



# Compliance With Guideline Statements for Urethral Catheterization in an Iranian Teaching Hospital

Negar Taleschian-Tabrizi<sup>1</sup>, Fereshteh Farhadi<sup>1</sup>, Neda Madani<sup>1</sup>, Mohaddeseh Mokhtarkhani<sup>1</sup>, Kasra Kolahdouzan<sup>1</sup>, Sakineh Hajebrahimi<sup>2\*</sup>

## Abstract

**Background:** It is believed that healthcare staff play an important role in minimizing complications related to urethral catheterization. The purpose of this study was to determine whether or not healthcare staff complied with the standards for urethral catheterization.

**Methods:** This study was conducted in Imam Reza teaching hospital, Tabriz, Iran, from July to September 2013. A total of 109 catheterized patients were selected randomly from surgical and medical wards and intensive care units (ICUs). A questionnaire was completed by healthcare staff for each patient to assess quality of care provided for catheter insertion, while catheter in situ, draining and changing catheter bags. Items of the questionnaire were obtained from guidelines for the prevention of infection. Data analysis was performed with SPSS 16.

**Results:** The mean age of the patients was  $50.54 \pm 22.13$ . Of the 109 patients, 56.88% were admitted to ICUs. The mean duration of catheter use was 15.86 days. Among the 25 patients who had a urinalysis test documented in their hospital records, 11 were positive for urinary tract infection (UTI). The lowest rate of hand-washing was reported before bag drainage (49.52%). The closed drainage catheter system was not available at all. Among the cases who had a daily genital area cleansing, in 27.63% cases, the patients or their family members performed the washing. In 66.35% of cases, multiple-use lubricant gel was applied; single-use gel was not available. The rate of documentation for bag change was 79%.

**Conclusion:** The majority of the guideline statements was adhered to; however, some essential issues, such as hand hygiene were neglected. And some patients were catheterized routinely without proper indication. Limiting catheter use to mandatory situations and encouraging compliance with guidelines are recommended.

**Keywords:** Urethral Catheter, Clinical Guideline, Standards, Teaching Hospital, Healthcare Staff, Urinary Tract Infection (UTI)

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## \*Correspondence to:

Sakineh Hajebrahimi

Email: Hajebrahimis@gmail.com

## Key Messages

### Implications for policy makers

- The first step in improvement is to identify and address the deficits. There is a gap between evidence-based recommendations and the practice for urethral catheterization.
- Routine and prolonged catheterization, without appropriate necessity is reported, which can lead to a high rate of catheter-associated urinary tract infection (CAUTI) and accompanying healthcare costs.
- Adapting evidence-based guidelines and increasing patients' knowledge can be a solution for this apparently simple but indeed important problem.

### Implications for public

Appraising the quality of healthcare provided and identifying the gaps in the system are the main bases of further directions for health policies. Iatrogenic infections such as catheter-associated urinary tract infection (CAUTI) are among the most widespread complications and can lead to increased morbidity and length of hospitalization and to affect the costs of healthcare significantly. These problems can be prevented easily by appropriate practices.<sup>1-3</sup> This article revealed the gap between evidence-based recommendations and the practice for urethral catheterization. Filling these gaps by developing evidence-based national guidelines and increasing patients' knowledge can minimize the complications associated with urethral catheterization.

## Introduction

Urinary tract infections (UTIs) are one of the leading hospital acquired infections,<sup>3-5</sup> they can be life-threatening and may lead to increased morbidity, length of hospitalization, and highly affects the costs of healthcare.<sup>1-3</sup> It is believed that urinary instrumentation, primarily urinary catheterization, is responsible for nearly 80% of the infections, defined as catheter-associated urinary tract infection (CAUTI).<sup>1</sup> CAUTI refers to a UTI that is caused by an indwelling urinary catheter in place or is acquired within 48 hours of its removal.<sup>6</sup> Although not all CA complications can be prevented, it is believed that proper catheter management and appropriate infection prevention strategies can prevent the occurrence.<sup>7</sup> Studies have shown that about 40% of CAUTI cases could be prevented by hygienic practices and removal of the catheter when it is no longer necessary.<sup>8</sup> Hospital staff plays an important role during this procedure, including insertion urine catheters, emptying and changing catheter bags, all of which should be done carefully and hygienically.<sup>9</sup> According to audits, inappropriate use of urinary catheters is widespread. Because of the poor quality of documentation, healthcare staff is often unaware of the insertion and ongoing care of urinary catheters, so that catheters remain in place of excessive lengths of time, until catheter-related complications occur.<sup>5,10-13</sup>

