Catheter-associated urinary tract infection (CAUTI) prevention and nurses' checklist documentation of their indwelling catheter management practices

Te Ārai Pokenga Ia Tōnga Mimi i takea mai i te ngongo rerenga wai (CAUTI) me ngā Tuhinga Rārangi Whakamahara Tapuhi mō ā rātou Ritenga Whakahaere Rerenga Wai Noho Tūmau

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Abstract

The purpose of this study was to investigate through an audit, nurses' catheter management practices as documented in a newly introduced self-administered indwelling catheter management checklist that incorporated four components of catheter care in a catheter-associated urinary tract infection (CAUTI) prevention bundle. The components of the bundle of care are: minimising inappropriate catheter use, aseptic insertion of catheters, catheter maintenance based on guidelines, and ongoing review and evaluation of catheter necessity. Implementation of these care components significantly decreased bacteriuria rates and CAUTI when put together in standardised clinical checklists and performed collectively by nurses. A quantitative research design, as part of a mixed methods research that investigated the impact of a CAUTI education package on nurses' knowledge and indwelling catheter management practices, was used for this study. The study was conducted at two surgical wards in a public hospital

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Ngā Ariā Matua

Te whāinga matua ia o tēnei rangahau he tūhura, mā tētahi arotake, i ngā ritenga whakahaere rerenga wahi a ngā tapuhi kua tuhia ki tētahi rarangi whakamahara whakahaere rerenga wai noho tūmau, mā te tapuhi e āta tirotiro, kātahi anō ka whakaputaina ki te ao mahi, kei roto nei ētahi wehenga e whā o te tiaki rerenga wai i roto i tētahi pōkai ārai pokenga ia tōnga mimi i takea mai i te rerenga wai. Ko ngā āhuatanga o roto i te pōkai taurimatanga he: whakaheke rawa i te whakamahi hē i te rerenga wai, te whakauru para-kore i te rerenga-wai ki roto i te tinana, te tiaki pai i te rerenga wai kia hāngai tonu ki ngā aratohu me te arotake pūputu i ngā rerenga wai me te tika o ngā pūtake i whakamahia ai. Nā te whakatinanatanga o ēnei āhuatanga taurima i whakaheke te putanga o ngā pokenga mimi me te CAUTI ina kawea ngātahitia i roto i ngā rārangi whakamahara taurima tūroro, ina kawea tahitia hoki e ngā tapuhi. I whakamahia he hoahoa rangahau tatau, hei wāhi hoki o tētahi rangahau tikanga hanumi i tūhuratia ai te pānga o tētahi mōkihi mātauranga CAUTI mō te mātauranga o ngā tapuhi me ngā ritenga whakahaere rerenga wai noho tūmau, mō tēnei tirohanga. I kawea te rangahau nei i ētahi wāhanga tūroro hāparapara i tētahi hōhipera tūmatanui i Tāmakimakaurau. E rima tekau ngā tapuhi

in Auckland. Fifty nurses completed 175 checklists. Thirty-one percent (n=54) showed that all evidence-based practices in the bundle of care were performed and documented by the nurses. The remaining checklists indicated that nurses did not perform some components of the bundle of care for unknown reasons. The findings were of sub-optimal performance of evidence-based catheter management practices by nurses. Whether this is a reflection of poor documentation or poor practice is not known. Catheter management practices impact on CAUTI prevention efforts when performed consistently as a bundle of care across all four components outlined in the checklist. Recommendations from this research include regular in-service education, complete and accurate documentation of care using the catheter maintenance checklist, regular audit of checklist use, and further research with a larger sample size.

nāna i whakaoti i ngā rārangi whakamahara 175. Toru tekau mā tahi (n=54) ōrau i whakaahua ko ngā ritenga mahi i taunakitia i te pōkai taurimatanga i āta kawea, i āta tuhia hoki e ngā tapuhi. I te nuinga atu o nga rārangi whakamahara i kitea kāore ētahi o ngā tapuhi i mahi i ētahi o ngā wae o te pōkai taurimatanga, tē mōhiotia hoki te take.E ai ki ngā kitenga kāore i eke ki ngā taumata e tika ana ngā ritenga whakahaere rerenga wai i tautokona e ngā taunakitanga, o ngā tapuhi. Kāore i te mōhiotia mehemea he hua tēnei o te tuhinga ngoikore, kua hē rānei ngā whakahaere. Ka pā ngā ritenga whakahaere rerenga wai ki ngā mahi ārai CAUTI ina kawea ōritetia hei pōkai taurimatanga, puta noa i ngā wae e whā e puta ana i te rarangi whakamahara. Ko ētahi o ngā tohutohu mai i tēnei rangahau ko te akoranga pūputu i roto i te wāhi mahi, te āta tuhi i te katoa o ngā taurimatanga kia tika mā te whakamahi i te rārangi whakamahara mō te tiaki rerenga wai, te arotake pūputu i te whakamahinga rārangi whakamahara, me te hiahia kia haere tonu ngā rangahau me tētahi haonga tirohanga rahi kē atu.

