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Evidence for a nurse-led protocol for removing urinary catheters: A scoping review

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ABSTRACT

Background: Catheter-associated urinary tract infections significantly contribute to hospital acquired complications globally, with adverse implications for patient outcomes, healthcare, and fiscal resources. Nurse-led protocols for early removal of urinary catheters to reduce the incidence of catheter-associated urinary tract infections have been trialled.
Aim: To report the evidence for nurse-led practices of removing urinary catheters within the acute healthcare setting.
Methods: Five databases (CINAHL, MEDLINE, SCOPUS, EMCARE, and INFORMIT) were systematically searched in a scoping review of all peer reviewed publications up to 12/03/2021.
Findings: Thirteen studies met the inclusion criteria. Eleven studies described a reduction in catheter-associated urinary tract infections regardless of the type of intervention, one study did not demonstrate a change and one study reported an increase in catheter-associated urinary tract infections. Settings, study duration and sample size varied substantially between the included studies. Interventions were exclusive nurse-led protocol for removal of urinary catheters, computerised reminder systems, bundle approaches or comprehensive packages. Outcome measures and definitions of catheter-associated urinary tract infections were varied or absent.
Discussion: The quality of evidence of included studies in this review was low, attributed to by a number of methodological issues related to sample size and statistical analyses. Whilst the introduction of nurse-led protocols showed some improvements, the methodological inconsistencies make it difficult to highlight a specific protocol.
Conclusion: Given the quality of existing evidence, caution is required in translating these findings to policy and practice.

Summary of relevance

Problem or issue

Catheter-associated urinary tract infections are avoidable and contribute to poor patient outcomes in hospitalised adults. Since 2010, an up-to-date systematic review for nurse-led protocols for removal of urinary catheters has not yet been conducted.

What is already known

Several interventions have been reported to reduce incidence of catheter-associated urinary tract infections in hospitalised adults.

What this paper adds

New evidence showed that a reduction in catheter-associated urinary tract infection incidence could be achieved by utilising nurse-led protocols for removal of urinary catheters. Interventions that could reduce catheter-associated urinary tract infection incidence are exclusive nurse-led pro-

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tocols, electronic reminder systems, bundle packages, and comprehensive care packages.

1. Background

Catheter-associated urinary tract infections (CAUTI) place a significant burden on healthcare systems globally and can lead to significant patient morbidity as well as having resource and fiscal implications for health services. In the United States of America (USA), hospital acquired infections have been estimated to cost up to $45 billion (USD) annually and account for approximately 100,000 deaths per year (Kennedy, Greene, & Saint, 2013). Approximately one-third of those hospital acquired infections are CAUTIs, with an estimated 15%–25% of patients in hospitals catheterised during their admission (Daniels, Lee, & Frei, 2014). In Australian hospitals during the financial year of 2018–2019, 13.90% of hospital separations (the process by which an episode of care for an admitted patient ceases) had a hospital acquired complication, of which 9.96% were urinary tract infections (UTI) (Australian Institute of Health and Welfare [AIHW], 2021; AIHW, 2022). Of all hospital acquired complications, UTIs represent the third largest number of occurrences following delirium and unspecified complications (AIHW, 2021).

Most UTIs are preventable and urinary catheters (UC) have long been regarded as a significant contributor to the development of a hospital acquired UTI (Foxman, 2002; Meddings, Rogers, Macy, & Saint, 2010). Complications of CAUTIs include prolonged hospital stays (Hu, Yang, Huang, Chen, & Chang, 2015), more complex care requirements (Daniels et al., 2014), pyelonephritis (Foxman, 2002; Nicolle, 2013), potential increased risk for delirium (Balogun & Philbrick, 2014; Eriksson, Gustafson, Fagerström, & Olofsson, 2011; Mayne, Bowden, Sundvall, & Gunnarsson, 2019), sepsis (Kennedy et al., 2013), septic shock and death (Nicolle, 2013). Urinary tract infections are a predictor of sepsis and are a part of sepsis pathways for determining the source of pathology (Nicolle, 2013). The use of antimicrobial agents to treat CAUTIs contributes to the ongoing global problem of antimicrobial resistance, further burdening the poor outcomes of patients, making infections more difficult to treat by narrowing the spectrum of antibiotics able to be used (Linhares, Raposo, Rodrigues, & Almeida, 2013; Nicolle, 2013; Shin et al., 2019). Because of the impact of CAUTIs on healthcare, some governments have ceased providing funding for CAUTIs in an attempt to incentivise hospitals to proactively reduce the incidence of this infection (Wald & Kramer, 2007; Wald, Richard, Dickson, & Capezuti, 2012).