Studies have indicated that many catheterizations were found as unnecessary and efforts to limit the procedure has been a viable solution.<sup>14,15</sup> Although many surgeons may believe that catheterization is a standard part of some operations, many patients consider it an invasive procedure<sup>12</sup>; moreover, it is considered to be a painful and uncomfortable procedure even among females, who are believed to experience less CA pain.<sup>16,17</sup>

The case against the routine use of catheters was first introduced by Beeson in 1958 to call attention to the possibility of reducing infections,<sup>18</sup> but the inappropriate use of catheters and sometimes its severe consequences are still encountered.<sup>5</sup> Unfortunately, there is a gap between evidence-based recommendations and staff knowledge.<sup>2</sup> Noticeable effects of infection control audits that have led to reductions in the risk of infection by developing critical standards, are clear.<sup>19</sup> Hence, observing the practices, and evaluating the implementation of key elements of care, such as inserting, emptying catheter bags and changing catheter as well as providing feedback on outcomes, are considered of great importance. The purpose of this study was to determine whether or not healthcare staff complied with the standards of catheter care derived from infection prevention guidelines.

## Methods

A questionnaire was used to carry out a process audit on urinary catheterization that assessed the quality of care given to the catheterized patients by healthcare staff (nurses, interns, and healthcare assistants) in Imam Reza hospital of Tabriz University of Medical Sciences (TUOMS), Iran. One hundred nine catheterized patients were selected randomly from inpatient wards of the hospital including urology and neurology (surgical wards), gastrointestinal and nephrology (medical wards) and all intensive care units (ICUs), such as pulmonary ICU, neurological ICU, surgical ICU, brain

injury ICU over a period of 3 months (July to September 2013). Wards were chosen, considering which were more likely to provide catheter care for more patients in number according expert's opinion. Patients and healthcare staff who participated in this study provided informed consent before filling out the questionnaires. Questionnaires were distributed by interviewers twice in a week. After identifying the staff responsible they were asked to complete the questionnaires and they were collected at the end of the day. Items of the questionnaire were obtained from the following guidelines: "Evidence-Based Practice in Infection Control (EPIC2),"<sup>20</sup> "National Institute for Clinical Excellence (NICE),"<sup>21</sup> and "Prevention of CAUTI, (HSE/HPSC)"<sup>22</sup> and were adapted by an expert urologist. Items were selected according to importance and relevance in our society. Patient records and nursing summary sheets were used to obtain data from patients with urinary catheters, such as demographic characteristics, including age, gender, reason for catheterization, reason for hospitalization and documented insertion date. Anonymity of the participants was preserved, as they were identified by code and no names were documented. The questionnaire included several sections, beginning with the section regarding the information about catheter care that healthcare staff provided to patients and their families, in order to increase patients' knowledge of procedures they could use in their own catheter care and their role in decreasing catheter-related infections. This section was completed by patients or if they were not conscious by family members. Other sections of the questionnaire were completed by the responsible staff, including questions about insertion of catheters, catheter-related care, draining and changing catheter bags, changing the catheter system and examining patients for catheter-related infections. The second section of the questionnaire assessed the quality of catheter insertion and change, performed either by nurses or interns and catheter-related cares by patients and/or healthcare assistants, consisted of draining and changing catheter bags. The last section addressed assessment of patients for UTIs caused by catheter use in inpatient wards. To complete this section, the patients' medical records were examined for urine culture reports and urinalysis and for related infections as reported by growth of bacteria, high white blood cell (WBC) count and positive nitrites. Items without check marks were considered missing data. Descriptive statistical analyses were performed with SPSS software version 16 to understand the rates of adherence to guideline statements. We also concluded subgroup analysis to compare compliance among ICU, surgical and medical wards. We looked for significant correlation between UTI occurrence and other statements by chi-square correlation test.