Keywords / Ngā kupu matua

catheter-associated urinary tract infection / pokenga ia tōnga mimi i takea mai i te ngongo rerenga wai; infection prevention / te ārai pokenga; checklist /rārangi whakamahara; documentation / tuhinga; indwelling catheter management / whakahaere rerenga wai noho tūmau; bundle of care/ te pōkai taurimatanga

Introduction

Nurses' compliance with infection prevention and control practice is vital in preventing healthcare-associated infections (HAI). The most common HAI worldwide is catheter-associated urinary tract infection (CAUTI) (Siddiq & Darouiche, 2012). Urinary tract infections (UTI) account for 40% of HAIs and 80% of these UTIs are attributed to indwelling catheters (Weber et al., 2011). Scientific evidence on effective CAUTI prevention deals primarily with avoiding prolonged catheter use (Mohajer & Darouiche, 2013). Avoiding unnecessary insertion of urinary catheters can also play a major role in CAUTI prevention (Gould et al., 2009; Lo et al., 2014). Catheter insertion and maintenance which include cleaning and other routine cares are some of the various nursing responsibilities related to catheter management (Alexaitis & Broome, 2014). These responsibilities place nurses at the forefront of CAUTI prevention (Meddings & Saint, 2011).

Literature review

The definition of CAUTI varies around the world. The more commonly used definition describes CAUTI as urinary tract infection in a person with an indwelling catheter for more than two days and at least one definite sign of UTI such as fever (> 38^0C), suprapubic tenderness, costovertebral angle pain, and a urine culture positive for no more than two microorganisms (Centers for Disease Control (CDC), 2015). It is therefore important for clinicians to ascertain the presence of an indwelling catheter, to assess for symptoms of CAUTI and to send a urine sample to the laboratory for proper identification of microorganisms.

The primary risk factor for CAUTI is prolonged catheter use (Mohajer & Darouiche, 2013). When the catheter is in place, the daily bacteriuria risk is about three to seven percent (Rebmann & Greene, 2010). When the catheter remains for a month, the risk increases to nearly 100% (Institute for Healthcare Improvement, 2011). Among those with bacteriuria, 10% will most likely develop CAUTI while 3% may progress to bloodstream infection (Institute for Healthcare Improvement, 2011).

The inappropriate use of indwelling urinary catheters is both a mechanical and physiologic risk to patients. These risks can be minimised by avoiding unnecessary insertion of catheters and by shortening the duration of catheter use particularly in patients with higher CAUTI risk such as women, elderly and immunocompromised (Gould et al., 2009; Lo et al., 2014). Other evidence-based strategies to prevent CAUTI include strict compliance to hand hygiene (Boyce & Pittet, 2002), early catheter removal in uncomplicated surgeries, use of catheter alternatives, use of asepsis on catheter insertion and maintenance (Chenoweth & Saint, 2013), maintenance of a closed drainage system, maintenance of unobstructed urine flow, and proper training of persons responsible for catheter insertion (Rebmann & Greene, 2010). These evidence-based strategies, when grouped together, form a bundle of care to prevent CAUTI.

A bundle of care is a structured method of improving patient care processes which includes a group of three to five evidence-based practices that when performed consistently and collectively can have a positive impact on patient outcomes (Resar, Griffin, Haraden, & Nolan, 2012). Strategies to prevent CAUTI identified in the literature can be summarised into four components of catheter care grouped together as a bundle of care, namely: minimising inappropriate catheter use, aseptic insertion of catheters, catheter maintenance based on guidelines, and ongoing review and evaluation of catheter necessity (Institute for Healthcare Improvement, 2011).

Implementing successful change in clinical practice requires multifaceted interventions (Boaz, Baeza, & Fraser, 2011). Multifaceted interventions released by the CDC to prevent CAUTI include nurse-focused education and guidelines and the use of daily catheter checklist and decision-making algorithm (Gould et al., 2009). Evidence indicates that use of standardised checklists for appropriate catheter care significantly decreased unspecified UTI and bacteriuria rates (Dilek et al., 2012; Gould et al., 2009).

