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THE EFFECT OF NURSE DRIVEN PROTOCOL IMPLEMENTATION ON THE INCIDENTS OF CATHETER ACQUIRED URINARY TRACT INFECTION IN GERIATRIC PATIENTS

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ABSTRACT
The aging process affects the immune system, making the elderly more vulnerable to bacterial and viral infections. Urinary tract infection (UTI) is the second most common infection among geriatric patients. UTIs caused by urinary catheter use, known as Catheter Acquired Urinary Tract Infections (CAUTI), are the leading cause of nosocomial infections, with 80% linked to catheter use. Preventing catheter use beyond 72 hours can reduce CAUTI incidence. The use of Nurse Driven Protocols (NDP) is one of the interventions recommended by the CDC to reduce catheter-related risk factors. This articles aiming to discuss the impact of NDP implementation on the incidence of CAUTI in geriatric patients. This study was conducted using the PRISMA checklist. Literature searches were conducted through several databases, including ProQuest. Science Direct, Scopus, and ClinicalKey Nursing, within the last five years (2020–2024). From 110 identified articles, five met the inclusion criteria, and two were analyzed in depth. The implementation of Nurse Driven Protocols (NDP) significantly reduced the incidence of CAUTI by ensuring catheters are only used when absolutely necessary and removed as soon as no longer indicated. Routine 24-hour assessments enable nurse to independently evaluate catheter use based on clear clinical criteri , such as the HOUDINI system. NDP empowers nurse to conduct independent evaluations and make decisions regarding catheter use, effectively preventing CAUTI and improving the quality of patient care.

Keywords: elderly; geriatric; HOUDINI protocol; infection

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INTRODUCTION

Urinary Tract Infection (UTI) is one of the most common problems experienced by elderly patients hospitalized in healthcare facilities. The Indonesian Ministry of Health (2016) recorded the number of UTI cases in Indonesia at 90–100 cases per 100,000 population annually.According to to the WHO (2016), UTI is the second most common infectious disease after respiratory tract infections. Annually, 8.3 million UTI cases are reported among women and 4.2 million among men (Ana et et al., 2020).

UTI prevalence is high in patients using urinary catheters, with 80% of them at risk, and 10%–30% may develop bacteriuria (Suryarinilsih et al., 2018). Adult patients with indwelling catheter experience a 5% daily increase in infection risk. This is due to bacteriuria potentially occur after the second day of catheter insertion, with infection risk increasing with longer catheterization duration (Ana et et al., 2020).

Bacteria colonize the distal urethra and external genitalia. Most bacteria enter through the extraluminal route (66%), either during catheter insertion or afterwards, when bacteria from the urethral meatus ascend along the outer surface of the catheter through the periurethral mucosa to the catheter lumen, reaching the inner mucosal lining and eventually the bladder

via the ascending urethral route, spreading to the bloodstream and kidneys. The intraluminal route occurs due to bacterial reflux from the urobag or contamination at the catheter-urobag junction. Bacterial colonization in the bladder can occur within 72 hours (3 days) (Suryarinilsih et et al., 2018).

Catheter-Associated Urinary Tract Infection (CAUTI) is a major cause of nosocomial infections, with 80% linked to urinary catheter use (Suryarinilsih et al, 2018). CAUTI refers to a UTI in patients with indwelling catheter for more than two days, accompanied by symptoms such as fever (temperature >38°C), suprapubic pain, costovertebral angle tenderness, and a positive urine culture containing no more than two microorganisms (Gandaria Purba & Ginting, 2018; Campbell, 2019; Anggreiny, 2019; Suryarinilsih et al., 2018). Other UTI symptoms include urinary urgency, frequency, and dysuria, which can be prevented by avoiding prolonged catheterization. Prolonged catheter use (≥72 hours) creates an ideal environment for bacterial growth, increasing infection risk (Suryarinilsih et al., 2018). A study conducted at Dr. M. Djamil General Hospital, Padang, showed that 43.2% of adult patients developed UTIs due to catheter duration, with 40.9% having catheterization beyond recommended guidelines (over 7 days), showing a significant association between catheter duration and UTI incidence (Suryarinilsih et et al., 2018).