## Results

The mean age of the participants was  $50.54 \pm 22.13$  years (Min = 1, Max = 87). 38.4% of participants were females, and 8 patients were under 18 years. Of the 109 patients, 62 were admitted to ICUs, 30 to medical wards, and 17 to surgical wards. The mean duration of catheter use at the time of survey was 15.86 days (range 1-66 days in non-ICUs and 2-132 days in ICUs). Only 25 patients (23%) had either urinalysis or urine culture results in their hospital records, and among

those, 11 were positive for UTIs (44 %). Chi-square test showed significant correlation between UTI and 3 statements: “Does the patient know his/her role in lowering the risk of CA-UTI” ( $P < .000$ ), “Is the genital region washed daily with antiseptics?” ( $P = .003$ ) and “Documentation” ( $P = .023$ )

The results of the first 3 questions about patients’ awareness of possible side effects and the training for catheter caring as well as the patients’ role in lowering the risk of UTI are depicted in [Table 1](#).

Among those who had a daily genital area cleansing, either with antiseptics, or soap and water (19% and 16%, respectively), 28% of the patients or their family members performed the washing, while the remaining 72% reported that the staff performed this task. Assessment of the catheterization process is illustrated in [Tables 2 to 5](#).

Most patients’ catheter bags (56%) were changed at intervals of more than a week and in nearly all of the cases (99%), catheters and drainage bags were changed if damaged. Seventy-eight percent reported that they emptied the bags when they were half or  $\frac{3}{4}$  full, while 22% reported that they emptied the bags only when they were filled completely. In the wards other than ICUs, catheterization considered unnecessary in nearly 70% of patients and seemed to be placed for the convenience of the healthcare staff and/or patients. Immobilization, routine assessment of urinary intake-output,

preoperative use, and urinary incontinence were the rationales for catheterization reported most frequently.

## Discussion

We found that healthcare staff adhered to the majority of guideline standards. Surgical wards reported better compliance with catheter care standards; however, hand hygiene while changing the urine bags was performed less often and the least attention was given to providing patients in the surgical ward with information about the procedure. The actual percentage of patients who suffered from CA-UTI was estimated to be higher than what was reported. According to the reviews, the most important risk factor for developing catheter-related complications is duration of catheterization. The risk of CA-UTI increases by an estimate of 5%-10% for each day the catheter remaining in place. Among patients catheterized for 10 days, the chance of developing bacteriuria increases to 50%. By day 30 after catheter insertion, the risk of CA-UTI nearly doubles.<sup>1,5,11,23</sup>

The low rate of CA-UTIs found in this study, might be due to the fact that urine culture was obtained in only 23% of patients, and approximately half of the cases were comprised of patients admitted to ICUs, which tend to be aseptic and in which patients receive broad-spectrum antibiotics that could minimize the risk of bacterial contamination, despite

**Table 1.** Patients’ Awareness

Question	Yes			No		
	ICU n = 62	Medical Ward n = 30	Surgical Ward n = 17	ICU n = 62	Medical Ward n = 30	Surgical Ward n = 17
Is the patient aware of the probable risks of using catheter?	12%	13%	0%	88%	87%	100%
Has the patient been trained to care for catheter?	65%	57%	6%	35%	43%	94%
Does the patient know his/her role in lowering the risk of CA-UTI?	25%	31%	6%	75%	69%	94%

Abbreviations: ICU, intensive care unit; CAUTI, catheter-associated urinary tract infection.

**Table 2.** Process of Catheter Insertion

Catheter Insertion	Yes			No		
	ICU n = 62	Medical Ward n = 30	Surgical Ward n = 17	ICU n = 62	Medical Ward n = 30	Surgical Ward n = 17
Washing urethral meatus with soap and water	25.0%	27.0%	23.5%	75.0%	73.0%	76.5%
Washing urethral meatus with sterile water	46.5%	48.0%	23.5%	47.5%	52.0%	76.5%
Washing urethral meatus with antiseptic	89.0%	86.0%	100%	11.0%	14.0%	0.0%
Using multiple-use lubricant gel (tube)	55.0%	66.0%	76.5%	45.0%	34.0%	23.5%
Using lidocaine gel	80.0%	89.0%	100%	20.0%	11.0%	0.0%
Using gloves during the process	100%	100%	100%	0.0%	0.0%	0.0%
Hand hygiene before catheter insertion	71.0%	78.5%	100%	29.0%	21.5%	0.0%
Hand hygiene after catheter insertion	93.0%	95.0%	100%	7.0%	5.0%	0.0%
Antibiotic prescription before catheter insertion	53.0%	43.0%	0.0%	47.0%	57.0%	100%

Abbreviation: ICU, intensive care unit.