The Australian Commission on Safety and Quality in Health Care provides a set of standards against which hospital performance is measured (Australian Commission on Safety and Quality in Health Care, 2019). As a part of the National Safety and Quality Health Service Standards Standard 3: Preventing and Controlling Healthcare Associated Infections, the prevalence of CAUTIs must by audit by hospitals and data made available to governing bodies (Australian Commission on Safety and Quality in Health Care, 2021). Organisations have the potential to experience additional financial penalties from the mismatch between reported data from coding systems compared to actual CAUTI events (Shaban, Russo, Mitchell, & Potter, 2018).

Many initiatives have been developed with an aim of reducing the incidence of CAUTIs and improving patient outcomes. The objectives underpinning these initiatives include: reducing the number of insertions of UCs by determining the appropriateness of the intervention; identifying the ongoing need for the UC; alerts to remind clinicians of the presence of a UC; electronic reminders to review the UC; and protocols for the early removal of UCs by clinicians (DePuccio et al., 2020; Giles et al., 2020; Meddings et al., 2010). Nurse-led removal of UC protocols allows nurses to have the autonomy to make the clinical decision to remove the UC according to a predetermined list of criteria (DePuccio et al., 2020). By introducing these preventative measures, there may be benefits such as the reduction of costs of CAUTIs and their health sequelae by up to 50% (Kennedy et al., 2013).

The evidence underpinning nurse-led removal of UC protocols needs to be collated, tabulated and summarised to describe best practice. To this end, a scoping review protocol was developed to guide the synthesis of evidence for nurse-led practices in removing UCs within an acute healthcare setting.

2. Aim

The aim of this scoping review was to report the evidence for nurse-led practices of removing UCs within the acute healthcare setting.

3. Methods

A scoping review provides a rigorous and transparent method for mapping areas of research (Pham et al., 2014). The purpose of scoping reviews includes summarising and disseminating the research findings to inform practitioners, consumers and policy makers (Arksey & O'Malley, 2005). This scoping review was guided by the framework of Arksey and O'Malley with modifications by Levac and colleagues (Arksey & O'Malley, 2005; Levac, Colquhoun, & O'Brien, 2010). The five stages of the framework are: developing a research question; identifying relevant studies; study selection; charting the data; and collating, summarising and reporting the results (Arksey & O'Malley, 2005; Levac et al., 2010).

The research question for this scoping review was, 'What is the evidence for nurse-led removal of urinary catheters in adults within the acute hospital setting?' A search strategy was developed using key words and, where relevant, controlled vocabulary for each of the databases: CINAHL; MEDLINE; SCOPUS; EMCARE and INFORMIT (Supplementary 1). Boolean operators 'AND' and 'OR' were used to combine terms (Supplementary 2). Alternative sources of articles included a manual search of the reference lists of included studies and the table of contents of key journals.

3.1. Selection criteria

Eligibility criteria were articles that specified a nurse-led practice for urinary catheter removal in an acute hospital setting with reference to the impact on CAUTI rates. All peer reviewed publications published up to 12/03/2021 were included with no restrictions for year of publication, language or study design and therefore quality improvement projects were also included. Articles were excluded if full text was not available. Letters to the editor, commentaries, reviews and editorials were excluded. Studies involving the following contexts were also excluded: aged care facilities; community settings; physician-led; paediatrics; suprapubic and long-term urinary catheters.