Various literature on CAUTI prevention and surveillance has been published in other countries. In New Zealand, national reporting of CAUTI is yet to be undertaken. Although HAIs are mapped as indicators of a system-level measure of adverse events; HAIs, including CAUTI, require further work regarding the availability and understanding of local and national data (Health Quality & Safety Commission, 2012). Various district health boards in New Zealand have started to look at their CAUTI incidence rates. The baseline CAUTI rate for one district health board was at 26.1/1000 catheter days across the medical, surgical and rehabilitation wards and urinary source of infection accounted for 25-30% of nosocomial bloodstream infections (Bhally et al., 2014). Unpublished surveillance data from the research setting of this study indicate CAUTI as a source of 8-10% of the bloodstream infections reported over

a two-year period. These documented cases represent the tip of the iceberg because this district health board is yet to start an organisation-wide CAUTI surveillance and prevention program.

The need to review catheter management practices as possible risk factors for CAUTI served as an impetus for the conduct of this research. The purpose of this study was to investigate, through an audit, nurses' catheter management practices as documented in a newly introduced self-administered indwelling catheter management checklist that incorporated the four components of catheter care in a CAUTI prevention bundle.

Research design

This quantitative research is part of a mixed methods study that investigated the impact of a CAUTI education package on nurses' knowledge and indwelling catheter management practices. Fifty nurses (n=50) were eligible to participate in the study. Thirteen (n=13) nurses participated in the focus group interviews where nurses' baseline knowledge and catheter care practices were initially gathered. Misconceptions and catheter care issues identified in the focus groups were addressed in the intervention phase. The intervention involved educating nurses on evidence-based strategies that utilised multi-faceted teaching methods such as a brief lecture, an interactive question and answer session, the introduction of a new catheter management algorithm, a factsheet, and a CAUTI prevention flowchart, and the use of posters and checklists to prevent CAUTI. Fourteen (n=14) nurses participated in the complete education package and their knowledge was evaluated with the use of a post-test. Findings showed that the CAUTI education package had a significant impact ($p < 0.0001$) on the nurses' overall knowledge of CAUTI prevention and on each of the four catheter care components ($p < .05$) (Gesmundo, 2016). Brief instructions on checklist use were provided during handovers to the remaining 36 nurses. These nurses were also given CAUTI prevention factsheets and had access to CAUTI prevention posters found in strategic areas of the ward. This study focuses on the nurses' post-intervention indwelling catheter management practices measured with the use of a self-administered indwelling catheter management checklist.

Setting

The study was conducted at two surgical wards within one public hospital in Auckland, New Zealand. The hospital provides multi-disciplinary inpatient day-surgery services and elective and acute planned surgery for patients who do not require intensive care. Post-operative patients include those who had general, orthopaedic, colorectal, breast, plastic and gynaecological procedures. Most of these patients continued to have indwelling catheters several hours after surgery**.** These wards were chosen based on the 2009 CDC recommendation that highlights catheter removal within 24 hours for uncomplicated surgeries, unless catheter indication was documented (Gould et al., 2009; Institute for Healthcare Improvement, 2011). The district health board that covers this hospital has two sets of policies on catheter management that nurses can access. These polices were developed by two different hospital services, with both lacking in vital information and requiring an update at the time of the study.

Sampling

Data was gathered from the checklists completed by a convenience sample of all nurses (n=50) working at the two surgical wards. Participant recruitment involved approaching charge nurse managers and discussing the importance and methods of the study. The researcher was known to the study participants due to her role as an infection preventionist, thus, to avoid bias and conflict of interest, the nurse managers were approached for the purpose of participant recruitment. Participant recruitment involved sending out general research invitation e-mails to all nurses employed on the two wards and distribution of flyers, participant information sheets and consent forms.

All nurses working with patients (n=50), regardless of length of nursing experience or experience with indwelling catheter care, were eligible for participation in the study. When working with patients, New Zealand nurses are expected to maintain infection control principles in promoting patient safety as stated in competency 1.4 of the domain of professional responsibility for registered nurses (Nursing Council of New Zealand, 2012).

Data gathering tool

Data was gathered using the self-administered Daily Urinary Catheter Maintenance Checklist (Figure 1) adopted from CDC evidence-based guidelines implemented in various hospitals all over the US (Gould et al., 2009) and developed for use in this research. A checklist is a two-dimensional arrangement of statements and responses (Polit & Beck, 2012). The advantages of using checklists include efficiency, ease of use, absence of interviewer bias and that they serve as procedure prompts for nurses in clinical areas (Fuchs et al., 2011; Polit & Beck, 2012).

