TWOC around the clock: a multimodal approach to improving catheter care

Journal of Infection Prevention
2017, Vol. 18(2) 57–64
DOI: 10.1177/1757177416668584
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Abstract

Background: Urinary tract infections (UTI) are the second-largest group of healthcare-associated infections (HCAI). The Saving Lives Urinary Catheter Care Bundle was introduced to reduce catheter-associated urinary tract infections (CAUTI). In response, we implemented a catheter care group to examine ways to improve catheter care in an acute hospital NHS Trust.

Methods: We adopted a multimodal approach, revolving around four components: (1) Catheter Care Pathway; (2) HOUDINI checklist; (3) catheter magnets; and (4) use of bladder ultrasound scanners.

Results: The yearly CAUTI prevalence survey showed an annual reduction in CAUTI from 2012–2013 to 2014–2015 (3.5% to 2.4%). Evaluations of the multimodal approach have highlighted limitations, leading to priorities being established around provision of tools, education, and use of measurement and feedback.

Conclusions: Our multimodal approach demonstrates CAUTI rate improvements are achievable, directly benefiting patients. However, long-term maintenance of multimodal components is required to ensure sustained benefit. Engagement and accountability have emerged as significant challenges to the effectiveness and longevity of the catheter care group. We suggest greater emphasis on such challenges if long-term national or international improvement is to be achieved.

Keywords

catheter-associated urinary tract infections (CAUTI), HOUDINI, multimodal, infection prevention, apathy, engagement, accountability

Date received: 21 March 2016; accepted: 6 August 2016

Background

Urinary tract infections (UTI) are the second largest group of healthcare-associated infections (HCAI), with point prevalence in England of 17.2%. Of these infections, 43% occurred in patients with an indwelling device present prior to onset of infection (HPA, 2011).

Emmerson et al. (1996) found a UTI rate of 23% in a UK and Republic of Ireland prevalence study, with Elvy and Colville (2009) stating that 80% of these UTI could be traced to indwelling urinary catheters (IDC). This is of particular concern considering inappropriate catheter use (in patients without indication) has been cited at between 21% and 55.7% (Meddings et al., 2013). While the economic cost of UTI is of note, estimated at approximately £1327 per case, arguably the greater burden is felt by the patient, who may have to spend up to an additional six days in hospital, suffering from symptoms including fever, pain and confusion (Codd, 2014). Thus, avoidance of catheter-associated UTI (CAUTI) is of great importance.

Saving Lives

The Department of Health (DoH) launched the Saving Lives initiative to support healthcare professionals in reducing HCAI rates by introducing seven high-impact interventions (HII) targeting key areas of clinical practice linked to risk of infection. Standardisation, through minimising variation in practice, was a clear aim, enabling staff to ensure that actions were aligned with evidence-based practice and established guidelines. (Coghill, 2009).

The link between catheter use and subsequent UTI has been well established (e.g. Meddings et al., 2009; Nicolle,

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2014) and the DoH included a Urinary Catheter Care Bundle as one of these seven HII, aimed at reducing catheter associated urinary tract infections (Department of Health, 2007).

Here we present the experience of a quality improvement initiative designed to tackle CAUTI at a large NHS University Hospital Trust in England. We highlight a multi-modal approach to implementing the Saving Lives Urinary Catheter Care Bundle, and discuss associated challenges.

Method

Trust overview

Our acute hospital NHS Trust provides care for a population of over 1 million people, via a district general hospital and a separate large major trauma centre. Responsibility for infection prevention is held by a dedicated multidisciplinary infection prevention and control team (IPCT), consisting of 4.88 whole time equivalent (WTE) nurses, a healthcare assistant, analyst, researcher and administrative support. Historical data suggested that the Trust was a high outlier in terms of CAUTI rates, indicating the need for further investigation.

Tackling CAUTI

We responded to the launching of the Saving Lives Urinary Catheter Care Bundle by convening a catheter care group to examine ways to improve catheter care. During its seven-year history, this multidisciplinary group has included Practice Facilitators, a continence nurse specialist, a urology nurse specialist, an Emergency Department nurse, community continence nurse specialists and members of the IPCT. Initially, this group focused on catheter management; however, it has evolved to include catheter insertion practice. The IPCT began chairing this group in 2012.