3.2. Data extraction

Results were collated using reference software (EndNote X9.3) and duplicates were removed. Titles and abstracts were screened for eligibility independently by one team member. The second screening involved a full text read conducted independently by two team members. A third team member was available and required to resolve one discrepancy relating to selection. Data extraction was conducted by one team member and reviewed by three other

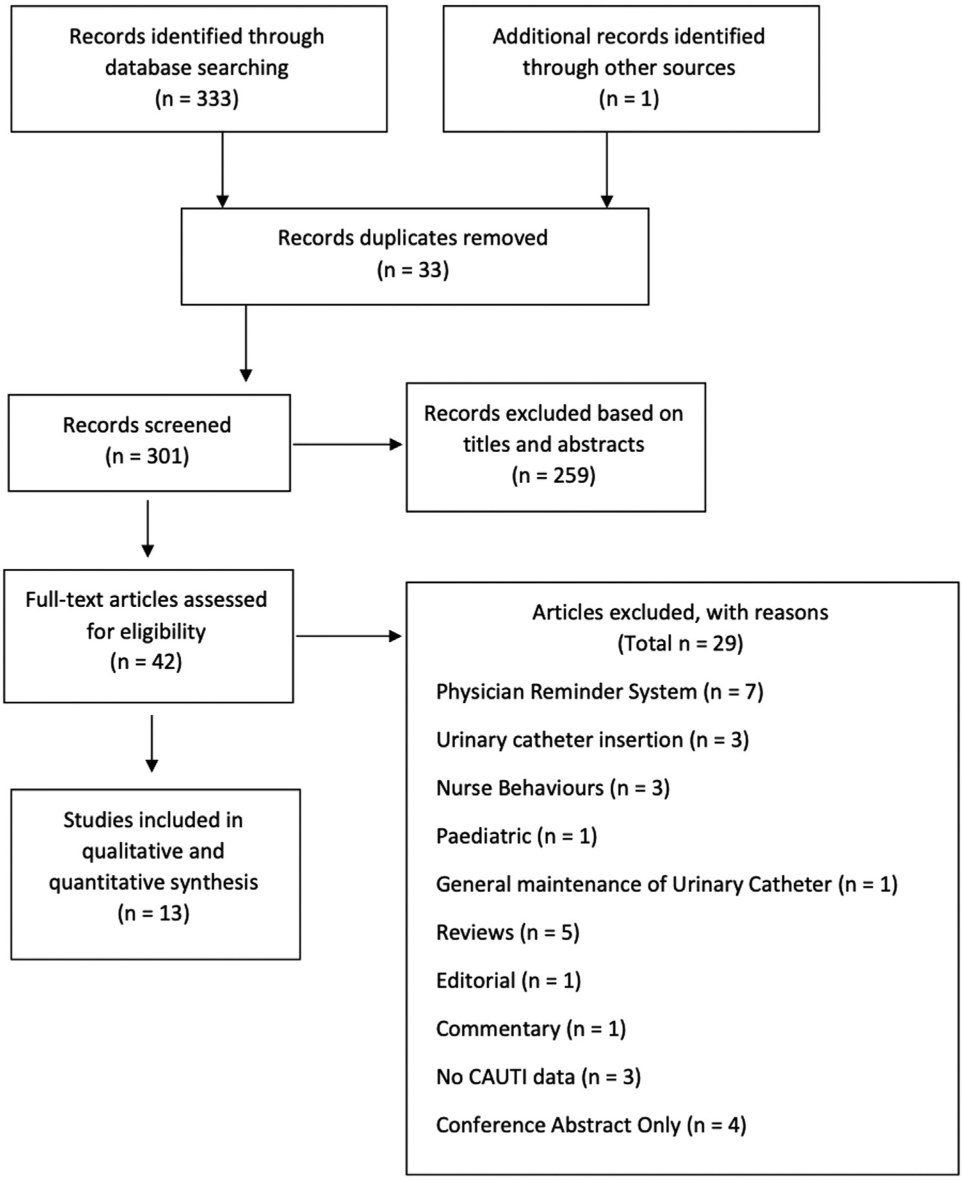

Fig. 1. PRISMA Flowchart.

team members. Data extracted were author, year, study type, setting and country, sample size, aims, intervention type, study duration, outcome measure, definition of CAUTI, self-evaluation tool, and key findings. The extracted data was recorded and summarised using Microsoft Excel and was reviewed by all team members.