Nurses were educated on how to use the new checklist during the pre-intervention phase. The checklist contains procedure-specific evidence-based care practices under sub-headings that reflect the components of a CAUTI prevention bundle. The checklist sub-headings are: appropriate catheter indications, hand hygiene, catheter insertion technique, catheter maintenance, and catheter removal. Nurses are expected to perform these practices consistently and collectively to prevent CAUTI. The checklist contains tick boxes next to the evidence-based care practices to indicate whether nurses performed the practices or not, or whether the practice is not applicable. Nurses completed parts of the checklist that were relevant to a specific nurse-patient interaction. Each of the checklist subheadings are explained further below.

Appropriate catheter indications

Appropriate catheter indications relate to minimising inappropriate catheter use as a component of the CAUTI prevention bundle. Appropriate catheter indications include: acute urinary retention or urinary obstruction, the requirement for accurate urine output measurement in critically ill patients, prolonged immobilisation, to assist in the healing of open sacral or perineal wounds, end of life care, perioperative use for selected surgical procedures, such as for urologic surgery or surgery of adjoining structures, surgical procedure of more than three 3 hours, intra-operative monitoring of urine output, and intra-operative administration of large-volume infusions or diuretics (Gould et al., 2009).

Hand hygiene

Hand hygiene relates to the catheter insertion, maintenance and catheter removal component of the CAUTI prevention bundle. Hand hygiene is required to be performed before and after catheter insertion, before and after catheter manipulation and after catheter removal as part of standard precautions.

Insertion technique

Appropriate catheter insertion technique relates to aseptic insertion of catheters as a component of the CAUTI prevention bundle. The recommended catheter insertion practices include: use of sterile equipment (including sterile gloves, drape, sponges and antiseptic solution), use of aseptic technique to insert catheter, replacing the catheter and collecting bag with sterile equipment if aseptic technique was broken, use of single-use lubricant jelly packet for insertion, and securing the catheter to prevent movement and urethral traction.

Catheter maintenance

Catheter maintenance relates to the evidence-based catheter maintenance component of the CAUTI prevention bundle which include: keeping the collecting bag below the level of bladder at all times, checking the tubing frequently for kinking, keeping the urine collecting bag off the floor at all times, maintaining a closed-drainage system, regular emptying of the urine collecting bag, using a separate clean urine collecting

Figure 1: Daily Urinary Catheter Maintenance Checklist

Daily Urinary Catheter Maintenance Checklist

Instruction: Please read each statement carefully and tick the appropriate answer. **All participants are assured that your answers to this checklist will be treated with strictest confidentiality and you will not be identified in any way.**

Thank you very much for your participation.

Components of Care to Prevent Catheter-associated Urinary Tract Infection (CAUTI)	YES	NO	Not Applicable
Appropriate Catheter Indications • Patient meets at least one of appropriate catheter indications*			
Hand Hygiene • Hand hygiene before catheter insertion			
• Hand hygiene after catheter insertion			
• Hand hygiene before catheter manipulation			
• Hand hygiene after catheter manipulation			
Insertion Technique • Use sterile equipment including sterile gloves, drape, sponges and antiseptic solution			
• Use aseptic technique to insert catheter. If aseptic technique is broken, replace catheter and collecting bag with sterile equipment			
• Use single-use packet of lubricant jelly for insertion			
• Secure catheter to prevent movement and urethral traction			
Catheter Maintenance • Collecting bag below level of bladder at all times			
• Tubing checked frequently for kinking			
• Urine collecting bag off the floor at all times			
• Closed-drainage system maintained			
• Urine collecting bag emptied regularly			
• Used separate clean urine collecting jug for each patient			
• Contact of drainage spigot with collecting jug is avoided when collecting urine			
• Routine hygiene, i.e., cleansing of peri-urethral area done during daily bathing or showering			
Catheter Removal • Catheter need assessed daily			
• Standard precaution used during catheter removal			
• Catheter removed Date removed: _____ Removed by: _____ Signature			

* Appropriate catheter indications: acute urinary retention or urinary obstruction, accurate urine output measurement in critically ill patients, prolonged immobilisation required, to assist in healing of open sacral or perineal wounds, end of life care, perioperative use for selected surgical procedures, e.g. for urologic surgery or surgery of adjoining structures, surgical procedure > 3 hours, intra-operative monitoring of urine output, and intra-operative administration of large-volume infusions or diuretics

jug for each patient, avoiding contact of the catheter drainage spigot with the collecting jug, and peri-urethral cleaning during daily bathing or showering.