Similar findings were reported in a study by Sitorus (2012), where out of 20 respondents, 14 had catheters in place for more than 4 days, and 11 developed UTIs. Hartawan, Taza, & Sukriyadi (2012) also found that out of 30 respondents, 15 had prolonged catheter use (>4 days), and 10 developed UTIs (Suryarinilsih et al., 2018). Catheter-associated UTIs are nosocomial infection associated with a threefold increased risk of complications, longer hospital stays, increased catheter use, higher healthcare costs, and even death. CAUTIs carry numerous negative health consequences (Mrziglod et al., 2023; Joseph- Armstrong, 2023; Suryarinilsih et et al., 2018; Anggreiny, 2019).

The theory of functional consequences explain that health in the elderly is defined as the abilities to function optimally despite age related changes and risk factors (Dutta et al., 2022). Age- related changes in the urinary system include bladder muscle hypertrophy and thickening of the bladder wall, which reduce bladder elasticity and storage capacity. Age-related changes in voiding control May also cause nocturia.These problems, along with incontinence, are common in older adults with dementia or neurological conditions affecting the cerebral cortex. The inability to control urination is not a normal part of aging but is exacerbated by age related changes. Inefficient neurological control of bladder emptying, weakening bladder muscles, and reduced bladder capacity can lead to significant urinary retention, resulting in incomplete bladder emptying (Milsom & Gyhagen, 2019; Dutta et al., 2022; Alamri et et al., 2022).

Urinary retention provides an ideal environment for bacteriuria to develop into a UTI (Irawan & Mulyana, 2018; Joseph- Armstrong, 2023). Symptoms include frequent urination, straining, palpable distension, and a feeling of incomplete emptying.These conditions often necessary catheterization in older adults, particularly those under medical care (Dutta et et al., 2022; Mrziglod et al., 2023). Improper catheter use is a risk factor for UTI in older adults, in addition to decreased immunity and comorbidities like diabetes mellitus (Hariati, 2019; Meddings et et al., 2010;

Nursing interventions for catheter use are typically divided into three stages: insertion, maintenance, and removal (Menegueti et et al., 2019; Atkins et et al., 2020; Gandaria Purba & Ginting, 2018). Indonesia's Standard Operating Procedures (SOP) for nursing interventions still emphasize insertion and maintenance using the HAI Bundle guidelines (Atkins et al., 2020). Nurses ' active involvement in catheter insertion and removal strategies remains limited, and related studies are scarce.

The use of a Nurse-Driven Protocol (NDP), particularly the HOUDINI protocol, is one intervention to reduce catheter-related risk factors and is a component of health promotion (Campbell, 2019; Dutta et al., 2022). The NDP-HOUDINI criteria for maintenance catheter use include hematuria, obstruction, urological surgery, pressure ulcers, accurate intake / output monitoring, palliative comfort care, and immobility due to physical limitations.

Four core principles guide this protocol: (1) Preventing UTIs is crucial for improving care quality and shortening hospital stays for elderly patients ; (2) The best strategy to prevent UTI in older adults is to limit indwelling catheter use and remove it as early as possible ; (3) Nurses evaluate the patient's need for catheter use ; and (4) the protocol is used to assess catheter necessity, significant reduce catheter use and duration. The main intervention is to use a catheter only when truly needed and to remove it promptly when no longer indicated. Reassessment is conducted every 24 hours (Nuwa et et al., 2018).

Mori Candace (2014) conducted a study on the use of NDP as a simple nursing intervention involving comprehensive assessment and decision -making regarding catheter removal or continuation based on indications (Nuwa et al., 2018). Before protocol implementation, catheter usage was at 37.6%, average duration was 3.35 days, and CAUTI incidence was 0.77%. After implementation, usage dropped to 27.7%, average duration was 3.46 days, and CAUTI incidence decreased to 0.35% (Nuwa et et al., 2018).