4. Results

A PRISMA flowchart (McGowan et al., 2020) was used to report the study retrieval and selection as displayed in Figure 1. Thirteen studies met the criteria (Adams, Bucior, Day, & Rimmer, 2012; Dumigan et al., 1998; Elpern et al., 2009; Johnson, Gilman, Lintner, & Buckner, 2016; Major-Joynes, Pegues, & Bradway, 2016; Mori, 2014; Parry, Grant, & Sestovic, 2013; Russell, Leming-Lee, & Watters, 2019; Topal et al., 2005; Tyson et al., 2020; Underwood, 2015; Wenger, 2010; Yatim et al., 2016) for inclusion in this scoping review (Fig. 1) and are described in the data extraction table (Table 1). Twelve studies were classified as research studies and one study was a quality improvement project (Russell et al., 2019). Articles were published between 1998 and 2020.

The primary objective of all studies was to reduce incidence of CAUTIs. Secondary objectives were to reduce UC usage and/or to reduce duration UC in situ, to assess nurses' perceptions and behaviours for UC removal, and to measure uptake of a nurse-led protocol. All studies took place in the United States, with the exception of two, one from the United Kingdom (Adams et al., 2012) and the other from Singapore (Yatim et al., 2016). No studies were conducted in Australia.

Articles varied in study design: one point prevalence study (Adams et al., 2012); one prospective cohort study (Dumigan et al., 1998); seven observational pre and post intervention studies (Elpern et al., 2009; Johnson et al., 2016; Major-Joynes et al., 2016; Parry et al., 2013; Topal et al., 2005; Underwood, 2015; Yatim et al., 2016); three retrospective studies (Mori, 2014; Tyson et al., 2020; Wenger, 2010) and one quality improvement project (Russell et al., 2019). No randomised controlled trials were identified.

Only one study was conducted across multiple hospital sites (Major-Joynes et al., 2016). Two studies were conducted in all ar-

Table 1
Data extraction table.

Author;year	Study/project Type	Setting & country; sample size	Aims	Intervention type; duration	Outcome measure	Definition of CAUTI; self-evaluation tool	Key findings
Adams et al., 2012	Point prevalence	3 wards (elderly care, gastroenterology, respiratory) small acute general hospital, UK; Not reported	Evaluate nurse-led HOUDINI UC removal protocol reducing days of UC usage and associated risk of CAUTI	Nurse-led early removal; 2-months	E.coli in urine	Nil; Plan-Do-Study-Act	UC use decreased >17%, E.coli decreased 70% in intervention group, 25% in control group
Dumigan et al, 1998	Prospective cohort	3 ICUs, USA; 102	Reduce infection rates in 3 ICUs	Nurse-led UC removal; 18-months	CAUTIs/1000 catheter days	Presence of E.coli or Enterococcus in urine; FOCUS-PDCA	2 of 3 ICUs had significant decreases of 45% and 29% in CAUTI incidence, the third decreased by 17% but not statistically significant
Mori, 2014	Pre/post intervention observational	150 bed community hospital, USA; 389 pre, 282 post	Evaluate effectiveness of a nurse-led removal protocol on incidence, duration of UC use and CAUTI	Nurse-led removal protocol; 6-months	UC usage = catheter days/patient days, Dwell time = catheter days/total patients with catheter, CAUTIs/patients with UC	CAUTI definition given by Gray, M. (2010); Donabedian's model	Reduction in CAUTI from 0.77% to 0.35% (3 cases per 389 patients to 1 case per 282 patients)
Johnson et al, 2016	Pre-/postintervention observational	4 x ICUs, USA; Not reported	Demonstrate the collaborative relationship between academic nurses and clinical nurses in implementing evidence-based nurse-led protocol for decreasing the rate of CAUTIs	Nurse-led orders for UC discontinuation, UC care, education of staff; 16-months	CAUTIs/month, catheter days/month	Nil; ICARE	28% reduction in CAUTIs for all ICUs. CAUTIs reduction 36%, rates of catheter days 11% reduction. CAUTI rates 0.60% pre-intervention, 0.43% post-intervention. CAUTIs detected at 8.9 days pre to 16.5 days post
Major-Joynes et al., 2016	Pre-/postintervention observational	3 urban acute care hospitals, USA; Not reported	Reduce UC utilisation and CAUTI rates	Two options 1) time and condition then nurse can remove UC, 2) provider will assess then provide order for UC removal; 12-months	CAUTIs/1000 catheter days or patient days, UC utilisation rate	CDC CAUTI surveillance criteria; Nil	Hospital 1 - UC utilisation reduction by 6%, reduction in CAUTIs/1000 catheter days 28%. Hospital 2 - CAUTI and UC rates increased. Hospital 3 - no change
Elpern et al, 2009	Pre/post intervention observational	Medical ICU, USA; 337	Reduce CAUTIs by decreasing use of UCs	Nurse-led indications for UC; 6-months	CAUTIs/1000 catheter days	CDC CAUTI surveillance criteria / Nil	4.7 CAUTIs/1000 catheter days pre-intervention, O during intervention phase 6 months ($p < 0.001$). Reduction of 73.1 catheter days per month. ($p = 0.01$)

