Long-term outcome of an intervention to remove unnecessary urinary catheters, with and without a quality improvement team, in a Thai tertiary care center

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Long-Term Outcome of an Intervention to Remove Unnecessary Urinary Catheters, With and Without a Quality Improvement Team, in a Thai Tertiary Care Center

To the Editor—Several studies about reducing the rate of catheter-associated urinary tract infections have reported the success of interventions that were not device-based.¹⁻⁵ Two previous studies reported successful outcomes of quality improvement programs featuring interventions to remind physicians to remove unnecessary catheters.⁶⁻⁷ These programs subsequently reduced the number of unnecessary urinary catheter-days and decreased the rates of catheter-associated urinary tract infection. However, such interventions are labor intensive and require a long-term commitment from nursing and physician staff. In addition, the long-term effects of these programs have not been adequately explored. Whether interventions can be successful without the involvement of a quality improvement team deserves further investigation. In this letter, we report 2 years of follow-up data from a hospital-wide quality improvement program featuring an intervention to remind physicians to remove unnecessary urinary catheters, with and without the involvement of a quality improvement team, at one university-based hospital.⁵

From July 1, 2005 through June 30, 2006 (period 1), we implemented a hospital-wide quality improvement program featuring physician reminders to remove unnecessary urinary catheters. During this period, the nursing staff identified patients who had had a urinary catheter in place for at least 3 days by reviewing orders keyed into a computer terminal linked to the hospital central workstation, and they notified investigators of these patients. If urinary catheterization was deemed inappropriate, daily bedside discussions occurred among treating physicians and physicians from the intervention team regarding the reasons for urinary catheterization and the possibility of discontinuing it. Treating physicians then made a decision to maintain or remove the patient’s catheter. The nursing staff continually monitored patients for any systemic or local sign of catheter-associated urinary tract infection, and an infectious diseases physician confirmed the appropriateness of the indication for urinary catheterization and determined whether there was a urinary tract infection. This intervention was also promoted at a monthly staff meeting held to discuss problems and identify possible risk factors for patients who had developed urinary tract infections in the previous month.

From July 1, 2006 through June 30, 2007 (period 2), all activities related to the quality improvement team (ie, physicians’ bedside discussion and monthly staff meeting) were discontinued, except for a simple reminder by nurses to physicians to remove unnecessary catheters from patients who had inappropriate urinary catheterization. From July 1, 2007 through June 30, 2008 (period 3), all interventions related to the quality improvement team were again implemented. Data on patient demographic characteristics, underlying diseases, severity of illness, admission diagnosis, indication for urinary catheterization, appropriateness of urinary catheterization, and the occurrence of catheter-associated urinary tract infection were compared during the 3 study periods.

Data on patient demographic and clinical characteristics and on catheterization and urinary tract infections are shown in the Table. There was an absolute increase of 7% in the rate of inappropriate urinary catheterization in period 2, compared with period 1 (from 11% to 18%; P <.001). In period 2, significantly more patients developed catheter-associated urinary tract infection, and some patterns of inappropriate catheterization also changed (Table). However, during period 3, there was an absolute decrease of 10% in the rate of inappropriate catheterization, compared with period 2 (from 18% to 8%; P <.001). There was also a significant reduction in the rate of and the number of reasons for inappropriate urinary catheterization, and fewer patients developed catheter-associated urinary tract infection, in period 3 compared with period 2 (Table).

This study suggests that simple reminders from nurses did not reduce the rate of inappropriate catheterization in a resource-limited setting, and it emphasizes the important role of the activities of the quality improvement team (ie, physicians’ bedside discussion and monthly staff meetings) in helping to reduce the rate of inappropriate urinary catheterization. These findings imply that physicians were more receptive to a change in practices if the recommendation came from other physicians than if it came from the nursing staff. To sustain these results, both commitment for the intervention team and repeated efforts appear to be needed. Nevertheless, this intervention was inexpensive and effective and did not require the purchase of expensive equipment, and use of this nondevice intervention should be considered initially to reduce the rate of catheter-associated urinary tract infection in hospitals in developing countries.

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Potential conflicts of interest. All authors report no conflicts of interest relevant to this study.
### TABLE. Patient Characteristics and Rates of Inappropriate Urinary Catheterization and Associated Urinary Tract Infections (UTIs) in the 3 Study Periods

