to remove catheters when they are no longer indicated.

External Catheter Use

Eckert et al. (2020) show a baseline CAUTI rate of 1.11% and after implementation of the female external urinary catheter, their CAUTI rates were 0% within a year. The indwelling catheter usage rates also decreased (Eckert et al., 2020). Dublynn and Episcopia (2019) show that including the female external catheter in the CAUTI bundle holds significant results for

reducing CAUTI rates. In this specific situation there was a 51.7% CAUTI reduction after implementing the external catheter (Dublynn & Episcopia, 2019). The standardized infection ratio also decreased to 0.965 from 1.319 (Dublynn & Episcopia, 2019). Beeson and Davis (2018) provide three case studies where the female external catheter was successfully used and referred by the patients. While using this device, no penetration of the urinary tract is made, decreasing the risk of CAUTIs (Beeson & Davis, 2018). Beeson, Davis, and Vollman (2018) show that during a six-month study with the use of the female external catheter, there was a 27% reduction of CAUTIs within an 18 bed SICU. This is shown by a CAUTI rate of 2.55 in 2016 reducing to 0.70 in 2017 (Beeson, Davis & Vollman, 2018).

Synthesis

Evidence gathered from the articles reviewed shows that CAUTI rates can be decreased with simple changes made to routine nursing care. Utilizing the external catheter improves infection rates, improves patient satisfaction is used for monitoring of intake and output, and is less costly. Combining the use of this device with early removal of an indwelling catheter and limiting the use to only those who are critically ill has a significant impact on overall CAUTI rates, decreasing them by more than 50%. Data analysis occurred by constant comparison of results of each study that was presented in the articles that were evaluated. Each article presented a different study and showed different outcomes. They were all compared to one another to achieve an overall effect.

Ethical Considerations

The Liberty University Institutional Review Board approved this project. The Institutional Review Board approval letter can be found in Appendix B. Both the project leader and project chair completed the Collaborative Institutional Training Initiative (see Appendix C).

Timeline

Section One - Complete by March 28, 2021

Section Two - Complete by April 25, 2021 and then complete first defense. Send application to the Liberty University IRB.

Section Three - Complete by May 23, 2021

Section Four - Complete by June 20, 2021

Chair - have completed paper to chair by July 18, 2021 for review

Editor - send to editor by July 25, 2021

Defense – on August 17, 2021

Scholars Crossing - send to SC as soon as defense is completed; have paper accepted to SC by August 20, 2021

End of Summer D - August 20, 2021

Section Four: Discussion

Summary of Evidence

Completing this literature review regarding CAUTI reduction by implementing strategies such as CAUTI bundles that include proper insertion and maintenance of indwelling catheters, early removal of indwelling catheters and the use of external urinary devices for both male and females provides sufficient evidence to support CAUTI reduction. Due to the high volume of infection rates that continuously increase daily, it is imperative for new changes to be studied and implemented. Patient outcomes should be a priority when focusing on improving health care.

The review of the literature provided shows sufficient evidence that CAUTI rates can decrease by greater than 50% when these strategies are implemented. With the decrease in infection rates, patient satisfaction increases, hospital stays decrease, medical bills decrease and

overall patient outcomes and mortality are decreased. Multiple themes were reviewed, including indwelling catheter insertion, indwelling catheter removal, CAUTI bundles, and external catheter use.

Implications for Practice

The initial goal for implementation of this project is to educate physicians and nurses of the results shown in this integrative review. Addressing the overall CAUTI rates prior to any studies is imperative to show that the implementations have a positive impact. Developing a presentation for physicians and nurses to show the results before and after each study and the details regarding what is included in the study would be beneficial. Presenting this information would allow visual insight into the review and the results of improving CAUTI rates.

Once the information is delivered thoroughly, it will be relatively simple for the staff to understand the importance of implementing these changes to the units in which they are involved. Continuing education and training regarding the new devices or policies regarding CAUTI reduction is essential to know that healthcare providers can properly perform the new interventions. The external catheters may be new to most providers and patients; they should be educated and demonstrated before patient use. Indwelling catheter insertion, drainage, and removal should also be practiced and demonstrated prior to patient implementation.