(*continued on next page*)

Table 1 (*continued*)

Author;year	Study/project Type	Setting & country; sample size	Aims	Intervention type; duration	Outcome measure	Definition of CAUTI; self-evaluation tool	Key findings
Parry et al., 2013	Pre-/postintervention observational	300 bed community teaching hospital, USA; Not reported	Reduce UC use and CAUTIs	Nurse-led UC removal; 36-months	CAUTIs/catheter day (%), CAUTIs/patient days (%)	CDC CAUTI surveillance criteria; Nil	Reduction CAUTIs/catheter day 3.3% per month and CAUTI/patient day 5.29%, 50% reduction in UC use
Russell et al, 2019	Quality Improvement Project	Cardiovascular thoracic stepdown unit, urban academic medical centre, USA; 54 with UCs, 31 met algorithm criteria	Implement a nurse-led, evidence-based CAUTI reduction algorithm for 6 weeks to decrease the risk of CAUTIs and reduce the CAUTI rate by 50% from 4.80 to 2.40 per 1000 catheter days	Daily nurse UC rounds, nurse-led algorithm for UC removal; 6 weeks	CAUTIs/1000 catheter days	CDC CAUTI surveillance criteria; Model for Improvement	37% reduction CAUTI rates, 3.32 CAUTIs/1000 catheter days preintervention, 3.05 CAUTIs/1000 catheter days postintervention
Topal et al, 2005	Pre/post intervention observational	4 general medical units, USA; 164 pre, 81 post	Nil	Physician ordered [1) discontinue the device, 2) UC for 48 hours or 3) maintain UC] or Nurse-led UC removal; 159 days	Device utilisation (catheter days/1000 patient days %), CAUTIs/1000 catheter days	CDC CAUTI surveillance criteria; Nil	CAUTIs decreased 47% (p=0.054), 36 pre to 19 post CAUTIs/1000 days. 81% reduction in UC use
Tyson et al, 2020	Retrospective cohort	Surgical trauma ICU, large tertiary care centre, USA; 11490 catheter- days in 27208 patient days.	Compare CAUTI rate and UC utilisation pre/post nurse-led UC removal	Multimodal CAUTI prevention bundle; 19-month control, 15-month intervention	CAUTIs/1000 catheter days, UC utilisation (catheter days/patient days)	CDC CAUTI surveillance criteria; Nil	59 patients with CAUTI pre-intervention, 16 patients with CAUTI post-intervention, UC utilisation decreased from 0.78 to 0.70 ($p < 0.05$, risk ratio post vs pre 0.89, 95% confidence interval [CI]: 0.86–0.91). CAUTI reduced from 5.1/1000 catheter days to 2.0/1000 catheter days ($p < 0.01$, risk ratio: 0.38 with 95% CI: 0.21–0.65)
Underwood, 2015	Pre-/postintervention observational	Neurosurgical, neurological ICU, USA; 936 pre, 902 post	Evaluate effect of targeted intervention to decrease CAUTIs and UC utilization by implementing quality improvement initiatives	Comprehensive unit-based safety program; 12-months	Catheter days, UC utilisation (catheter days/patient days), number of CAUTIs, CAUTIs/1000 catheter days	CDC CAUTI surveillance criteria / Nil	14% decrease in catheter days ($p = 0.001$), UC utilisation decreased 14% (89% pre to 75% post intervention) ($p = 0.001$), 21 CAUTIs pre to 17 CAUTIs post (19% decrease although not significantly different, $p = 0.95$), CAUTIs/1,000 catheter days (7.6 vs 7.2) ($p = 0.84$) remained unchanged
Wenger, 2010	Retrospective cohort	9 units of Lancaster General Hospital, USA; Not reported	Nil	3-prong model - Education, products, nurse-led UC removal; 2-month pilot, 2-years post	CAUTIs/1000 catheter days	CDC CAUTI surveillance criteria; Plan-Do-Study-Act Model	Statistically significant reduction (2008 & 2009) of 1.23 CAUTIs/1000 catheter days (95% CI, 0.6-1.87, p=0.001). Statistically significant reduction (2007 & 2009) of 1.72 CAUTIs/1000 catheter days (95% CI, 0.68-2.77, p =< 0.001). No statistical significance 2007 & 2008
Yatim et al, 2016	Pre-/postintervention observational	General Medicine Ward (75 beds) at General Hospital, Singapore; Not reported	Evaluate effectiveness of nurse-led removal process in reducing the duration of UC and CAUTI rate	Nurse-led UC removal protocol; 15-months	Catheter days utilisation ratio (total catheter days: total patient days), CAUTIs/1000 catheter days	CDC CAUTI surveillance criteria / Nil	Reduction of 4 CAUTIs/1000 catheter days to 0 CAUTIs/1000 catheter days ($p = 0.06$). Utilisation rate increased from 0.12 to 0.18