A similar study by Affan et al. (2016) on the use of NDP to reduce UTIs in post-operative patients with catheter involved be careful assessment of catheter use and removal criteria. Pre-intervention data were collected from September 2007 to December 2008, and post-intervention data from January 2009 to December 2010. The results showed a significant reduction in CAUTI: 36 out of 1040 patients (2.6%) were diagnosed with CAUTI before the protocol, compared to 38 out of 2469 patients (1.5%) afterward, a 1.1% reduction (Nuwa et et al., 2018; Meddings et et al., 2010).

Data from the geriatric inpatient ward at Cipto Mangunkusumo Hospital (RSCM) showed that 52% of patients used catheter inappropriately, with 48% of patients catheterized in January 2022. This percentage increased to 50% in February 2022. No studies in Indonesia have yet reported on inappropriate catheter use. The NDP-HOUDINI protocol can be an effective strategy to actively involved nurses in catheter removal interventions (Mrziglod et al., 2023; Nuwa et et al., 2018). Research on the effectiveness of NDP-HOUDINI in Indonesia is currently lacking, and the limitations of the HAI bundle lie in its lack of detailed patient assessment criteria for catheter continuation or removal decisions.

METHOD

In this study, the researcher employed systematically review method using the PRISMA checklist. Literature was sourced from several databases, including ProQuest, ScienceDirect, Scopus, and ClinicalKey Nursing, covering the past five years (2020–2024). The selected research articles focused on elderly population aged over 60 years who used urinary catheters. The inclusion criteria were articles written in English, published in scientific journals, and available in full text. Out of 110 journal articles obtained, only two met the eligibility criteria. To minimize the risk of potential bias, the researcher utilized the Critical Appraisal tools from the JBI Systematic Reviews, specifically the checklist for Quasi-experimental studies (non-randomized) experimental studies). The assessment was categorized as very good, good, or poor, depending on the level of bias present in each study.

RESULT

From the initial search , the researcher identified 110 journal articles . After removing duplicates and screening titles and abstract for relevance , the number was reduced to 33

articles eligible for the next stage . A more in- depth review of the full texts revealed that only two studies met the inclusion and exclusion criteria . Based on the risk of bias assessment , both studies were found to be of reasonably good quality .

Table 1.
PRISMA Checklist Table

Identification	Identification through database search (Proquest , ScienceDirect, Scopus and ClinicalKey Nursing) (n = 115)	
Screening	Screening with limitation (5 year last , full-text , language English, Journal scientific) (n=44)	Excluded articles (n = 71)
	Screening title and abstract (n=6)	Excluded articles (n=38)
	Full- text screening (review) eligibility) (n=2)	Excluded articles (n=4)
Inclusion	Articles analyzed ➔(n=2)	

Table 2.
Search table literature

Date	Database	Keywords	Total Articles from the first search	Limiter	Total article in the beginning	1st Selection (title, abstract) - Inc. Crit	2nd Selection (full text)	Total articles to be analyzed
05-22-2025	Proquest	(geriatric OR elderly OR "older people" OR aged) AND (CAUTI OR "catheter associated urinary tract infection") AND (" houdini protocol" OR "nurse driven protocol" OR " houdini nurse driven protocol")	50	5 years last, full-text, language English, Journal scientific	27	6	2	2
05-26-2025	ScienceDirect		31	5 years last, full-text, language English, Journal scientific	9	0	0	0
05-26-2025	Scopus		1	5 years last, full-text, language English, Journal scientific	1	0	0	0
05-26-2025	ClinicalKey Nursing		33	5 years last, full-text, language English, Journal scientific	7	0	0	0