Catheter removal

The catheter removal subheading relates to the ongoing review and evaluation of catheter necessity as a component of the CAUTI prevention bundle. The recommended practices include: daily catheter assessment, prompt removal of indwelling catheter, and use of standard precautions during catheter removal.

CAUTI prevention flowchart

A CAUTI prevention flowchart can also be found at the back of the checklist (Figure 2). The flowchart shows a decision-making tree for the proper management of catheters.

Data collection procedure and data analysis

The checklists were collected once a week from June to September 2014, for a total of 15 weeks. The checklists were strategically placed at the ward work station for the purpose of visibility and were replenished by the charge nurse managers as needed. Nurses attached the checklist to the clinical notes of patients who required an indwelling catheter or who were admitted to the ward with an indwelling catheter. The checklists were then removed from the clinical notes by the nurses or the ward clerk and placed in a tray for collection by the researcher when the patient was discharged. The study did not gather patient information, thus, no identifying patient data appeared on any of the checklists. Data collation was done immediately after the checklists were collected. Data was entered straight from the checklist into Microsoft Excel worksheet. Data analysis was undertaken after the data gathering phase. Frequency counts and percentages were utilised to describe data derived from the checklist.

Ethical considerations

Ethical approval was sought from the District Health Board Research Committee and the University of Auckland Human Participants Ethics Committee. The study was approved on February 25, 2014 for three years. The study adhered to the principle of beneficence by ensuring that the research participants gained knowledge through this study; principle of respect for human dignity, by protecting the participants' right to make informed decisions; principle of veracity, by fully disclosing the nature of the study; and principle of justice, through fair treatment and protection of confidentiality of information. The study did not gather patient information, thus, consent from the patients was not obtained.

Findings

One-hundred and seventy-five (175) Daily Urinary Catheter Maintenance Checklists were collected by the researcher. Of the 175 checklists, only 54 (31%) showed that all evidence-based practices in the bundle of care were performed by the nurses; 38 (22%) had a partially completed performance of evidence-based practices with the hand hygiene, catheter insertion, maintenance, and removal completed; 52 (30%) indicated that nurses performed the catheter maintenance and removal component; 16 (9%) indicated that nurses performed only the catheter maintenance component; 13 (7%) indicated that nurses performed only the catheter removal component; and, two (1%) indicated that nurses performed only the catheter insertion component. Thirty-five (20%) checklists were not signed and dated. Table 1 summarises the nurses' indwelling catheter care practices as documented in the Daily Urinary Catheter Maintenance Checklist.

Findings from this audit showed that 104 (59%) catheters were inserted in the operating room, with 103 of the catheters inserted by nurses and one inserted by a