**Table 3.** Care for the Inserted Catheter

Care for the Inserted Catheter	Yes			No		
	ICU n = 62	Medical Ward n = 30	Surgical Ward n = 17	ICU n = 62	Medical Ward n = 30	Surgical Ward n = 17
Was the catheter system continuously connected without being separated?	85%	84%	40%	15%	16%	60%
Is the genital region washed daily with water and soap?	16%	16%	24%	84%	84%	76%
Is the genital region washed daily with antiseptics?	19%	19%	30%	71%	83%	70%
Is the catheter bag hanging from the stand?	100%	100%	100%	0%	0%	0%
Does the catheter bag touch the floor?	2%	8%	12%	98%	92%	88%
Is the catheter bag below the level of bladder?	100%	100%	100%	0%	0%	0%
Are the catheter maintenance solutions or bladder washouts used routinely?	10%	13%	18%	90%	87%	82%
Are antiseptics added to the urine drainage container?	7%	5%	0%	93%	95%	100%
Are damaged bags changed?	100%	99%	100%	0%	1%	0%

Abbreviation: ICU, intensive care unit.

**Table 4.** Catheter Bag Draining

Catheter Bag Draining	Yes			No		
	ICU n = 62	Medical Ward n = 30	Surgical Ward n = 17	ICU n = 62	Medical Ward n = 30	Surgical Ward n = 17
Hand hygiene before bag drainage	43%	50%	47.0%	57%	50%	53.0%
Hand hygiene after bag drainage	100%	96%	88.0%	0%	4%	12.0%
Using gloves during the process	100%	93%	58.8%	0%	7%	41.2%
Drainage of each patient's urine into a separate clean container	12%	100%	6.0%	88%	0%	94.0%
Avoiding contact of the drainage tap with the container that the urine is drained into	90%	13%	88.0%	10%	87%	12.0%
Wiping the drainage tap dry after emptying the bag	20%	90%	18.0%	80%	10%	82.0%

Abbreviation: ICU, intensive care unit.

prolonged durations of catheterization; however, ICU patients have significant complications and the effects of CA-UTI can be critical.<sup>24</sup>

According to the HSE/HPSC guidelines for the prevention of CA-UTI, information about the benefits and risks of urinary catheterization should be provided to patients. Improved knowledge about the risks of urethral catheter can help patients participate more actively in decision-making regarding the necessity of catheterization and reduce requests for placement of a catheter only for convenience.<sup>25</sup>

A negligible percentage of patients was aware of the probable complications and risks of catheters. Knowledge about signs and symptoms of complications (eg, infection, blockage, leakage) and who to contact for assistance, can help facilitate the diagnosis and management of complications.<sup>22</sup> Approximately, half of the patients were trained for catheter care such as emptying the catheter bag, while in most of the wards, patients or one of their family members took the

responsibility for this task. Most patients were not informed of their role in minimizing CA-UTIs, such as performing daily meatal cleansing. If patients were not instructed or equipped to perform it, this procedure was ignored in the majority of cases, even by the healthcare. However, there is no advantage in using antiseptics for meatal cleansing upon routine personal hygiene (bathing or showering) in lowering the rate of UTI.<sup>22</sup> And washing the meatus with soap and water, during daily routine hygiene is appropriate.<sup>20,26,27</sup>

In the majority of cases, the urethral meatus was washed with antiseptics (typically povidone iodine) prior to catheter insertion; however, furthermore researches for periurethral cleaning is needed to compare the use of antiseptic solutions versus sterile water or saline.<sup>26</sup>

The effect of lidocaine gel in reducing pain is controversial. Intraurethral use of topical lidocaine gel prior to the urethral catheterization results in significantly less pain in comparison with a lubricant alone,<sup>17,29</sup> although Tanabe et al<sup>30</sup> and

**Table 5.** Catheter bag change

Catheter Bag Change	Yes			No		
	ICU n = 62	Medical Ward n = 30	Surgical Ward n = 17	ICU n = 62	Medical Ward n = 30	Surgical Ward n = 17
Documentation	72%	79%	100%	28%	21%	0%
Hand hygiene before changing	53%	69%	100%	47%	31%	0%
Hand hygiene after changing	77%	87%	100%	23%	13%	0%
Using gloves during the process	100%	100%	100%	0%	0%	0%

Abbreviation: ICU, intensive care unit.

Vaughan et al<sup>31</sup> claimed that it is ineffective in alleviating pain and discomfort in women and children respectively.