Limitations

During this literature review, the primary limitation was the lack of information regarding the recently developed female external urinary catheter. There was a small amount of information regarding this theme; however, the articles found provided evidence of a significant decrease in CAUTI rates.

Summary

Catheter-associated urinary tract infections are proven to be decreased by more than 50% when proper changes are made. Early removal of indwelling catheters, avoiding indwelling catheters when patients do not need them, and implementing the external female catheters have the most impact on infection rates. While lowering infection rates, healthcare costs that patients would be responsible for are reducing, and morbidity and mortality rates improve. The purpose of this integrative review is to compare the CAUTI rates in immobile patients that are hospitalized and requiring catheters for urinary management before and after implementation of CAUTI bundles including proper insertion and early removal, and external urinary devices.

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Appendix A: Evidence Table

Article Title, Author, etc. (Current APA Format)	Study Purpose	Sample (Characteristics of the Sample: Demographics, etc.)	Methods	Study Results	Level of Evidence (Use Melnyk Framework)	Study Limitations	Would Use as Evidence to Support a Change? (Yes or No) Provide Rationale.
Dublynn, T., & Episcopia, B. (2019). Female external catheter use: A new bundle element to reduce CAUTI. *American Journal of Infection Control*, *47*(6). https://doi.org/10.1016/j.ajic.2019.04.093	To assess the effects on CAUTI rates after implementing a CAUTI prevention bundle including the external catheter	Incontinent women patients in a 300 bed-community hospital in the northeast region	Pre- and Post-Control study	This study provided a 51.7% CAUTI reduction, along with a decrease in the indwelling catheter use.	Level 3: Quasi Experimental Design	Only performed for 1 year; Small community hospital.	Yes, this supports the decrease in CAUTI rates following the implementation of an external catheter with a drastic drop at 51.7%.
Scanlon, K. (2017). Saving lives and reducing harm: A CAUTI reduction program. *Nursing Economics*, *35*(3). https://www.medscape.com/viewarticle/890284	To develop a CAUTI reduction program, considering best	ICU and non-ICU units in an 814-bed quaternary hospital	Quality improvement project-quasi-experiment	Overall reduction in CAUTI rates with an increase in developme	Level 3: Quasi-experimental design	Conducted on many floor and units throughout the hospital	Yes, shows a decrease in infection greater than 50% with the

	practices and implementing them organization wide			nt and autonomy in frontline staff			implemented program
John, S. (2018). Changing practice, saving lives: Reduction of CAUTIs in the neurosurgical ICU. *Nursing Management (Springhouse)*, *49*(11), 12–16. https://doi.org/10.1097/01.numa.0000547258.15086.30	To decrease CAUTI rates in a single ICU by 25%, to prevent reinsertion and to increase compliance with catheter care	16-bed ICU in New York	Quality improvement project- quasi-experiment	The project exceeded expectations and decreased CAUTI rates by 33.3% at the end of the project and a 94% reduction to date	Level 3: Quasi-experimental design	Only conducted in 1 unit (ICU), small unit size	Yes, there is a large reduction to date with improvements in patient care, the project was successful and implemented hospital wide
Ohanian, S., & Gaines-Hill, S. (2019). Reduction of CAUTI rates organization wide begins in the Emergency Department. *American Journal of Infection Control*, *47*(6). https://doi.org/10.1016/j.ajic.2019.04.086	To lower CAUTI rates by restricting catheter insertions within the emergency department making	unknown	Quality improvement project- quasi-experiment- Plan, Do, Study, Act process	CAUTI rate decreased from 3.17 to 0.96 in 1 year (70%) with a 66% decrease in insertion rates	Level 3: Quasi-experimental design	No provided sample size or demographics	Yes, while there is a lack of some information, the results are significant and could potentially lead to phenomena