Over the past seven years, our catheter care group has utilised a range of methods to improve catheter care, the four primary components are described here.

1. Catheter Care Pathway

In 2008, the catheter care group devised and implemented a care pathway. This pathway (Figure 1) aimed to consolidate documentation surrounding catheter care, including details of insertion and reviews, enabling assessment of adherence to the Saving Lives Urinary Catheter Care Bundle guidelines.

Adherence to this pathway, including the completion of all documentation, is monitored in monthly audits by the continence nurse specialist, as part of ongoing quality improvement.

Of note, the Trust considered adoption of a 'Catheter Passport' to improve practice. This patient-held urinary catheter passport, designed and developed by a multidisciplinary team within an NHS Trust, enables monitoring of

catheter reviews recorded in a standardised document (Codd, 2014). Our discussions with colleagues from the community setting indicated that introducing a paper-based tool would not be beneficial, due to their plans to move all documents to an electronic format. A new paper-based tool was therefore not welcomed, due to potential duplications of work and information, and costs associated with producing the passport document. Encouragingly, the catheter care group has established strong relationships between healthcare professionals in the community and acute setting, with a focus on producing electronic documentation which can be accessed by all.

2. The HOUDINI checklist

Our IPCT conducted a survey in 2012 to establish whether healthcare professionals at our Trust understood data being produced by the Saving Lives Catheter Care Bundle audit process. This established that knowledge and understanding of indications for catheterisation was poor and therefore improved awareness was urgently required.

The acronym HOUDINI was developed to enable staff to recognise indications for continued urinary catheter use (Adams et al., 2012). Fundamentally, a catheter should not be used, or should be removed, when none of the following indications occur: Haematuria; Obstruction; Urology surgery; Decubitus ulcer; Input and output measurement; Nursing end of life care; and Immobility. Finer detail explains that haematuria does not require a catheter unless the patient is in retention.

Based upon documented successful use of the HOUDINI concept to decrease urinary catheter usage, and the associated CAUTI risk (Adams et al., 2012), we launched the HOUDINI concept at our 2012 study day. This was further rolled out throughout 2013.

The concept enhanced our existing Catheter Care Pathway. HOUDINI checklists were added to the front of pathway documentation, to aid staff in their decision-making process at the point of insertion and/or reviews. This addition was supported from 2013 by a series of power training sessions, delivering education and training around the HOUDINI concept directly to staff within the healthcare setting. Previous research has demonstrated the effectiveness of this technique (e.g. Weinstock et al., 2009), and the IPCT has used it successfully when tackling *Clostridium difficile* (Bradley et al., 2015).

Use of HOUDINI is now widespread, with it underpinning our review process. Catheter insertion and/or continued use must now be supported by one or more of the HOUDINI indications. Successful implementation of the HOUDINI concept has been further supported by its inclusion in our annual infection prevention link staff study days. Key staff members have been able to explore the concept in detail, ask questions and return to their specific units to disseminate the practice.

Figure 1. Extract from Catheter Care Pathway (full document available as supplementary material web appendix).

Place Banda Label Here		Was Catheter in situ on admission? YES NO If yes contact District Nurse or Healthcare Facility to ascertain any information regarding catheter Date & Reason for insertion: Date catheter needs removing:
Ward	Ensure that all alternatives to catheterisation have been explored Where none of the indications below exist the catheter should be removed Haematuria does not require catheter unless in retention Obstruction / Retention Urology surgery Damage to skin – if severe consider if clinically indicated Input and Output fluid monitoring Nursing end of life care Immobility due to physical constraints e.g. unstable fracture & unable to use bottles / bed pans NB Suprapubic catheters must not be removed without medical consultation	
Catheter Inserted in Hospital? (Please Circle) Yes No		
Name and Designation of staff that inserted Catheter		
Date Catheter Inserted		
Reason Catheter Inserted		
Date Catheter to be removed		
Date Catheter removed		
If catheter inserted for retention was a bladder scan performed Yes / No		
Place Catheter Sticker here		

3. Catheter magnets

Engagement with infection prevention is a known challenge, with the specialty not being seen as ‘interesting’, and being regarded as an ‘additional burden’ for clinical staff (Kaur et al., 2014; Ward, 2012). Within the field of catheter care, this negative attitude is further compounded by ‘catheter apathy’, explained as the incorrect belief that as colonisation of urinary catheters is inevitable nothing can prevent CAUTI (Stokowski, 2009; Tew, 2005).