In nearly half of the patients, antibiotics were prescribed prior to catheterization. Because of concerns about antimicrobial resistance, routine systemic antimicrobial prophylaxis to reduce CA- bacteriuria or CA-UTI should be avoided in patients with either short-term or long-term catheterization for.<sup>32</sup>

Catheter bags must be placed below the level of the bladder on a stand to prevent contact with the floor<sup>20</sup>; this standard was adhered to in nearly all cases.

It is recommended that unless there is a good clinical reason, eg, changing the bag; the connection between catheter and the urinary drainage system should remain connected.<sup>20</sup> In 84% of patients, it was claimed that the catheter system was connected continuously.

Guidelines advocated maintaining a sterile, closed drainage system; by using pre-connected catheter and drainage system with sealed junctions.<sup>33</sup> However, the open drainage system is used primarily in Iran and the closed drainage system was not used in the hospital in this study.

There is limited evidence for the efficacy of “catheter maintenance solutions.” However, using a catheter maintenance solution can be beneficial for some patients by increasing the life of the catheter, thereby avoiding the trauma of recatheterization.<sup>34</sup> A maintenance solution was used in 13% of patients. Antiseptics or antimicrobials should not be added to the drainage bag to reduce the rate of CA-UTIs,<sup>32</sup> and this was performed for just 5% of cases. The drainage bag must be emptied regularly, using a clean container for each patient. Compliance with this statement was low and in 87% of the patients shared containers were used. The drainage tap should not touch the container and when emptying, the outlet tap should be wiped with a tissue.<sup>35</sup>

The rate of documentation for bag changes was 79%. Good documentation is important in patient care, audits and for medico-legal purposes.<sup>36,37</sup>

Nosocomial transmission occurs patient-to-patient via healthcare workers' hands, and therefore hand hygiene is vital in reducing the transmission of microbial agents and preventing healthcare-associated infections.<sup>7,32</sup> Despite its great importance, hand hygiene during any stage of catheterization was considered poor compared to similar audits, that reported hand washing in over 80% of cases.<sup>11,19,38</sup> The lowest rate of hand hygiene occurred before bag drainage (50%). Bag drainage was mostly performed by healthcare

workers or patients' family members, which indicated the need for improved education about the importance of hand hygiene. It is notable that hand washing before procedures (inserting catheter, draining and changing the bag) was neglected compared to postprocedure hand hygiene. Despite the unacceptable rate of hand hygiene, clean, nonsterile gloves were worn 100% of the time for catheter insertion and bag changes and 93% of the time for bag drainage.

In order to keep continuity of the urine flow and prevent reflux, the urinary bag should be drained frequently enough.<sup>39</sup> Changing indwelling catheters or drainage bags routinely with fixed intervals is not recommended by Healthcare Infection Control Practices Advisory Committee (HICPAC) guideline. Rather, changing them is suggested only based on clinical indications such as obstruction, infection or compromised system.<sup>26</sup>

The routine use of catheters and inappropriate indications for the procedure have been a major focus in a number of articles as described in the introduction. Many articles on catheter care have been published, each of which focused on a particular predictive risk factor, however, universal recommendations and every single audit and guideline mention limiting catheter use only to mandatory situations and minimizing the duration of use when a catheter is indicated; as 2 essential steps for CA-UTI prevention. Further the Center for Disease Control and Treatment (CDC) has updated its guidelines on the appropriate indications for the use of indwelling urinary catheters recently.<sup>26</sup>

In ICUs, common rationales for catheterization were low Glasgow Coma Scale (GCS) and measurements of urinary intake-output, both of which seem appropriate; however, catheterization was performed routinely for all patients in the throughout their hospitalization. In other wards, catheterization was considered unnecessary in almost 70% of patients and seemed to have been placed for convenience. Immobilization, routine assessment of urinary intake-output, preoperative use, and urinary incontinence were the rationales reported most often.

Studies have attempted to identify appropriate methods to minimize the duration of urethral catheterization. Implementation of low-technology interventions to improve the appropriateness of catheter use,<sup>40</sup> such as the use of daily physician reminders to remove unnecessary catheters,<sup>41-43</sup> and computer-based entry of order<sup>44</sup> may result in reductions in the duration of catheterization and concomitant declines in the rate CA-UTIs. With the advent of new super-absorbent

diapers and under pads as well as using appropriate urine collection strategies (eg, incontinence products, condom catheters, penis pouches, bladder scanners) there are now feasible measures that may be used to limit catheter use even in acute care facilities.<sup>3,26</sup> Finally, this study addressed only evaluation of the catheterization process and good or poor outcomes could not be assessed due to a lack of documentation.