	it a "foley free ED"						l changes as they make good points that the ED is not sterile and nurses are rushed
Elkbuli, A., Miller, A., Boneva, D., Puyana, S., Bernal, E., Hai, S., & Mckenney, M. (2018). Targeting catheter-associated urinary tract infections in a trauma population. *Journal of Trauma Nursing*, *25*(6), 366–373. https://doi.org/10.1097/jtn.0000000000000403	To reduce CAUTI in trauma patients by implementing a bundle with 5 interventions	12,962 adult trauma patients within one facility	Quality improvement project-quasi-experiment	Only 94 total patients developed a CAUTI in 4 years, indicating an 80% reduction rate	Level 3: Quasi-experimental design	None identified	Yes, there is a significant decrease in CAUTI rates over a 4 year time frame after implementation showing extraordinary results.
Mundle, W., Howell-Belle, C., & Jeffs, L. (2020). Preventing catheter-associated urinary tract infection. *Journal of Nursing Care Quality*, *35*(1), 83–87. https://doi.org/10.1097/ncq.0000000000000418	To show decrease in CAUTI rates with the use of a CAUTI bundle	unknown	Quality improvement project-quasi-experiment	After implementation of a CAUTI bundle, there was a 79% reduction in infection rates	Level 3: Quasi-experimental design	No specifications on where the studies took place regarding hospitals and population	Yes, there is a large reduction in CAUTI rates following the implementation of a bundle
Sultan, I., Kilic, A., Arnaoutakis, G., & Kilic, A. (2018). Impact of foley catheter placement by medical students on rates	To evaluate	Adult surgical	Quality improve	Patients who had a	Level 3: Quasi-	Only performed	Yes, I would use

of postoperative urinary tract infection. *Journal of the American College of Surgeons*, *227*(5), 496–501. https://doi.org/10.1016/j.jamcollsurg.2018.08.182	the effects of post op foley placement by medical student on CAUTI rates	patients, post op (891 patients)	ment project-quasi-experiment	foley placed by a medical student had more than a 4-fold increase in risk for CAUTIs than if a nurse or resident	experimental design	in one hospital	this study to focus on the real needs of a foley post op and also develop a plan for safer use byy medical students to reduce overall CAUTI rates

Beeson, T., & Davis, C. (2018). Urinary management with an external female collection device. *Journal of Wound, Ostomy and Continence Nursing, 45*(2), 187-189. doi:10.1097/won.0000000000000417	To identify strategies for decreasing CAUTIs and the use of indwelling urinary catheters	3 female patients that were incontinent after removal of a indwelling urinary catheter in an acute care hospital	3 Descriptive Case Studies	A successful alternative to an indwelling urinary catheter to manage urinary incontinence and to decrease infections is an external urinary	Level 5: 3 descriptive studies	Small sample size, each external device was used after an indwelling was already placed (infection is already introduced)	Yes, good information is provided about patient preference and the improvement of their conditions

				catheter. Patients report that they have an increase of comfort and cleanliness with these devices			
Kuzow, H., Mansour, M., Vaccarello, S., & Lane, E. (2019). 1277: MICU REDUCTION OF CAUTIS WITH PUREWICK. *Critical Care Medicine, 47*, 615. doi:10.1097/01.ccm.0000552021.35364.15	To find alternatives to indwelling urinary catheters to help reduce indwelling catheter days along with infection rates in the MICU	This study does not specify a specific amount of patients, but identifies that it was studied over 40 months in a 20 bed medical intensive care unit	Retrospective observational study	External urinary catheters reduce CAUTI and indwelling catheter rates, CAUTI rates were reduced by 61%	Level 6: descriptive observational study	Limited to one facility and one unit within the facility,No specific sample size, No identification of the patients that it was performed on	Yes, with the implementation of the external catheter it decreased catheter day by 6.4% along with significant decrease in CAUTI rates within that specific unit of 61%
Beeson, T., Davis, C., & Vollman, K. M. (2018). Chasing zero catheter associated urinary tract infections (CAUTIs) through implementing a novel female external urine collection device in a tertiary academic surgical	To reduce CAUTIs in a SICU by utilizing a	No specific patient numbers, performed	Quality improvement pilot; Quasi-	Indwelling catheter days decreased by 9% and	Level 3: this is a quasi-experiment that was	Only performed in one unit within the	Yes, this is an adequate experiment with positive