With this challenge in mind, the catheter care group devised an engagement activity to capture the attention, and interest, of front-line staff. All Trust staff were invited to enter a competition to design a ‘catheter magnet’. The competition successfully raised awareness of catheter care, leading to entries from six different areas, and a winner being announced in 2014. The winning design was translated into a magnet, now used on patient discharge boards to remind staff to review patient catheters with a view to TWOC (trial without catheter) (Figure 2).

4. Use of bladder ultrasound scanners

Finally, the end of 2014 saw the introduction of bladder scanners. These diagnostic tools, which help identify urinary retention, can be used as part of the decision-making process prior to catheterisation, identifying cases where catheter use may not be required. Evidence supports the use of such tools to reduce unnecessary catheterisation, and therefore the risks of CAUTI (Lo et al., 2014; Palese et al., 2010). These scanners were introduced to staff through the use of scheduled demonstrations and training sessions, facilitated by the manufacturers. This ensured that both the catheter care group and Trust staff were aware of the optimal process for using bladder scanners, increasing the likelihood that they would be effectively used.

Monitoring CAUTI

A monthly prevalence survey of all patients in acute inpatient wards has been conducted using the Safety

Figure 2. Catheter magnet.

thermometer methodology since 2012 (NHS QUEST, 2013). This involves reviewing all in-patients to identify those with an indwelling catheter, and if they are currently being treated for CAUTI. These data are collected and analysed by an appointed Lead Nurse for Quality and Safety. A catheter audit is conducted annually by a designated nurse. All patients with an indwelling catheter in 49 defined areas are identified. As microbial analysis is of limited use for detecting CAUTI, symptomatic diagnosis is used based on one or more symptom being present: new onset or worsening of fever, rigors, altered mental status, malaise, or lethargy with no other identified cause; flank pain; costo-vertebral angle tenderness; acute haematuria; pelvic discomfort.

Ethical approval

As a quality improvement initiative this work did not require formal ethical review.

Results: evidence of improvement

The past seven years of multimodal activities introduced by our catheter care group appear to have positively impacted upon CAUTI rates.

Our annual Trust CAUTI prevalence surveys have shown a reduction in CAUTI between 2012–2013 to 2014–2015 (3.5% to 2.4%). This improvement is further supported by a review of the Safety Thermometer Data (STD), which demonstrated that the Trust average CAUTI rate is now below the national average (0.38% versus 0.73%). This STD tool is widely used throughout the NHS, and informs local priorities; however, there remain some unresolved issues directly related to establishing outcome measures for UTI (Power et al., 2014). Similarly, while point prevalence surveys are popular, due to relative simple

application with minimal required resource, there are documented limitations to consider (Haustein et al., 2011). Haustein et al. (2011) note that such surveys may be more useful for wider estimation of HCAI burden, rather than for use at local/facility level. In addition, Hopkins et al. (2011) highlight biases related to point prevalence data which could negatively affect the reporting of short duration inpatient illnesses such as UTI (Hopkins et al., 2011). Further, issues with understanding and following audit criteria have been explicitly noted within our own Trust, with feedback from the catheter pathway audit noting that not all staff completed documentation in the same manner.

However, benefits of a point prevalence approach within infection prevention have been highlighted, notably by Lusignani et al. (2016) who considered such data as important for increasing healthcare professional HCAI awareness and surveillance skills, allowing directed investigation. This benefit was apparent during our work on catheter care, whereby we were able to use the STD point prevalence data to investigate a spike in CAUTI rates in December 2015. This was judged to be an anomaly, and rates for January 2016 once again reflect levels below the national average (Figure 3). Thus, using data collected via such methods allowed early intervention, which may highlight ways of addressing increases in infection rates.

The impact of each of the four primary components described here has been evaluated, to help guide our future multimodal strategy.