eas of a single hospital (Mori, 2014; Parry et al., 2013), five studies were conducted exclusively in intensive care units (Dumigan et al., 1998; Elpern et al., 2009; Johnson et al., 2016; Tyson et al., 2020; Underwood, 2015), and the remainder were conducted in a combination of medical, surgical or intensive care units (Adams et al., 2012; Russell et al., 2019; Topal et al., 2005; Wenger, 2010; Yatim et al., 2016).

There were considerable differences in study duration ranging from 6 weeks (Russell et al., 2019) to 3 years (Parry et al., 2013). Sample sizes ranged from 16 (Tyson et al., 2020) to 1838 (Underwood, 2015) participants and the majority of studies described sample size in terms of total patient days or total catheter days. In seven studies, no sample size was reported. Six articles included a post-study self-evaluation tool for their studies and 11 studies presented the definition of CAUTI they used.

Interventions varied across studies. The intervention for eight articles was exclusively a nurse-led protocol for removal of urinary catheters (Adams et al., 2012; Dumigan et al., 1998; Elpern et al., 2009; Major-Joynes et al., 2016; Mori, 2014; Parry et al., 2013; Russell et al., 2019; Yatim et al., 2016), one integrated a computerised reminder system with a nurse-led protocol (Topal et al., 2005), two articles presented a bundle approach for catheter removal and management (Johnson et al., 2016; Wenger, 2010) and two presented a comprehensive care package for all aspects of urinary catheter care including insertion, catheter care, urinary drainage bag, specimen collection, and removal (Tyson et al., 2020; Underwood, 2015).

Outcome measures and definitions of CAUTIs also varied across studies. Nine articles used CAUTI per 1000 catheter days as an outcome measure; of these, eight used the Center for Disease Control and Prevention (CDC) definition for CAUTIs and one utilised the presence of *Escherichia coli* or *Enterococcus* spp. as the definition of CAUTI. One study utilised CAUTIs/catheter day and CAUTIs/patient days as percentages as the outcome measures and also used the CDC definition of CAUTI (Parry et al., 2013). In one study (Mori, 2014), the number of CAUTIs per patient was used as the outcome measure in combination with a definition of CAUTI as described by Gray (2010). The presence of *Escherichia coli* in urine was the outcome measure in one study (Adams et al., 2012), another used CAUTIs per month and catheter days per month (Johnson et al., 2016); neither of those studies included a definition of CAUTI. Eleven articles described a reduction in CAUTI incidence regardless of the type of intervention however only three studies had results that were statistically significant (Elpern et al., 2009; Tyson et al., 2020; Wenger, 2010); one study did not demonstrate a change in CAUTI (Underwood, 2015) and one study reported an increase in CAUTI incidence (Major-Joynes et al., 2016).