Figure 2: CAUTI Prevention Flowchart

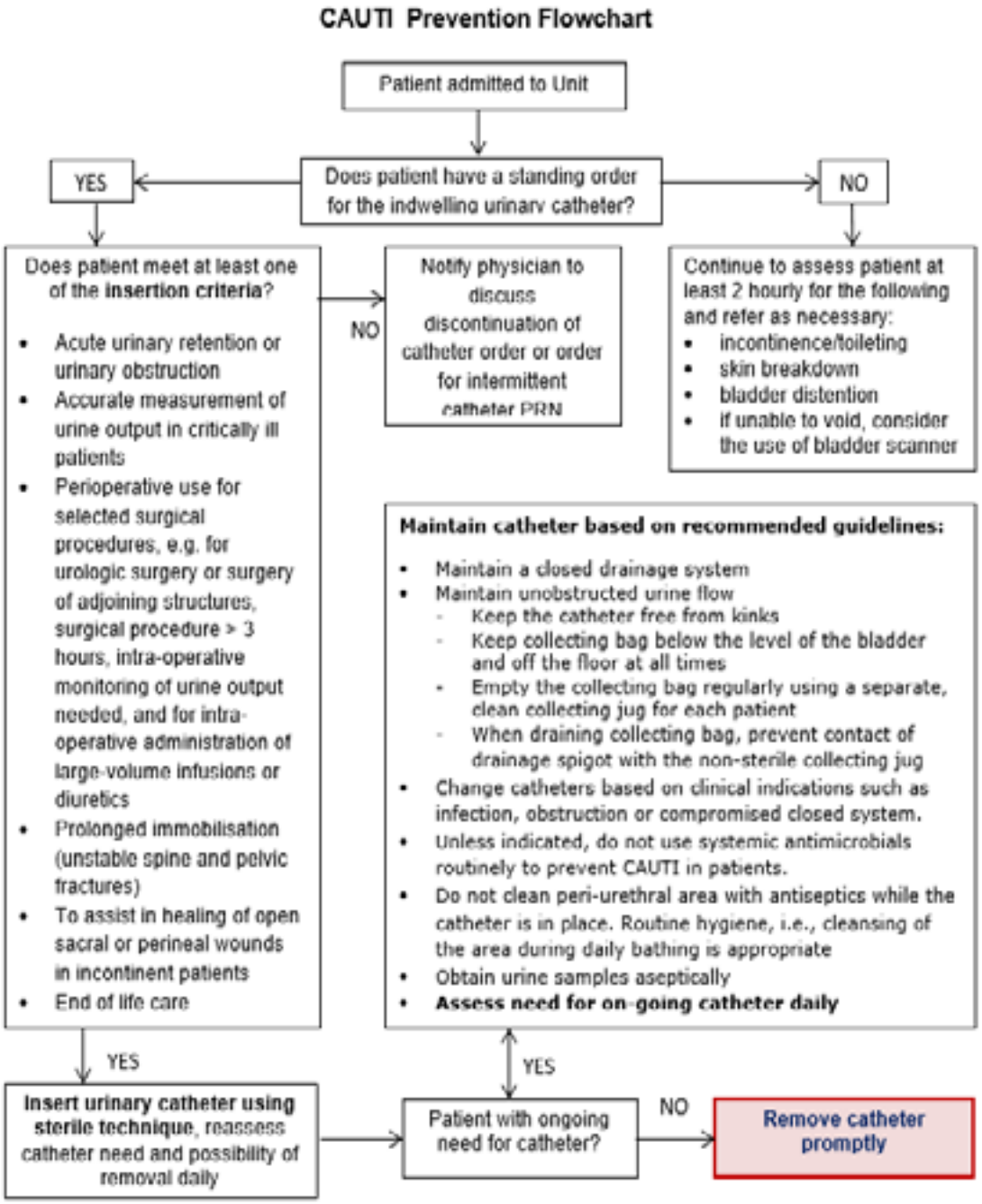

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Table 1: Summary of indwelling catheter care practices documented in the Daily Urinary Catheter Maintenance Checklist

Documentation Status	Component Performed by Nurse	Number	Percent
Complete Documentation	Appropriate catheter indications; hand hygiene; catheter insertion, maintenance and removal, Signed	54	31
Partially Complete (hand hygiene, catheter insertion, maintenance and removal only)	Hand hygiene, Catheter Insertion, Maintenance, Removal, Signed	25	14
	Hand hygiene, Catheter Insertion, Maintenance, Removal, Not Signed	13	8
Partially Complete (catheter maintenance and removal only)	Catheter Maintenance, Removal, Signed *	44	25
	Catheter Maintenance, Removal, Not Signed	8	5
Partially Complete (catheter maintenance only)	Catheter Maintenance, Signed	4	2
	Catheter Maintenance, Not Signed **	12	7
Partially Complete (catheter removal only)	Catheter Removal, Signed	13	7
	Catheter Removal, Not Signed	0	0
Partially Complete (catheter insertion only)	Catheter Insertion, Signed	0	0
	Catheter Insertion, Not Signed	2	1
Total		**175**	**100**

* Routine hygiene not ticked in ten checklists; hand hygiene ticked in five checklists; appropriate catheter indications ticked in three checklists

** Two patients discharged with an IDC; routine hygiene not ticked in seven checklists; hand hygiene and appropriate catheter indications ticked in four checklists

doctor. Of the 175 checklists, only 101 (58%) indicated that hand hygiene had been performed by the nurses. Nurses documented that they performed evidence-based recommendations that pertain to catheter insertion and maintenance. This indicates that during catheter insertion nurses observed aseptic technique, utilised sterile equipment, utilised a single-use packet of lubricant, and secured the catheter to prevent movement. Furthermore, nurses documented that during catheter maintenance, they ensured that the catheter bag was below the bladder and off the floor at all times, there was no kinking of the catheter tubing, the collecting bag was emptied regularly, a closed-drainage system was maintained at all times, and a clean urine collecting jug was used for each patient at all times. However, not everyone who completed the catheter maintenance part of the checklist indicated that routine hand hygiene was performed.