<table>
<thead>
<tr>
<th>Variable</th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient characteristics</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of patients</td>
<td>1,307</td>
<td>1,415</td>
<td>1,363</td>
</tr>
<tr>
<td>Age, mean ± SD, years</td>
<td>52 ± 7.9</td>
<td>51 ± 6.5</td>
<td>51 ± 6.7</td>
</tr>
<tr>
<td>Female sex</td>
<td>640 (49)</td>
<td>714 (50)</td>
<td>668 (49)</td>
</tr>
<tr>
<td>Principal diagnosis</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiovascular disease</td>
<td>301 (23)</td>
<td>283 (20)</td>
<td>286 (21)</td>
</tr>
<tr>
<td>Gastrointestinal disease</td>
<td>288 (22)</td>
<td>325 (23)</td>
<td>286 (21)</td>
</tr>
<tr>
<td>Diabetes</td>
<td>274 (21)</td>
<td>311 (22)</td>
<td>313 (23)</td>
</tr>
<tr>
<td>Cerebrovascular or other neurological disease</td>
<td>222 (17)</td>
<td>226 (16)</td>
<td>204 (15)</td>
</tr>
<tr>
<td>Pulmonary disease</td>
<td>170 (13)</td>
<td>212 (15)</td>
<td>177 (13)</td>
</tr>
<tr>
<td>Immunocompromised state</td>
<td>91 (7)</td>
<td>99 (7)</td>
<td>109 (8)</td>
</tr>
<tr>
<td>Malignancy</td>
<td>39 (3)</td>
<td>28 (2)</td>
<td>40 (3)</td>
</tr>
<tr>
<td>Other</td>
<td>196 (15)</td>
<td>198 (14)</td>
<td>204 (15)</td>
</tr>
<tr>
<td>APACHE II score, mean ± SD</td>
<td>15 ± 8.6</td>
<td>16 ± 7.8</td>
<td>15 ± 8.3</td>
</tr>
<tr>
<td><strong>Urinary catheter use</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inappropriate use</td>
<td>144 (11)</td>
<td>255 (18)</td>
<td>109 (8)</td>
</tr>
<tr>
<td>Reason use was inappropriate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No more need to monitor urine output</td>
<td>27 (19)</td>
<td>65 (25)</td>
<td>20 (18)</td>
</tr>
<tr>
<td>Unclear indication (no useful purpose)</td>
<td>29 (20)</td>
<td>56 (22)</td>
<td>23 (21)</td>
</tr>
<tr>
<td>Urinary incontinence without significant skin breakdown</td>
<td>24 (16)</td>
<td>36 (14)</td>
<td>15 (14)</td>
</tr>
<tr>
<td>Neurogenic bladder where intermittent self-catheterization is possible</td>
<td>17 (12)</td>
<td>25 (10)</td>
<td>14 (13)</td>
</tr>
<tr>
<td>Use for convenience of care</td>
<td>17 (12)</td>
<td>25 (10)</td>
<td>14 (13)</td>
</tr>
<tr>
<td>Insertion for amphotericin B bladder irrigation</td>
<td>14 (10)</td>
<td>20 (8)</td>
<td>11 (10)</td>
</tr>
<tr>
<td>Staff too busy to remove</td>
<td>9 (6)</td>
<td>12 (4)</td>
<td>6 (6)</td>
</tr>
<tr>
<td>Staff forgot to remove</td>
<td>7 (5)</td>
<td>13 (5)</td>
<td>6 (6)</td>
</tr>
<tr>
<td>Total no. of urinary catheter–days</td>
<td>3,920</td>
<td>4,005</td>
<td>3,963</td>
</tr>
<tr>
<td>No. of inappropriate urinary catheter–days, mean ± SD</td>
<td>823 (21)</td>
<td>1,410 (35)</td>
<td>753 (19)</td>
</tr>
</tbody>
</table>

**Note.** Data are no. (%) of patients, unless otherwise indicated. Interrupted time series analysis with segmented regression analysis was used to evaluate the trend of CA-UTI in the entire study periods. APACHE, Acute Physiology and Chronic Health Evaluation; CA-UTI, catheter-associated urinary tract infection; period 1, July 1, 2005 through June 30, 2006; period 2, July 1, 2006 through June 30, 2007; period 3, July 1, 2007 through June 30, 2008; SD, standard deviation.

- Categorical variables were compared using χ² or Fisher exact test, as appropriate; the 2-tailed Student t test was used to compare continuous variables.
- P < .05, compared with period 1.
- P < .05, compared with period 2.
- Reason per episode of inappropriate use of urinary catheter during each period.

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Antibiotic Stewardship and Clostridium difficile–Associated Disease

To the Editor—In the past 2 decades, Clostridium difficile has emerged as a major cause of nosocomial infection, largely facilitated by antibiotic use, much of which is excessive and/or unnecessary. We applied recently described case definitions of C. difficile–associated disease (CDAD) to document the beneficial effects of an antibiotic stewardship program.

Beginning January 1, 2001, we tracked every case of CDAD at our 550-bed teaching hospital. Despite continued emphasis on handwashing and isolation procedures, the incidence of CDAD remained constant during the period from October 2003 through August 2006 (Figure).