5. Discussion

The aim of this study was to report the evidence for nurse-led practices of removing UCs within the acute healthcare setting and findings from a combination of research studies and a quality improvement project found limitations in methodologies with varied results. There was unclear evidence for use of a particular protocol as results varied depending on differing settings, patient groups, clinicians' behaviours, perceptions, and culture. Twelve studies were classified as research studies based on the definition of research as the systematic investigation aimed at the discovery into and study of materials and sources in order to establish facts and reach new conclusions (Burns & Grove, 2009). One study was a quality improvement project and was included as it used a planned approach and measured outcomes (Russell et al., 2019). Quality assessment of the studies included in scoping reviews is considered contentious (Peterson, Pearce, Ferguson, & Langford, 2017) and after some consideration the team decided against conducting this assessment.

A critical review of each included study identified methodological concerns related to sample size and statistical analyses. Whilst 11 studies displayed a reduction in CAUTI rates, small sample sizes in combination with small incidence rates of CAUTIs per population indicates that due diligence needs to be taken before implementing policy and procedural changes based on the available evidence. While several parameters need to be considered when calculating sample size, justification of sample size is required to determine the level of confidence in sample estimates (Webb, Bain, Page, Kirk, & Sleigh, 2020). No studies included how sample sizes were calculated and the implications of having an inadequate sample size are increasing the margin of error, less conclusive results, increasing the risk of developing a Type II error, falsely confirming a hypothesis when in fact the alternative hypothesis is true and decreasing the power of the study (Delorme, Micheaux, Liquet, & Riou, 2016). From the included studies in this scoping review, the number of participants required to capture an adequate number of CAUTIs to determine the effectiveness of the intervention would be high given the low rate of CAUTI occurrence in the population. The duration of some studies was quite short, or point prevalence data collection utilised, which perhaps did not allow enough time to capture CAUTI events to demonstrate statistical significance.

To gain an adequate sample size, given the frequency of CAUTI events, the duration of a study might be so long as to make it not feasible in the clinical context subject to research fatigue, conflicting priorities and loss of interest in the impact of the study (Clark, 2008). Likewise, if a study proposed is of considerable length, approval might not be granted by the organisation if the cost of the study begins to outweigh the cost benefits of the intervention (Yazdizadeh, Majdzadeh, & Salmasian, 2010). In order to capture a larger sample size, multiple sites may be required, but this relies on cooperation and collaboration between different organisations, which may be difficult to coordinate and it would require consistent practices at each participating site.

Of the included studies, it was noted that no randomised controlled trials or metanalyses existed for the research question. This lack of hierarchical evidence has implications for the robustness of the studies as they can be susceptible to bias and affects the validity of results (Evans, 2003). However, given that hierarchy of evidence is based on the principles of effectiveness, feasibility and appropriateness (Evans, 2003), prospective cohort observational studies may be the best study type to address the research objective as randomised controlled trials may not be clinically or ethically appropriate. For this reason, control data groups may need to be retrospective as having a control and intervention group concurrent may be subject to external influences and bias. Randomised controlled trials may also be considered unethical given the evidence that UCs contribute to the development of CAUTIs.

The use of a specific definition of CAUTI is an important point as six studies did not offer a definition. The use of one definition may capture more or less CAUTI events compared to another definition, which may result in reported CAUTI events differing from actual CAUTI events. This may influence the effectiveness of an intervention that had success based on one definition to a context that utilises a different definition. Depending on the geographical context and the governing bodies responsible for accreditation and funding, the definition may impact the reporting rates to these bodies, which can result in over reporting in surveillance indicators which may be an overestimation of the actual numbers occurring (Shaban et al., 2018). If the organisational definition does not align with the governing body definition of CAUTI, this also can result in erroneous reporting of data (Shaban et al., 2018). The majority of the studies were conducted in the United States and this is likely due to the long-standing existence of penalties for organisations for CAUTIs as they are considered a preventable condition (Wald & Kramer, 2007). There were no studies undertaken in Australia, which may limit the generalisability of protocols used overseas to an Australian healthcare context.