In addition to this, the checklists indicated that nurses assessed the need for catheter removal and that standard precautions were used. Documentation showed that 157 out of 175 (90%) indwelling catheters were removed. Of these, 144 (82%) had the appropriate date of removal and nurse's signature. On examination, all 144 patients had their catheters removed within 24 hours of surgery. While two patients were documented to have been discharged home with catheters, what happened to the other 16 catheters was not known due to lack of documentation.

The number of checklists completed by the nurses dwindled as the study period reached its fourth month. In the first four weeks of data collection, the researcher collected 12 to 16 checklists per week. The number declined further in the succeeding weeks until only eight checklists were gathered on the final week of data collection.

Discussion

Indwelling catheter management represents a continuum of care with four components: reduce inappropriate use of urinary catheters, perform proper techniques for indwelling catheter insertion, implement proper catheter maintenance procedures, and remove catheters in a timely manner. These components are inter-related and represent the entirety of proper catheter management to prevent CAUTI (Gould et al., 2009; Institute for Healthcare Improvement, 2011; Meddings & Saint, 2011). The findings from this audit will be discussed in relation to each of the four components.

Avoidance of unnecessary urinary catheter use is the most important strategy to prevent CAUTI (Meddings et al., 2013), thus, nurses should be aware of appropriate catheter indications. Nurses' performance of the catheter insertion component shows that sterile equipment was used, sterile technique was observed and the catheter was secured to minimise movement and urethral traction after insertion. Adherence to these recommendations indicate best practice for catheter insertion (Institute for Healthcare Improvement, 2011; Lo et al., 2014). Nurses' performance of the catheter maintenance component shows that the catheter bag was below the bladder and off the floor, there was no catheter tube kinking, the collecting bag was emptied regularly, a closed-drainage system was maintained, and a clean urine collecting jug was used for each patient. Adherence to these recommendations indicate best practice in catheter maintenance (Institute for Healthcare Improvement, 2011; Lo et al., 2014).

Education and training of all healthcare professionals involved in catheter insertion, regardless of the setting, is necessary. The findings from this audit showed that a substantial number of catheters were inserted in the operating room and not in the ward where this study was

conducted. This implies that for quality improvement to occur, education and training of all those involved in catheter care, including those in operating rooms, should be involved (Institute for Healthcare Improvement, 2011; Lo et al., 2014; Meddings et al., 2013). The majority of catheters (103) were inserted by nurses, with just one checklist specifying that the catheter was inserted by a doctor. Literature recommends involving doctors in quality improvement measures related to catheter care (Institute for Healthcare Improvement, 2011; Lo et al., 2014; Meddings et al., 2013). These recommendations support the collaborative nature of urinary catheter management (Gould et al., 2009; Meddings & Saint, 2011).

In accordance with the evidenced-based recommendations, the audit findings indicated the majority of indwelling catheters (82%) were removed within 24 hours of surgery and the checklists had the appropriate date of removal and signature. Nurses assessed the patient's catheter need daily and standard precautions were utilised for each catheter removal. These are consistent with evidence-based recommendations which indicate documentation of appropriate catheter indications, daily assessment of catheter need and prompt catheter removal using standard precautions, preferably within 24 hours after an uncomplicated surgery (Institute for Healthcare Improvement, 2011; Lo et al., 2014).

According to the audit findings, two patients were discharged with an indwelling catheter. There was no documentation of why the catheter was not removed and if the catheter was for long term use. Best practice recommends early catheter removal (Gould et al., 2009; Lo et al., 2014). However, for long-term indwelling catheters, it is not certain whether catheters used for short-term purposes in acute-care settings are also suitable for long-term use. Further research is needed of the use of optimal catheter materials as long-term catheters are prone to frequent obstructions (Gould et al., 2009; Lo et al., 2014). Further research is also recommended for alternative methods of urinary drainage, including intermittent catheterisation, external catheters, and suprapubic catheters (Gould et al., 2009; Lo et al., 2014). Sixteen of the catheters inserted during the study period were unaccounted for, that is, there was no documentation as to whether the catheters were removed or not. This is alarming because it is an indication of poor clinical documentation and potentially, of poor patient care. Proper documentation is necessary for continuity of care. Proper documentation also enhances collaborative care as it facilitates communication among health care workers (Berman, Snyder, Kozier, & Erb, 2008). Collaborative catheter care is effective in preventing CAUTI (Gould et al., 2009; Meddings et al., 2013). Furthermore, when catheters are unaccounted for, patients run the risk of possible exposure to prolonged catheter use, a major risk factor for CAUTI. The strongest predictor of CAUTI development is the length of time a urinary catheter is in place (Gould et al., 2009). When the catheter stays for a week, the patient runs a 25% chance of developing bacteriuria (Institute for Healthcare Improvement, 2011). Bacteriuria may lead to lethal complications such as nosocomial blood stream infection (Centers for Disease Control, 2013; Gould et al., 2009; Lo et al., 2008).