1. Catheter Care Pathway

While the implementation of the catheter care pathway has been successfully achieved Trust-wide, data demonstrate continued limitations with its application. Monthly catheter audits have allowed the catheter care group to establish the level of adherence and competence in filling in the required pathway documentation. Where areas of poor adherence are identified, bespoke education is delivered by the continence nurse specialist. The latest results, for March 2016, identified six areas requiring further education. Flaws were noted in completion of the catheter care pathway documentation, with particular weakness seen within the Emergency and Theatre departments. Education is being introduced here as a priority. Of note, the latest Trust-wide Urinary Catheter audit (2015–2016) highlighted only 33% adherence to using the correct version of pathway. This may partially account for the poor adherence to completing the documentation correctly found on the monthly catheter audits. Thus, ensuring dissemination of the correct pathway version has been identified as an immediate action.

2. The HOUDINI checklist

Ward (2013) suggests that using a theoretical basis to guide future required actions can be beneficial within infection prevention. This is supported here by our reviews of healthcare

Figure 3. Safety Thermometer Data.

professionals, whereby knowledge of the theoretical HOUDINI concept has led to positive changes in behaviour.

Knowledge was assessed at three consecutive annual study days, attended each year by between 80 and 110 IP link staff. The IPCT developed a version of the popular culture quiz 'Who wants to be a millionaire?' to measure how well staff recognised and understood catheter care, incorporating HOUDINI. This multiple-choice quiz presents players with a series of 15 questions, each accompanied by four potential answers. Correctly answering a question allows a player to move to the next level, with question difficulty increasing at each level. Each year has seen a noted increase in correct answers, with the majority of staff completing all levels scoring 100% in 2015. Behavioural improvement is suggested by the Urinary Catheter audit (2015–2016) which records an increase in the application of HOUDINI, with 87% of pathways having a HOUDINI reason documented; a rise of 18% from the previous year.

3. Catheter magnets

Catheter magnets have been deployed across wards/units throughout the Trust. Explanations as to their use on discharge boards are delivered by IPCT via in-situ demonstrations. Usage of catheter magnets has also been included in link staff briefings and discussed by members of the Trust attending the catheter care group. To evaluate their impact, a bespoke audit was conducted by the IPCT in May 2016, approximately two years after these magnets were launched. This measurement returned mixed results as to staff awareness and usage of catheter magnets. Eighty-one percent

(26/32) of areas involved in the audit were using the magnets incorrectly, either not using them at all ($n = 17$), using them on the welcome board ($n = 4$) or displaying them on discharge boards but not using them to review patients ($n = 5$). Discussions with ward staff revealed varied reasons for not using magnets, including lack of knowledge, discharge boards being unavailable, and a feeling that the current TWOC process was well established, thus a visual prompt was unnecessary.

While these findings suggested poor uptake of the magnets, discussions also revealed a level of enthusiasm for their use. Staff requested training on correct usage, enquired about obtaining discharge boards and suggested variations specific to their area. Considering the factors for successful multimodal implementation (e.g. Allegranzi et al., 2013; Zingg et al., 2015), reminders, education and feedback have been identified as priorities for the catheter magnet initiative. Magnets are to be made available to areas currently without, and a schedule of training and awareness regarding the catheter magnets has now been devised by the IPCT, with a repeat audit to be conducted in 2017.

4. Use of bladder ultrasound scanners

Evaluating the impact of our multimodal strategy has revealed a gap in explicit data regarding the impact of bladder scanners. No formal record is kept of bladder scanner use to determine catheter need; therefore, it is impossible to measure how many unnecessary catheterisations have been prevented. While frustrating, our lack of data appears by no means an anomaly within healthcare, with very few

reported data regarding the preventative impact of bladder scanners. Cutright (2011) notes that though studies have demonstrated associations between bladder scanner use and decreased UTI (e.g. Moore and Ed, 1997; Sparks et al., 2004) there remains a lack of large scale experimental studies to confirm their impact. Where data are available (Cutright, 2011; Lee et al., 2007), it appears to be collected to establish economic benefit, or as part of specific ongoing research, rather than being a feature of routine data collection. Despite the lack of formal data, staff using bladder scanners have provided positive feedback regarding their application and anecdotal data regarding their role in reducing catheterisation. As a result of our investigations to understand the impact of bladder scanners, the proposal for a regular audit of their role in catheter use decision-making has been raised for discussion at a forthcoming catheter care group meeting.

