A nurse-driven process for timely removal of urinary catheters

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ABSTRACT
Catheter-associated urinary tract infection (CAUTI) comprises 30–40% of all health care-acquired infections, and 70–80% of these infections are related with use of indwelling urinary catheters. This quality improvement (QI) project was initiated to evaluate the effectiveness of a nurse-driven urinary catheter removal process in reducing the duration of urinary catheter usage in a general medical ward in Singapore. A pre- and post-study design was adopted. The pre-implementation data included urinary catheter utilization ratio and CAUTI rates. Over a 6-months period, nurses used a nurse-driven urinary catheter removal process to improve rates of timely removal of catheter. Data collected included nurses’ compliance with the process and clinical outcomes, such as urinary catheter utilization ratio and CAUTI rates before and after implementation. Compliance with the use of the nurse-driven process by staff was 89%. The urinary catheter utilization ratio revealed a raise from 0.12 before implementation to 0.18 after implementation. However, CAUTI rates decreased from 4 to 0 per 1000 catheter-days, indicating a marginally significant difference between the pre and post-implementation rates (p = 0.06), using Fisher’s exact test. The nurse-driven process decision support tool for optimizing appropriate catheter usage had the potential of reducing a patient’s risk of acquiring CAUTI.

Key words: Catheter-associated urinary tract infection • Indwelling catheter • Intervention studies • Nurse protocol • Urinary catheterization

BACKGROUND
Prolonged catheterization is the primary risk factor for catheter-associated urinary tract infection (CAUTI), the most frequent type of health care-acquired infection (HAI) in acute care settings. CAUTI comprises 30–40% of all HAI, and 70–80% of these infections are related with the use of indwelling urinary catheters (Bagshaw and Laupland 2006). CAUTI symptoms may include fever, urgency, frequency, dysuria, suprapubic tenderness and a positive urine culture with no more than two species of organisms. Approximately 449,000 CAUTIs occur in US hospitals each year at a cost of up to US$450 million (Scott 2009). Although urinary tract infections associated with alternative urinary drainage systems are considered device-associated, CAUTI rates reported to the National Healthcare Safety Network (NHSN) refer exclusively to infections associated with indwelling urinary catheters (Centers for Disease Control and Prevention 2009).

Duration of urinary catheterization is the predominant risk factor for CAUTI. Hence, preventive measures directed at limiting placement, along with early removal of urinary catheters, have the greatest impact on decreasing CAUTI rates (Chenoweth et al. 2014). The body of evidence indicates that a variety of independent variables encourage early removal of urinary catheters and significantly reduce both CAUTI rates and catheter-days with minimal risk (Magers 2013). For example, in their meta-analysis, Meddings et al. (2010) concluded that urinary catheter reminders and stop-orders reduced CAUTI rates by 52% (p < 0.001).
and resulted in 2.61 fewer days of catheterization per patient in the intervention versus control groups.

The introduction of evidence-based, nurse-driven daily checklists for initiation and continuance of urinary catheters were shown to decrease CAUTI rate across five ICUs from 2.8 to 1.5/1000 d, and reduction in number of urinary catheter days from 402 to 380 ($p = 0.047$) (Fuchs et al. 2011). Catheter usage (per patient population) was decreased by greater than 17% after the introduction of a nurse-led urinary catheter removal protocol known as ‘HOUDINI,’ an acronym used to list the indications for continued use of a urinary catheter, namely: H – haematuria, O – obstruction, U – urology surgery, D – decubitis ulcer (grade 3 or 4) or perineal wound in incontinent patient, I – input and output measurement for patient management or hemo-dynamic instability, N – nursing end-of-life care and I – immobility due to physical constraint (Adams et al. 2012). In a more recent study, whereby nurse-driven catheter removal protocol was part of a multifaceted strategy to improve outcomes, Purvis et al. (2014) demonstrated a reduction in CAUTI rate from 4.7 to 2.3, as well as decreased catheter utilization.

Based on the collective evidence, the literature supports a nurse-led process to evaluate the continuing need for a catheter and to encourage its prompt removal where warranted, led by the clinical issue question, ‘Will nursing assessment for early removal of indwelling catheters decrease the number of catheter device days and the incidence of CAUTI?” However, the use of nurse-led protocols is still relatively new in our local setting. Henceforth, this current project was conducted to evaluate the implementation of a nurse-driven urinary catheter removal process in reducing the duration of urinary catheter usage in a general medical ward in Singapore.