Audit results showed that only half of the number of checklists provided evidence of hand hygiene performance during catheter management. Whether this a true indicator of poor hand hygiene during catheter care or an indicator of poor documentation is not known. Hand hygiene is the single most important measure that would prevent cross transmission of infections in the hospital setting (Grayson et al., 2008; Pittet et al., 2000). Evidence suggests that a substantial proportion of hospital acquired infections such as CAUTI can be effectively and efficiently prevented by improving hand hygiene practice among healthcare workers (Grayson et al., 2008; Pittet et al., 2000). Lack of hand hygiene indicates poor quality of patient care.

The number of checklists completed by the nurses declined in the later weeks of the audit. This observation is consistent with literature that recommends interventions such as continuous in-service education, standardisation of checklists and real-time feedback to sustain compliance to evidence-based guidelines, if they are to be an effective tool in infection prevention (Gurses et al., 2008).

The findings of the study also highlighted poor documentation of nursing care. Apart from not completing some components of the checklist, some of the checklists were also not signed and dated. This indicates non-adherence to documentation standards which is a concern expressed in various literature (Dailly, 2012; Malki et al., 2014). The lack of, or poor quality, documentation makes monitoring of catheter care very resource intensive (Meddings et al., 2013). Documentation provides evidence that nursing care has been performed as a necessary aspect of patient care and is a legal responsibility of the nurse. Documentation facilitates communication within the health team, aids in planning and auditing of care, demonstrates accountability and is a valuable source of information for research and legal processes (Crisp, Taylor, Douglas, & Rebeiro, 2013). New Zealand nurses are expected to ensure that their nursing care documentation is clear, concise, timely, accurate and current as stated in competency 2.3 of the domain of management of nursing care (Nursing Council of New Zealand, 2012). Nurses in this study were made aware that complete documentation was essential to the continuity of care (Gesmundo, 2016), however, this was not reflected in their actual practice. Proper documentation of catheter care for quality improvement purposes is part of the guidelines on CAUTI prevention (Gould et al., 2009; Institute for Healthcare Improvement, 2011; Lo et al., 2014). Incomplete documentation of care thus is a concern. Several factors affect the quality of nursing documentation including the level of staffing and education and training of nurses (Wang, Hailey, & Yu, 2011; Blake-Mowatt, Lindo, & Bennett, 2013). Increased training and continued monitoring of documentation of care is therefore recommended (Lindo et al., 2016).

Limitations

The actual number of patients with catheters during the study period and the CAUTI rate was not obtained because this is not the focus of the study. It would benefit future research if the CAUTI rate and the actual number of patients with catheters during the study period was obtained so that the information can be used to compute the checklist completion rate.

Another limitation of the study is the use of a self-administered checklist which may be affected by under- or over-reporting of care practices thereby making it biased. The checklist design can also be improved further. Nurses recommended that a more compact checklist should be developed for patients whose catheter needs to remain for a longer period of time.

Recommendations

There is a need to implement continuous in-service nursing education about the evidence-based CAUTI prevention bundle and about complete and accurate documentation using the catheter maintenance checklist for it to be effective in CAUTI prevention. Regular audit of checklist use is also recommended to ensure nurses' compliance to evidence-based practice. Finally, further research with a bigger sample size should be done on the effectiveness of checklist use in catheter management and CAUTI prevention.

Importance in Nursing Practice

This study showed the need to reinforce CAUTI prevention strategies that are already in place either as single interventions or as components of a bundle of care. Catheter management practices can only impact on CAUTI prevention efforts when performed consistently across the four evidence-based components of catheter

care. This study also showed the importance of complete and accurate documentation of indwelling catheter management practices with the use of a self-administered checklist in CAUTI prevention.

Conclusion

In conclusion, audit of the self-administered indwelling catheter maintenance checklist showed sub-optimal performance of evidence-based catheter management practices by the nurses. Whether this is a reflection of poor documentation or poor practice is not known. Catheter management practices impact on CAUTI prevention efforts when performed consistently as a bundle of care across all four components outlined in the checklist, namely: minimising inappropriate catheter use, aseptic insertion of catheters, catheter maintenance based on guidelines, and ongoing review and evaluation of catheter necessity. Complete and accurate checklist documentation is necessary to effectively prevent CAUTI and provide evidence of best practice in catheter management.

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