Ongoing challenges: engagement and accountability

While evaluating each intervention has highlighted priorities for further improvement, it is also critical to note that the seven-year process has not been smooth. We continue to face two related challenges to reducing CAUTI through the interventions documented: staff engagement and accountability.

Lowe (2012) describes engaged employees as 'committed to their employer, satisfied with their work and willing to give extra effort to achieve the organization's goals' (p. 31). Such employees are likely to display signs of motivation, showing commitment to, and pride in, their workplace. Parallel with engagement is accountability, the need for individuals to take ownership and responsibility for actions. Lo et al. (2014) call accountability fundamental to preventing HCAI through translating scientific evidence into implementation. They argue that 'Without clear accountability, scientifically based implementation strategies will be used in an inconsistent and fragmented way, decreasing their effectiveness in preventing HAIs' (p. 472).

Krein et al. (2013) have previously highlighted lack of staff engagement as a threat to adopting a statewide Bladder Bundle initiative, designed to reduce unnecessary catheterisation (Saint et al., 2009a). They found that nurses tended to underappreciate both how invasive urinary catheters are and the potential for UTI to cause severe effects for patients. Additional concerns held by nurses were that reducing catheter use could negatively impact on workload and they had difficulty balancing competing patient safety priorities. Krein et al. (2013) found that Nurses did not pose the sole challenge however, with lack of interest from clinical staff (e.g. doctors) documented, both in terms of championing the Bladder Bundle initiative and the topic of CAUTI overall.

Throughout the lifespan of our catheter care group, low accountability and staff engagement have been a constant

challenge. Like Krein et al. (2013), we have found a lack of interest from clinical staff regarding joining and contributing to the catheter care group. The group reports specific examples of low accountability demonstrated through a lack of attendance from specific areas (e.g. ED, Urology) represented at meetings no more than three times in seven years. When non-attendance was explored by the IPCT, explanations included staff unavailability due to clashing clinics and multiple leadership changeovers requiring repeated explanations as to the need to attend catheter care group meetings. As with many infection prevention activities, the challenge posed is ensuring that the wider health-care team work towards achieving best practice, rather than actively resisting, or blocking, potential improvements (Saint et al., 2009b). Krein et al. (2009) have already documented potential reasons for low engagement with efforts to reduce catheter usage, and issues of workload may be especially pertinent when considering our difficulties engaging staff from a very busy and pressurised ED. In an attempt to tackle issues of engagement and accountability, the IPCT have recently performed a review of the catheter care group attendee list, resulting in the proposal that rotational attendance may improve accountability. The IPCT aim to identify areas of low/non-attendance and increase the number of named attendees from such areas, increasing the likelihood that at least one area representative could attend on any given date. Similarly, to encourage attendance a location rotation every two months is to be trialled, rotating meetings between the community and acute setting. We are hopeful that increasing attendance may lead to more engagement, and ultimately accountability, from areas currently underrepresented within the catheter care group.

Strategies such as education, positive role models and dedicated link staff (Krein et al., 2013; Tatham et al., 2015) have led to moderate improvements in engagement, with a noted increase in non-attending clinicians showing engagement through notation/review of meeting minutes. We see the immediate priority as ensuring clarity within the Trust as to where accountability for catheter care, and associated CAUTI, lies. Once this is achieved, efforts can be directed towards increasing engagement, through making CAUTI rate data applicable to specific stakeholders, and working towards an understanding that collaborative working is required to reduce CAUTI throughout the Trust (Fakih et al., 2014).

Conclusion

Our multimodal approach to catheter care has demonstrated that required improvement is possible, through focused and considered activities. Such work delivers a direct benefit to patients, with reducing CAUTI rates also benefitting the whole health economy.

However, the review of the effectiveness of each component of our multimodal approach has highlighted the

importance of ongoing evaluation to enable sustained improvement. While some elements of the components have successfully been implemented and adopted, it is clear that improvements can still be made. Provision of tools (e.g. correct pathway version, catheter magnets), targeted education and routine measurement have all been revealed as priorities for the catheter care group to manage.