In September 2006, we instituted an antibiotic stewardship program, under which prescriptions for most parenteral antibiotics required approval by an infectious disease physician or clinical pharmacist. Penicillin, ampicillin, ampicillin-sulbactam, nafcillin, ceftriaxone, aztreonam, aminoglycosides, metronidazole, and oral formulations of antimicrobial agents could be ordered without approval; daytime orders for all other antibiotics were only honored if approved. Nighttime orders for formulary antibiotics were honored until 7:30 AM the following day, when the pharmacist and infectious diseases physician reviewed them, either approving the order or contacting a resident to make other recommendations. Antibiotic prophylaxis before surgery was not addressed, although continuation of such treatment after 48 hours required approval through the antibiotic stewardship program.

Beginning February 2007, we applied Centers for Disease Control and Prevention case definitions of CDAD retroactively to 2003 and prospectively. CDAD was defined as a diarrheal disease (loose or watery stools generally 3 or more times per day) and/or an abdominal discomfort with a positive result of an enzyme-linked immunosorbent assay (ELISA) for C. difficile toxins A and B (Premier Toxins A&B EIA; Meridian Bioscience). A new case of CDAD was diagnosed if a patient met the case definition and had not had a diagnosis of this disease any time in the preceding 8 weeks. Recurrent disease was considered to be present if symptoms reappeared 2–8 weeks after the initial assay result was found to be positive for C. difficile toxin in a patient who had responded to therapy. A patient with continuous symptoms and repeated positive test results was considered to have a single case. The total number of cases equals the sum of new and recurrent cases.

For the 3 years preceding the introduction of the antibiotic stewardship program, the mean incidence of all cases of CDAD was 41.7 cases per month (3.3 cases per 1,000 bed-days) (Figure). Implementation of the program was followed by a decline to 22.0 cases per month (1.7 cases per 1,000 bed-days) during the ensuing 12 months, a 47.2% decrease (P < .001, by t test). The mean incidence of first-time CDAD, which we defined as a documented case of CDAD in a patient who had never previously had this disease, was 28.4 cases per month (2.2 cases per 1,000 bed-days) before implementation of the antibiotic stewardship program and 16.4 cases per month (1.2 cases per 1,000 bed-days) after, a 42.2% decrease (P < .001).

These data show that implementation of a hospital-wide
antibiotic stewardship program brought about a significant and lasting reduction in the incidence of CDAD. Other investigators have suggested this, either with control of specific antibiotics such as clindamycin, cephalosporins, or fluoroquinolones or with general measures aimed at all antibiotics.\(^6,7\)

Our results are particularly robust, meeting standardized case definitions and showing consistent findings for several years before the intervention as well as for a full year afterward. Interestingly, our antibiotic stewardship program was as successful as a recently reported “bundle” approach; it is possible that implementation of both approaches might have further reduced the incidence of CDAD.

The Centers for Disease Control and Prevention case definitions introduce 2 potential sources of bias. First, some patients respond poorly to treatment\(^9\) and continue to have intermittent symptoms. ELISA results may be only intermittently positive, and a single, poorly responding patient may meet case definitions for having several recurrent cases or new cases. Second, patients who remain free of symptoms and have negative test results for 8 weeks but again develop diarrhea and have positive ELISA results may have a recurrence of CDAD rather than a new infection; only fecal culture with molecular fingerprinting would distinguish the 2 possibilities. Our demonstration of a similar reduction in the incidence of first-time cases supports the validity of the case definitions for CDAD.

Some of the observed reduction in the incidence of CDAD may have reflected the implementation of a program to reduce the spread of methicillin-resistant \textit{Staphylococcus aureus} (MRSA). Beginning in August 2006, our medical center took the initial steps toward an eventual hospital-wide policy of culturing samples from the nares of every patient admitted and isolating patients for whom culture yielded MRSA. These steps included hospital-wide briefings on the importance of infection control and renewed attempts to emphasize the importance of patient isolation procedures. This project began on a single 40-bed medical ward in our hospital. In the ensuing year, this effort was expanded to 3 other areas in the hospital, totaling 110 beds. Although this program has steadily heightened hospital-wide interest in infection control, it is unlikely to have accounted for the immediate decrease in new cases of CDAD. Furthermore, its expansion has led to no additional decrease in cases of MRSA infection. According to a recent report,\(^10\) partial (as opposed to hospital-wide) implementation of a policy to control MRSA infection did not reduce its incidence. Similarly, in our hospital, the incidence of MRSA infection did not decline during the first year of the program. These observations support our conclusion that the reduction in the incidence of CDAD is largely attributable to the antibiotic stewardship program.

In summary, motivated by the ongoing epidemic of CDAD in our medical center, we instituted an antibiotic stewardship program. Utilizing data on the incidence of CDAD at our medical center for the 3 years before the implementation of antibiotic stewardship program and for 1 year after implementation, we showed that there was a 47% decrease in all cases of CDAD and a 42% decrease in new cases of CDAD.

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