intensive care unit (SICU). *American Journal of Infection Control, 46*(6). doi:10.1016/j.ajic.2018.04.027	novel external female urine collection device	in an 18-bed adult SICU for a 6-month phase	experiment	CAUTI rates decreased by 27% in the 6-month pilot phase	performed on one unit, with one intervention on patients that were selected regarding urinary catheters, that lead to quantitative results for CAUTI rates	hospital, only performed over a 6-month period, probably performed on a small sample size given the time length and size of the ICU	results for CAUTI rates even though it was performed with only one ICU
Eckert, L., Mattia, L., Patel, S., Okumura, R., Reynolds, P., & Stuiver, I. (2020). Reducing the risk of indwelling catheter–associated urinary tract infection in female patients by implementing an alternative female external urinary collection device. *Journal of Wound, Ostomy & Continence Nursing*, *47*(1), 50–53. https://doi.org/10.1097/won.0000000000000601	To reduce CAUTI's by implementing the use of an external catheter with suction	Female patients in a 386-bed hospital in southern California	Quality Improvement Pilot; Quasi-experiment	Prior to the external catheter, CAUTI rates were 1.11% and 1 year after it was 0%. The rate for the use of the indwelling catheters has	Level 3: this is a quasi-experiment with a controlled trial. The patients are chosen for the use of the devices	Only performed in 1 facility; trialed on a small telemetry unit.	Yes, there are positive results from this study indicating the implementation is beneficial. After the trial it was used facility wide with

				gradually declined.			rates continuing to decrease.
Haley, T. M. (2018). EC-99 - CAUTI reduction observed during development of nurse driven protocol for foley catheter removal. *American Journal of Infection Control*, *46*(6). https://doi.org/10.1016/j.ajic.2018.04.120	To reduce CAUTI rates by using nurse specified protocols to remove foley catheters when appropriate	This study does not provide specific sample characteristics, but identifies it was performed over 2 years	Pre- and post-control study	This study shows a 83% reduction in CAUTI rates with a decrease from 2.3 to 0.41	Level 3: quasi experimental design where results were improved following implication of a specific protocol	Only performed in 1 facility	Yes, this study shows that with an implemented protocol for nurses to use their judgment based off of specific criteria and the patients condition, they can remove foley catheters without doctor orders and it shows a positive result, decreasing the CAUTI rates
Fletcher-Gutowski, S., & Cecil, J. (2019). Is 2-person urinary catheter insertion effective in reducing CAUTI? *American Journal of Infection Control*,	To reduce CAUTI by having	330 bed community	Pre- and post-	This study shows a decrease in	Level 3: quasi experimen	Only performed in 1	Yes, while the results are small

47(12), 1508–1509. https://doi.org/10.1016/j.ajic.2019.05.014	2 people present and using a checklist to prevent infection	teaching hospital	control study	CAUTI rates after implementing the 2-person insertion technique, though the results are not statistically significant	tal design where CAUTI rates improved after implementing new 2-person technique	facility in 3 units over 6 months	there is still a decrease in the CAUTI rates after implementation
Lewandowski, A., Kokoczka, L., & Reddy, A. (2020). 1318: REDUCING URINARY CATHETER DAYS AND CAUTI THROUGH MULTIPROFESSIONAL ROUNDS. *Critical Care Medicine*, *48*(1). https://doi.org/10.1097/01.ccm.0000645188.32929.d0	To reduce CAUTI rates by including indwelling catheters to safety rounds performed by a muliprofessional team allowing for evaluation of removal	64 bed medical intensive care unit	Pre- and Post-control study	This study shows a decrease in CAUTI rates by 57% when comparing the year before and the year after implementation of the safety rounds	Level 3: quasi experimental design where CAUTI rates were decreased after implementing safety rounds for patients with indwelling catheters	Only performed in 1 facility and in 1 ICU	Yes, the rate of decrease in CAUTI was 57% after implementing the safety rounds on patients with indwelling urinary catheters. This has also been effective with other tubes and drains,