We highlight the challenge of apathy, using engagement and accountability as demonstrable factors, and continue to focus on mechanisms to overcome this attitude. Revisiting the catheter magnet concept, previously useful for raising engagement, will be among the first actions taken by our catheter care group.

However, we also suggest wider focus on this question of apathy from the infection prevention community and health-care economy as a whole, to prevent potentially successful interventions from being unintentionally sabotaged.

Acknowledgements

With thanks to staff at University Hospitals Coventry and Warwickshire Trust for their continued support for the catheter care group. With thanks to IPCN Carly Baker and Nicki Chamberlain for their help with collecting and reporting of audit data.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Peer review statement

Not commissioned; blind peer-reviewed.

References

- Adams D, Bucior H, Day G and Rimmer JA. (2012) HOUDINI: make that urinary catheter disappear—nurse-led protocol. *Journal of Infection Prevention* 13: 44–46.
- Allegranzi B, Sax H and Pittet D. (2013) Hand hygiene and healthcare system change within multi-modal promotion: a narrative review. *Journal of Hospital Infection* 83 (Suppl.): S3–S10.
- Bradley A, Prevc K, Dawson C, Baker C, Gallo M, Goodbody J, Reakes-Wells F, Thomas M, Wheldon D, Connor E and Parr J. (2015) 100 Days ‘C Diff’ Free! Using meaningful data to engage staff with infection prevention. *Journal of Infection Prevention* 16 (Suppl.): S3–S52.
- Codd J. (2014) Implementation of a patient-held urinary catheter passport to improve catheter management, by prompting for early removal and enhancing patient compliance. *Journal of Infection Prevention* 15: 88–92.
- Coghill E. (2008) Using high-impact interventions to reduce infection risk by standardising good practice. *Nursing Times* 105: 14–16.
- Cutright J. (2011) The effect of the bladder scanner policy on the number of urinary catheters inserted. *Journal of Wound Ostomy & Continence Nursing* 38: 71–76.
- Department of Health. (2007) *Saving Lines – High Impact Intervention No. 6, Urinary catheter care bundle*. London: Department of Health.
- Emmerson AM, Enstone JE, Griffin M, Kelsey MC and Smyth ETM. (1996) The Second National Prevalence Survey of infection in hospitals—overview of the results. *Journal of Hospital Infection* 32: 175–190.
- Elvy J and Colville A. (2009) Catheter associated urinary tract infection: what is it, what causes it and how can we prevent it? *Journal of Infection Prevention* 10: 36–41.
- Fakih MG, Krein SL, Edson B, Watson SR, Battles JB and Saint S. (2014) Engaging health care workers to prevent catheter-associated urinary tract infection and avert patient harm. *American Journal of Infection Control* 42: S223–S229.
- Haustein T, Gastmeier P, Holmes A, Lucet JC, Shannon RP, Pittet D and Harbarth S. (2011) Use of benchmarking and public reporting for infection control in four high-income countries. *Lancet Infectious Diseases* 11: 471–481.
- Health Protection Agency. (2012) *English national point prevalence survey on healthcare-associated infections and antimicrobial use, 2011: Preliminary data*. London: HPA.
- Hopkins S, Shaw K and Simpson L. (2011) *English national point prevalence survey on healthcare-associated infections and antimicrobial use, 2011: preliminary data*. London: Health Protection Agency. Available at: www.gov.uk/government/uploads/system/uploads/attachment_data/file/331871/English_National_Point_Prevalence_Survey_on_Healthcare_associated_Infections_and_Antimicrobial_Use_2011.pdf (accessed 1 Mar 2016).
- Kaur R, Razee H and Seale H. (2014) Facilitators and barriers around teaching concepts of hand hygiene to undergraduate medical students. *Journal of Hospital Infection* 88: 28–33.
- Krein SL, Kowalski CP, Harrod M, Forman J and Saint S. (2013) Barriers to reducing urinary catheter use: a qualitative assessment of a state-wide initiative. *JAMA Internal Medicine* 173: 881–886.
- Lee YY, Tsay WL, Lou MF and Dai YT. (2007) The effectiveness of implementing a bladder ultrasound programme in neurosurgical units. *Journal of Advanced Nursing* 57(2): 192–200.
- Lusignani LS, Blacky A, Starzengruber P, Diab-Elschahawi M, Wrba T and Presterl E. (2016) A national point prevalence study on healthcare-associated infections and antimicrobial use in Austria. *Wiener Klinische Wochenschrift* 128: 89–94.
- Lo E, Nicolle LE, Coffin SE, Gould C, Maragakis LL, Meddings J, Pegues DA, Pettis AM, Saint S and Yokoe DS. (2014) Strategies to prevent catheter-associated urinary tract infections in acute care hospitals: 2014 update. *Infection Control & Hospital Epidemiology* 35: S32–S47.
- Lowe G. (2012) How employee engagement matters for hospital performance. *Healthcare Quarterly* 15: 29–39.
- Meddings J, Rogers MA, Krein SL, Fakih MG, Olmsted RN and Saint S. (2013) Reducing unnecessary urinary catheter use and other strategies to prevent catheter-associated urinary tract infection: an integrative review. *BMJ Quality & Safety* doi:10.1136/bmjqs-2012-001774.
- Moore DA and Edwards K. (1997) Using a portable bladder scan to reduce the incidence of nosocomial urinary tract infections. *Medsurg Nursing* 6(1): 39–44.
- NHS Quest (2013) NHS Safety Thermometer Classic. Available at: <https://www.safetythermometer.nhs.uk> (accessed 6 October 2016).
- Nicolle LE. (2014) Catheter associated urinary tract infections. *Antimicrobial Resistance and Infection Control* 3: 1.
- Palese A, Buchini S, Deroma L and Barbone F. (2010) The effectiveness of the ultrasound bladder scanner in reducing urinary tract infections: a meta-analysis. *Journal of Clinical Nursing* 19: 2970–2979.
- Power M, Fogarty M, Madsen J, Fenton K, Stewart K, Brotherton A, Cheema K, Harrison A and Provost L. (2014) Learning from the design and development of the NHS Safety Thermometer. *International Journal for Quality in Health Care* 26: 287–297.
- Saint S, Olmsted RN, Fakih MG, Kowalski CP, Watson SR, Sales AE and Krein SL. (2009a) Translating health care-associated urinary tract infection prevention research into practice via the bladder bundle. *The Joint Commission Journal on Quality and Patient Safety* 35: 449–455.