We acknowledge a number of limitations of this study, primarily the fact that a self-report questionnaire was used for data collection, rather than an observational assessment; the former might result in exaggerated reporting and also recall bias, even if the time interval between practice and completing the questionnaire was brief. However, we plan to conduct observational studies in the future. Collecting data from several wards was another limitation of our study, because practices vary between wards; on the other hand, it also can be considered a positive point because data from a single ward may increase bias and it cannot provide a realistic overview of what is really taking place in hospitals. Moreover, performing subgroup analyses can clarify the ongoing status of practice in each section, however selecting an equal numbers of patients from each ward might have increased the accuracy of the study.

In conclusion, despite the guidelines indicating inappropriate use of catheters and subsequent CA complications, in some cases surveyed in this paper, patients had been catheterized routinely and without appropriate necessity. Thus, more limitations on catheterization are recommended in order to reduce the rates of CAUTIs. In this study it was apparent that, although most of the guideline statements were followed, some important issues, such as hand hygiene were still neglected. On the other hand, lack of facilities, such as closed-system drainage and single-use lubricant gel may increase complications. Therefore, applying appropriate programs to equip hospitals, and improving the knowledge of healthcare staff also patients by developing a national guideline is recommended in order to fill the gap between evidence-based recommendations and practice.

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### Ethical issues

The proposal of this study was approved by the Research Vice Chancellor (Students' Research Committee) of Tabriz University of Medical Sciences (TUOMS), Tabriz, Iran. All participants were provided with the informed consent before filling out the questionnaires.

### Competing interests

Authors declare that they have no competing interests.

### Authors' contributions

All authors have contributed significantly to carry out this study. SH designed the study. NTT, FF, NM, and MM collected the data. KK conducted the data analysis. The article was written by NTT, FF, NM, and MM and critically edited by SH.

### Authors' affiliations

<sup>1</sup>Students' Research Committee, Iranian Evidence-Based Medicine Center of Excellence, Tabriz University of Medical Sciences, Tabriz, Iran. <sup>2</sup>Iranian Evidence-Based Medicine Center of Excellence, Department of Urology, Tabriz University of Medical Sciences, Tabriz, Iran.