**PROJECT AIM**

The aim of this quality improvement (QI) project was to evaluate the effectiveness of a nurse-driven urinary catheter removal process in reducing the duration of urinary catheter usage and CAUTI rate (per 1000 catheter days) in a general medical ward.

**METHODS**

**Setting**

Singapore General Hospital is the largest, acute tertiary care hospital in Singapore, with a capacity of 1700 beds. The identified general medical ward where the intervention was piloted has a capacity of 75 beds and admits individuals with various medical conditions.

**Study design and sample**

A pre-post study QI project design was used to compare catheter days and CAUTI rates pre (9 months) and post (6 months) implementation of the nurse-driven process.

All patients with indwelling urinary catheters or those that have a catheter placed during hospitalization were eligible for review and were included in the project. Patients who had a condom catheter, arrived from home or an extended care facility with a chronic urinary catheter, had a nephrostomy tube, suprapubic catheter or who were practising intermittent catheterization was excluded from evaluation. Center for Disease Control (CDC)’s definition for CAUTI was used to identify patients who develop CAUTI.

**Implementing the nurse-driven process**

We adapted Adams et al.’s (2012) ‘HOUDINI’ urinary catheter removal process for use in this project. Registered nurses (RN) were empowered to make independent assessments of the continued need for an indwelling catheter based on the ‘HOUDINI’ process. The ward RN evaluated the patient upon insertion of the urinary catheter and on a daily basis (see Figure 1). If a patient with a urinary catheter did not meet one of the seven criteria indicated by the acronym HOUDINI, RN had the autonomy to remove the device without a physician order.

Staffs were encouraged to think ‘HOUDINI’ each time a patient’s urinary catheter status was assessed. After the catheter was removed, the RN assessed the patient for voiding within 6 h. Bedside bladder ultrasound scanners were used to assess patients who could not void after removal of catheter (Figure 1). If urinary retention was documented, an indwelling urinary catheter was placed.

An education programme for all nursing staff, nursing assistants and physicians was conducted before implementation of this nurse-driven process. Attendance rate for the programme was 80%. ‘Let’s Zero CAUTI!’ was used as tagline to create awareness during the implementation period. Over a 3-week period, training took place at staff meetings, unit practice council meetings, as well as in-service one-on-one consultations with unit nurses. Posters illustrating key points were created and used as visual aids when conducting staff education in the ward. In this pilot ward, posters were placed at every nursing station. To ensure consistency in the daily use of the HOUDINI process, the researcher observed the use of the process by the ward’s nursing staff; feedback and clarification were provided on the spot as required.

A ‘Daily Review HOUDINI Protocol’ stamp was also developed to remind the physicians and nursing staff
Timely removal of urinary catheters

Nurse Driven Urinary Catheter Removal Process

“HOUDINI” NURSING PROCESS

Removal of Urinary Catheter

**ACTION:** Remove catheter and assess for voiding within 6 hours

If patient has not voided within 6 hours…

**Bladder scanner available:**
1. If bladder scan shows <150 ml, contact physician, provide condition report and obtain orders.
2. If scan >150 m, but <300 ml and patient is not uncomfortable, re-assess 2 hours later.
3. If scan shows >300 ml, straight (in and out) catheterize patient; record amount and catheter size.
4. Repeat process after 6 hours; straight catheterize patient if necessary and document.

No bladder scanner available in unit:
1. Palpate bladder for distention, assess patient’s comfort level; straight catheterize patient as determined by assessment.

Figure 1 HOUDINI nursing process.

of the need to evaluate indications for the catheter on a daily basis (Figure 2).

Fidelity measures were collected throughout the project to determine whether or not the intervention was implemented and used as outlined. Nurses were responsible for completion of the tool and the ward’s nurse champions assessed fidelity on a daily basis for the duration of project. Criteria for success, evaluated by the fidelity measures, were set at 85% adherence or above. For all fidelity measures below 80%, the principal investigator undertook re-education of staff.
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**Fidelity (compliance with HOUDINI)**

The rates of compliance by nurses with the nurse-driven HOUDINI process were measured after implementation. Compliance is defined as use of the nurse-driven process by RN for each day an individual patient has a urinary catheter. Nurses from the ward used an audit tool (developed by the author) on a daily basis to check compliance. A dichotomous (yes/no) response was used to determine whether the RNs assessed the patients with indwelling urinary catheter and used HOUDINI. The following components were audited: (i) Was the daily review HOUDINI process stamp used? (ii) Is the catheter still in situ as criteria indicated in HOUDINI process? (iii) Was the catheter removed following the HOUDINI process? (iv) If the catheter was removed following the HOUDINI process, is there any re-catheterization required? Descriptive statistics was used to describe the percentage of audit checklists received.