- Saint S, Kowalski CP, Banaszak-Holl J, Forman J, Damschroder L and Krein SL. (2009b) How active resisters and organizational constipators affect health care-acquired infection prevention efforts. *Joint Commission journal on quality and patient safety/Joint Commission Resources* 35: 239–246.
- Sparks A, Boyer D, Gambrel A, Lovett M, Johnson J, Richards T, Johnson J, Grimm E, Daniels C, Tylka S and Mattingly H. (2004) The clinical benefits of the bladder scanner: a research synthesis. *Journal of Nursing Care Quality* 19(3):188–92.
- Stokowski LA. (2009) Preventing Catheter-Associated Urinary Tract Infections. Available at: http://www.medscape.com/viewarticle/587464_4 (accessed 1 March 2016).
- Tatham M, Macfarlane G, MacRae M, Tully V and Craig K. (2015) Development and Implementation of a Catheter Associated Urinary Tract Infection (CAUTI) Toolkit. *BMJ Quality Improvement Reports* 4: u205441.w3668.
- Tew L, Pomfret I and King D. (2005) Infection risks associated with urinary catheters. *Nursing Standard* 20: 55–61.
- Ward DJ. (2012) Attitudes towards infection prevention and control: an interview study with nursing students and nurse mentors. *BMJ Quality & Safety* 21: 301–306.
- Ward DJ. (2013) The barriers and motivators to learning infection control in clinical placements: Interviews with midwifery students. *Nurse Education Today* 33: 486–491.
- Weinstock PH, Kappus LJ, Garden A and Burns JP. (2009) Simulation at the point of care: reduced-cost, in situ training via a mobile cart. *Pediatric Critical Care Medicine* 10: 176–181.
- Zingg W, Holmes A, Dettenkofer M, Goetting T, Secci F, Clack L, Allegranzi B, Magiorakos AP and Pittet D. (2015) Hospital organisation, management, and structure for prevention of health-care-associated infection: a systematic review and expert consensus. *Lancet Infectious Diseases* 15: 212–224.