Table 3.
Results table search

No	Author	Year	Country	Study Design	Study Type	Sample size	Gender
1	Folashade Oluwafunmi	2021	USA	quantitative quasi-experimental	prospective	32	NR
2	Atkins, L., Sallis, A., Chadborn, T., Shaw, K., Schneider, A., Hopkins, S., Bunten, A., Michie, S., & Lorencatto , F.	2020	English	mixed methods	systematic review, content analysis, matriculation	25	NR

DISCUSSION

Catheter Acquired Urinary Tract Infection (CAUTI) is a leading cause of nosocomial infections, with 80% associated with the use of urinary catheters (Ana et et al., 2020; et al., 2018; Anggreiny, 2019). Preventing the use of urinary catheter beyond 72 hours can reduce the incidence of CAUTI. The use of a Nurse-Driven Protocol (NDP) is one of the interventions recommended by the CDC to minimize catheter-related risks (Joseph-Armstrong, 2023; Mrziglod et al., 2023). Within NDP, the criteria for catheter use follow the HOUDINI system: Hematuria, Obstruction, Urological surgery, Decubitus ulcers, Accurate Input & Output measurement, No code / comfort care for palliative patients, and Immobility due to physical limitations.

There are four key principles in implementing this protocol: First, preventing CAUTI is a crucial step in improving the quality of care and reducing hospital length of stay in older patients. Second, the best strategy to prevent CAUTI in geriatric patients is to limit the use of indwelling catheter and remove them as soon as they are no longer needed. Third, nurses should regularly assess whether the patient still requires the catheter. Lastly, the protocol is used to evaluate catheter usage and can significantly reduce the incidence and duration of urinary catheterization. The main intervention in this protocol is to use catheter only when absolutely necessary and remove them as soon as possible. Reassessment is conducted every 24 hours (Atkins et al., 2020; Suparyanto & Rosad, 2015, 2020; Joseph- Armstrong, 2023).

Recent research confirm that CAUTI remains a significant challenge across countries, regardless of income level. A 2024 position paper from the International Society for Infectious Diseases emphasized that CAUTI is not only increases healthcare costs and length of hospital stay but also contribute to higher mortality. While CAUTI incidence rates difference between developing and developed countries, the consistent implementation of evidence based preventive strategies have been shown to effectively reduce CAUTI rates and improve patient outcomes in various healthcare settings (Rosenthal et et al., 2025).

The implementation of Nurse Driven Protocols (NDP) has been proven to significantly reduce both catheter utilization and CAUTI incidence. A 2025 international systematic review and meta- analysis showed that NDP implementation reduced catheter usage rates from 49.40% to 34.84%, and CAUTI incidence from 6.50% to 2.86%. Risk analysis showed a 55.91% reduction in CAUTI risk in the NDP group compared to conventional methods.These findings reinforce that empowering nurse through evidence based protocols is highly effective in reducing infection rates and enhancement patient safety (Su, 2025).

Furthermore, a 2025 ICU study found that CAUTI occurred in 8.83% of patients who used urinary catheters for more than 48 hours after hospital admission. This rate was significantly higher than the rate of urinary tract infections present on admission (2.3%), with an average CAUTI incidence of 6.99 per 1,000 patient-days. These findings highlights the critical importance of regular evaluation and timely catheter removal in accordance with NDP, especially in high-risk environment like intensive care units (Sleziak et et al., 2025).

Based on these findings, it is evident that implementing a Nurse-Driven Protocol (NDP) is a strategic and effective measure to address the high incidence of CAUTI, especially in high-risk units such as ICUs. NDP not only strengths nurses ' roles in objective, criteria-based clinical decision -making, but also significantly reduces unnecessary catheter use, minimize complications, and improve overall patient safety. With strong institutional policy support and on going training, NDP can become an integral part of quality improvement and infection control efforts in healthcare facilities across both developing and developed countries.

CONCLUSION

The use of a Nurse-Driven Protocol (NDP) includes an initial assessment conducted by nurse for every new patient with a urine catheter. Through this protocol, nurses can determine whether to maintain or remove the catheter. If the criteria for urinary catheter use are not met, the nurse can proceed smoothly with catheter removal.

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