**Data analysis**

Descriptive statistics were used to describe the compliance with the HOUDINI tool completion by the RN staff. Data for urinary catheter (UC) days and CAUTI rates were summarized and frequency of CAUTI at pre- and post-implementation was compared using a Fisher’s exact test. Differences were regarded as statistically significant at $p < 0.05$.

**Ethical considerations**

Implementation of this study was approved and classified exempt by our health systems’ Institutional Review Board (IRB) as well as Duke University IRB.

**RESULTS**

**Clinical outcomes**

‘Immobility’ (70.2%), ‘strict monitoring of intake and output (64.6%) and ‘management of urological symptoms’ (23.4%) were the most common indications for urinary catheters.

Data on clinical outcomes were collected before and after implementation of the HOUDINI process in this ward. The urinary catheter utilization ratio demonstrated an increased from 0.12 before implementation to 0.18 after implementation (see Figure 3).

CAUTI decreased from 4 to 0 per 1000 catheter-days, revealing a marginally significant difference between the pre and post-implementation period ($p = 0.06$) (see Figure 4).

**Fidelity outcomes**

Compliance with the use of the daily HOUDINI process stamp and assessment of indications for urinary catheterization by staff during the 6 months monitoring period was 89%.

**DISCUSSION**

The results demonstrated a slight increase in urinary catheter utilization ratio (from 0.12 to 0.18). This was most likely due to different patient profile in the two periods.

CAUTI incidents declined from 4 to 0 per 1000 catheter-days, between the pre and post-implementation ($p = 0.06$). This was consistent with our ‘Let’s Zero CAUTI!’ tagline. The statistical significance of these findings was only marginal.
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However, a reduction in one CAUTI is still clinically significant (Meddings et al. 2010).

Several factors can contribute to the reduction in CAUTI rates and utilization ratio – daily assessment for need of catheter, use of care bundle, decision-making algorithm and nurse-driven protocol (Reilly et al. 2006; Adams, et al. 2012). Our results were consistent with well-conducted studies and systematic reviews indicating that catheter-days and CAUTI rates are nurse-sensitive indicators that can be controlled through changes in nursing practice.

While the 89% rate of compliance in using the HOUDINI process was satisfactory, this study did not examine variables such as overall unit priorities, unit culture, patient types and staff demographics that may influence the adoption of interventions such as this nurse-driven process. Further research is needed to gain a better understanding of these variables and their impact on compliance rates.

The process measures used in this intervention may be even more important than the actual clinical results. According to the nurses’ anecdotal feedback, compliance with HOUDINI increased nurses’ awareness of the need for daily patient assessment for timely removal of catheters when the clinical need for them no longer exists. Our experience with this project suggested that acceptance and use of care protocols or algorithms for nursing care by individual nurses and
units were best achieved with feedback and close communication.

LIMITATIONS
This project had several limitations. First, the project described the experience of a single site, large acute tertiary academic teaching hospital; thus, the generalization of our results may be limited to hospitals of similar size and type. Given the observational nature of the project, we were unable to establish causality. Nevertheless, it is reasonable to consider that beyond fundamental nursing care, an ideal approach to reducing catheter-days and CAUTI rates is to employ a nurse-driven process that discourages unnecessary catheterization and promotes the removal of urethral catheters as soon as indicated.

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CONCLUSIONS
It is always challenging for hospitals to ensure the delivery and provision of safe, quality patient care. HOUDINI provided a structure for nurse decision-making, empowering nursing staff to do the right thing. Key strategies for implementation success include a project-planning committee, multimodal education, organizational support and active use of provider feedback to improve the adoption process.

IMPLICATIONS FOR NURSING PRACTICE
We intend to embark on disseminating this nurse-driven HOUDINI process to other inpatient units in our hospital. We have made available the beginning framework of incorporating HOUDINI process into local nursing practice. Future studies to evaluate the sustainability and nurses’ satisfaction with the HOUDINI process should be conducted.

WHAT IS KNOWN ABOUT THIS TOPIC
- CAUTI comprises 30–40% of all HAIs, and 70–80% of these infections are related with use of indwelling urinary catheters. This QI project was implemented to evaluate the effectiveness of a nurse-driven urinary catheter removal process in reducing the duration of urinary catheter usage in a general medical ward.

WHAT THIS PAPER ADDS
- The nurse-driven process decision support tool for optimizing appropriate catheter usage was successful in reducing a patient’s risk of acquiring CAUTI.

REFERENCES