### References

1. Bruminhent J, Keegan M, Lakhani A, Roberts IM, Passalacqua J. Effectiveness of a simple intervention for prevention of catheter-associated urinary tract infections in a community teaching hospital. *Am J Infect Control*. 2010;38(9):689-693. doi:10.1016/j.ajic.2010.05.028
2. Mody L, Saint S, Galecki A, Chen S, Krein SL. Knowledge of evidence-based urinary catheter care practice recommendations among healthcare workers in nursing homes. *J Am Geriatr Soc*. 2010;58(8):1532-1537. doi:10.1111/j.1532-5415.2010.02964.x
3. Catheter-associated urinary tract infections. *Crit Care Nurse*. 2012;32(2):75. doi:10.1097/nhh.0b013e31825e3166
4. Winter M, Helms B, Harrington L, Luquire R, McVay T, Rhodes N. Eliminating catheter-associated urinary tract infections: part I. Avoid catheter use. *J Healthc Qual*. 2009;31(6):8-12. doi:10.1111/j.1945-1474.2009.00049.x
5. Rhodes N, McVay T, Harrington L, Luquire R, Winter M, Helms B. Eliminating catheter-associated urinary tract infections: part II. Limit duration of catheter use. *J Healthc Qual*. 2009;31(6):13-17. doi:10.1111/j.1945-1474.2009.00050.x
6. Saint S, Chenoweth CE. Biofilms and catheter-associated urinary tract infections. *Infect Dis Clin North Am*. 2003;17(2):411-432.
7. Allegranzi B, Pittet D. Role of hand hygiene in healthcare-associated infection prevention. *J Hosp Infect*. 2009;73(4):305-315. doi:10.1016/j.jhin.2009.04.019
8. Rebmann T, Greene LR. Preventing catheter-associated urinary tract infections: An executive summary of the Association for Professionals in Infection Control and Epidemiology, Inc, Elimination Guide. *Am J infect control*. 2010;38(8):644-646.
9. McNulty CA, Bowen J, Foy C, et al. Urinary catheterization in care homes for older people: self-reported questionnaire audit of catheter management by care home staff. *J Hosp Infect*. 2006;62(1):29-36. doi:10.1016/j.jhin.2005.03.008
10. Gokula RM, Smith MA, Hickner J. Emergency room staff education and use of a urinary catheter indication sheet improves appropriate use of foley catheters. *Am J infect control*. 2007;35(9):589-593.
11. Dailly S. Auditing urinary catheter care. *Nurs Stand*. 2012;26(20):35-40.
12. Conybeare A, Pathak S, Imam I. The quality of hospital records of urethral catheterisation. *Ann R Coll Surg Engl*. 2002;84(2):109.
13. Saint S, Wiese J, Amory JK, et al. Are physicians aware of which of their patients have indwelling urinary catheters? *Am J Med*. 2000;109(6):476-480.
14. Li L, Wen J, Wang L, Li YP, Li Y. Is routine indwelling catheterisation of the bladder for caesarean section necessary? A systematic review. *BJOG*. 2011;118(4):400-409. doi:10.1111/j.1471-0528.2010.02802.x
15. Harrod M, Kowalski CP, Saint S, Forman J, Krein SL. Variations in risk perceptions: a qualitative study of why unnecessary urinary catheter use continues to be problematic. *BMC Health Serv Res*. 2013;13:151. doi:10.1186/1472-6963-13-151
16. Tabrizi NT, Torabi Z, Bastani P, et al. Assessing the Perception of Pain and Distress of Female Patients Undergoing Routine Urethral Catheterization in Cesarean Delivery. *International Journal of User-Driven Healthcare*. 2013;3(2):78-84.
17. Chung C, Chu M, Paoloni R, O'Brien MJ, Demel T. Comparison of lignocaine and water-based lubricating gels for female urethral catheterization: a randomized controlled trial. *Emerg Med Australas*. 2007;19(4):315-319. doi:10.1111/j.1742-