							including central lines
Kulik, T., Mason, M., Alunday, R., & Brett, M. (2020). 1378: REDUCING THE INCIDENCE OF CAUTI IN THE INTENSIVE CARE UNIT. *Critical Care Medicine*, *48*(1), 666–666. https://doi.org/10.1097/01.ccm.0000645428.00412.b2	To reduce CAUTI rates by implementing removal policy for nurses and holding them accountable for foley care and maintenance	Specific sample not provided	Pre- and Post-control study	This study showed a 95% reduction in CAUTI rates after implementing new policies with only 1 CAUTI identified after 9 months of implementation	Level 3: quasi experimental design where CAUTI rates were decreased after implementing nurse removal and accountability for foley care	Only performed over 9 months, unsure of sample details	Yes, a 95% decrease is a large improvement for CAUTI reduction, nurses are the ones who care for and see the patient most, they will know when its appropriate to remove or inappropriate to have placed
Allen, B., Culbertson, J., Eyherabide, S., & Geca, M. (2019). A multifaceted approach to CAUTI reduction. *American Journal of Infection Control*, *47*(6). https://doi.org/10.1016/j.ajic.2019.04.094	To reduce CAUTI rates by implementing an "every line every day" protocol	31 bed telemetry unit at a 222-bed community hospital	Pre- and Post-control study	This study showed a 80% decrease with only 1 CAUTI from January to	Level 3: quasi experimental design that shows reduction in CAUTI rates after implement	Only performed on 1 unit that was 31 beds	Yes, 80% is a large decline in infection rates and understanding that patients and their lines

	where each patient and their foley was evaluated per hospital policy			November in 2018.	ing everyday evaluation of every line		and drains should be focused on daily is imperative
Wilkerson, S. D., Overbay, D., & Haake, H. (2020). Multi-pronged CAUTI reduction strategy. *American Journal of Infection Control*, *48*(8). https://doi.org/10.1016/j.ajic.2020.06.053	To reduce CAUTI rates by implementing policies that effect multiple phases with the use of foley catheters	Large regional medical center	Pre- and post-control study	This study shows a decrease in CAUTI Standardized Infection Rates from 0.85 in 2018 to 0.662 in 2019	Level 3: quasi experimental design that implements multiple attempts to reduce infection that results with a reduction in CAUTIS	Only performed at 1 hospital	Yes, additional monitoring in the ED for the need of foley placement may really decrease infection rates and providing additional charting mechanisms may keep the nursing staff aware and knowledgeable about the patients condition and their

							need for the foley.

Appendix B: LU IRB Approval

Date: 8-1-2021

IRB #: IRB-FY20-21-901
Title: STRATEGIES TO DECREASE CAUTI RATES IN HOSPITALIZED PATIENTS
Creation Date: 5-10-2021
End Date:
Status: Approved
Principal Investigator: Katie Robinson
Review Board: Research Ethics Office
Sponsor:

Study History

Submission Type Initial	Review Type Exempt	Decision No Human Subjects Research

Key Study Contacts

Member Vickie Moore	Role Co-Principal Investigator	Contact vbmoore@liberty.edu
Member Katie Robinson	Role Principal Investigator	Contact krobinson107@liberty.edu
Member Katie Robinson	Role Primary Contact	Contact krobinson107@liberty.edu

Appendix C: CITI Certification

CITI PROGRAM

Completion Date 16-Jul-2020
Expiration Date 16-Jul-2023
Record ID 37519295

This is to certify that:

Katie Robinson

Has completed the following CITI Program course:

Not valid for renewal of certification through CME. Do not use for TransCelerate mutual recognition (see Completion Report).

Biomedical Research - Basic/Refresher (Curriculum Group)
Biomedical & Health Science Researchers (Course Learner Group)
1 - Basic Course (Stage)

Under requirements set by:

Liberty University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?w59f7c77c-d099-4845-98db-6e4a5a4b3f53-37519295