The variation in settings may have an impact on the use of the interventions in settings that are different to where the studies were conducted. Intensive care units tend to have 1:1 or 1:2 nurse to patient ratios compared to acute wards which can range from 1:4 to 8 patients depending on public or private setting, workforce enterprise bargaining agreements and legislation (Safe Patient Care (Nurse to Patient and Midwife to Patient Ratios) Act, 2015; Safe Patient Care (Nurse to Patient and Midwife to Patient Ratios) Amendment Act, 2020). The net result of these variations in ratios and settings is the nursing time spent for involvement in each patient's care. The specialised training of nurses in these different settings will vary and potentially influence the knowledge and expertise of the nurse caring for the patient and may result in a greater awareness of symptoms and complications associated with UCs (Tyson et al., 2020). Busier work environments combined with higher patient to nurse ratios, patients at different stages of their care, patients who can advocate for themselves or patients who rely on staff to advocate on their behalf, the clinical condition of the patient, and cognitive ability of patients, can all affect the timing of when a UC is removed. These factors, combined with the environment, experience and focus of nurses, may affect confidence and autonomy, behaviours and knowledge, which all are contributing factors to the effectiveness of an intervention being introduced (Atkins et al., 2020).

While most of the studies displayed results with a reduction in CAUTI rates, there were no convincing results that favoured any particular intervention type. There were no discernible differences between comprehensive bundles or nurse-led protocol by itself in terms of reduction of CAUTIs, although given the methods of implementation of the nurse-led protocol, it is possible that bringing the focus of UC to the forefront of nurses' practice might mean that the other aspects of UC care and maintenance are also improved indirectly. Likewise, the analysis of this review was not able to distinguish which components of the comprehensive bundles had the most significant impact. Therefore, if policy makers were to adopt a comprehensive approach, the bundle would likely have to be implemented in its entirety to ensure the best possible outcomes. Given there were no statistically significant results, this poses difficulty choosing which strategy to implement.

The final observation of this review was the absence of qualitative data and the experience of the consumers. While some articles included an evaluation post intervention (Adams et al., 2012; Dumigan et al., 1998; Johnson et al., 2016; Mori, 2014; Russell et al., 2019; Wenger, 2010), most did not present follow-up data. Evaluation of a study allows for reflection on possible changes to future interventions, allows for policies to be fine-tuned and changed to allow for problems noted during the intervention period (Atkins et al., 2020). Utilising evaluation tools presents an opportunity to take into consideration the human aspects of nurses' behaviour and perceptions and whether the intervention is something that can be maintained in the long term. It is not uncommon for performance and key performance indicators to slip when not under the scrutiny of direct observation; evaluation tools can assist in developing recommendations to ensure that compliance continues to occur after the observers have left.

6. Limitations

While the initial screening may have the potential for the inclusion of selection bias as titles and abstracts were screened by one author and thus a limitation of this review, however, it was conducted under the supervision of the other experienced team members. The inclusion of quality improvement projects, while accepted in scoping reviews, may limit the outcomes to specific clinical settings and may not be generalisable to a broader context. Only one of the 13 studies included was conducted over multiple sites, the others were at a single site and this is a limitation of those studies.

7. Conclusion

There is limited quality evidence for a nurse-led catheter removal protocol associated with reducing incidence of CAUTIs, however noting the methodological limitations identified, caution needs to be taken in the interpretation of these results to inform practice. Results can vary substantially depending on the setting, patient groups, clinicians' behaviours, perceptions, and culture. The definition of CAUTI used may affect the results by over or under reporting CAUTI events, which may have a substantial impact if the reported data leads to financial penalties to organisations, therefore it is important to choose the protocol carefully that is in line with an evidence based standardised definition. The significance of CAUTIs cannot be underestimated, as the impacts reach patients, consumers, organisations, and governments.

Authorship contribution statement

All authors reviewed and approved the manuscript.

Ethical statement

An ethical statement is not applicable as no human or animal research was undertaken.

Conflict of interest

None.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.colegn.2022.08.008.

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