- 6723.2007.00961.x
18. Beeson PB. The case against the catheter. *Am J Med.* 1958;24(1):1-3.
  19. McNulty C, Bowen J, Foy C, et al. Urinary catheterization in care homes for older people: self-reported questionnaire audit of catheter management by care home staff. *J Hosp Infect.* 2006;62(1):29-36. doi:10.1016/j.jhin.2005.03.008
  20. Pratt RJ, Pellowe C, Wilson J, et al. epic2: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. *J Hosp Infect.* 2007;65:S1-S59. doi:10.1016/s0195-6701(07)60002-4
  21. National Clinical Guideline Centre. *Infection: Prevention and Control of Healthcare-Associated Infections in Primary and Community Care: Partial Update of NICE Clinical Guideline 2.* London: Royal College of Physicians (UK), National Clinical Guideline Centre; 2012.
  22. Health Protection Surveillance Centre (HPSC). Guidelines for the prevention of catheter-associated urinary tract infection. Published on behalf of SARI by HSE Health Protection Surveillance Centre; 2011.
  23. Andreessen L, Wilde MH, Herendeen P. Preventing catheter-associated urinary tract infections in acute care: the bundle approach. *J Nurs Care Qual.* 2012;27(3):209-217. doi:10.1097/NCQ.0b013e318248b0b1
  24. Lee JH, Kim SW, Yoon BI, Ha US, Sohn DW, Cho YH. Factors that affect nosocomial catheter-associated urinary tract infection in intensive care units: 2-year experience at a single center. *Korean J Urol.* 2013;54(1):59-65. doi:10.4111/kju.2013.54.1.59
  25. Greer SF, Sethi AK, Hecker MT, McKinney BL, Dumford DM 3rd, Donskey CJ. Survey of patients' knowledge and opinions regarding the use of indwelling urinary catheters. *Infect Control Hosp Epidemiol.* 2011;32(2):174-176. doi:10.1086/657935
  26. Gould CV, Umscheid CA, Agarwal RK, Kuntz G, Pegues DA. Guideline for prevention of catheter-associated urinary tract infections 2009. *Infect Control Hosp Epidemiol.* 2010;31(4):319-326. doi:10.1086/651091
  27. Koskeroglu N, Durmaz G, Bahar M, Kural M, Yelken B. The role of meatal disinfection in preventing catheter-related bacteriuria in an intensive care unit: a pilot study in turkey. *J Hosp Infect.* 2004;56(3):236-238. doi:10.1016/j.jhin.2003.12.017
  28. Godfrey H, Fraczyk L. Preventing and managing catheter-associated urinary tract infections. *Br J Community Nurs.* 2005;10(5):205-212. doi:10.12968/bjcn.2005.10.5.18048
  29. Siderias J, Guadio F, Singer AJ. Comparison of topical anesthetics and lubricants prior to urethral catheterization in males: a randomized controlled trial. *Acad Emerg Med* 2004;11(6):703-706.
  30. Tanabe P, Steinmann R, Anderson J, Johnson D, Metcalf S, Ring-Hurn E. Factors affecting pain scores during female urethral catheterization. *Acad Emerg Med.* 2004;11(6):699-702.
  31. Vaughan M, Paton EA, Bush A, Pershad J. Does lidocaine gel alleviate the pain of bladder catheterization in young children? A randomized, controlled trial. *Pediatrics.* 2005;116(4):917-920. doi:10.1542/peds.2005-0103
  32. Smith SL. *Effect of an Educational Intervention on Hospital Acquired Urinary Tract Infection Rates* [PhD Thesis]. Jacksonville: Brooks College of Health; 2009.
  33. Conway LJ, Larson EL. Guidelines to prevent catheter-associated urinary tract infection: 1980 to 2010. *Heart Lung.* 2012;41(3):271-283. doi:10.1016/j.hrtlng.2011.08.001
  34. NHS Quality Improvement Scotland. *Urinary Catheterisation & Catheter Care: Best Practice Statement.* <http://www.healthcareimprovementscotland.org/idoc.ashx?docid=feae66c-08e3-4168-ae5c-85eba638ae8b&version=-1>. Published 2004.
  35. Wirral Community NHS Trust. Procedure for catheter aftercare. <http://www.wirralct.nhs.uk/attachments/article/19/CP43ProcedureforCatheterAftercare.pdf>. Published 2010.
  36. Tijani KH, Lawal AO, Ojewola RW, Badmus TA. Quality of documentation of urethral catheterization in a Nigerian teaching hospital. *Nig Q J Hosp Med.* 2010;20(4):177-180.
  37. Conybeare A, Pathak S, Imam I. The quality of hospital records of urethral catheterisation. *Ann R Coll Surg Engl.* 2002;84(2):109-110.
  38. Fink R, Gilmartin H, Richard A, Capezuti E, Boltz M, Wald H. Indwelling urinary catheter management and catheter-associated urinary tract infection prevention practices in Nurses Improving Care for Healthsystem Elders hospitals. *Am J Infect Control.* 2012;40(8):715-720. doi:10.1016/j.ajic.2011.09.017
  39. National Collaborating Centre for Nursing and Supportive Care. *Infection Control: Prevention of Healthcare-associated Infections in Primary and Community Care. National Institute for Health and Clinical Excellence: Guidance.* London (UK): Thames Valley University; 2003.
  40. Elpern EH, Killeen K, Ketchum A, Wiley A, Patel G, Lateef O. Reducing use of indwelling urinary catheters and associated urinary tract infections. *Ame J Crit Care.* 2009;18(6):535-541. doi:10.4037/ajcc2009938
  41. Huang WC, Wann SR, Lin SL, et al. Catheter-associated urinary tract infections in intensive care units can be reduced by prompting physicians to remove unnecessary catheters. *Infect Control Hosp Epidemiol.* 2004;25(11):974-978. doi:10.1086/502329
  42. Saint S, Kaufman SR, Thompson M, Rogers MA, Chenoweth CE. A reminder reduces urinary catheterization in hospitalized patients. *Jt Comm J Qual Patient Saf.* 2005;31(8):455-462.
  43. Meddings J, Rogers MA, Macy M, Saint S. Systematic review and meta-analysis: reminder systems to reduce catheter-associated urinary tract infections and urinary catheter use in hospitalized patients. *Clin Infect Dis.* 2010;51(5):550-560. doi:10.1086/655133
  44. Cornia PB, Amory JK, Fraser S, Saint S, Lipsky BA. Computer-based order entry decreases duration of indwelling urinary catheterization in hospitalized patients. *Am J Med.* 2003;114(5):404-407. doi:10.1016/s0002-9343(02)01568-1