Catheter-associated urinary tract infection in primary and community health care

KATHRYN GETLiffe, TEREsA NEwTON

School of Nursing and Midwifery, University of Southampton, Highfield, Southampton, Hants SO17 1BJ, UK

Address correspondence to: K. Getliffe. Tel: (+44) 23 8059 7926. Fax: (+44) 23 8059 7979. Email: k.a.getliffe@soton.ac.uk

Abstract

Introduction: although often a last resort, urinary catheterisation is a relatively common management option for bladder dysfunction in older people and others cared for in community settings. Catheter-associated urinary tract infection (CAUTI) is a well-recognised source of increased morbidity and economic burden in acute care services, but much less is known about the prevalence and impact of CAUTI in primary and community care.

Objectives: the aim of this study was to examine the criteria and outcome measures used in reporting CAUTI, to identify sources and quality of data recorded on CAUTI and to determine a base-line prevalence rate for CAUTI in community settings.

Methods: (i) a mapping exercise to identify local, national and international sources of data on CAUTI and (ii) a retrospective prevalence survey of CAUTIs, recorded within three Primary Care Trusts in England during 1 month (October 2004).

Results: published or other recorded data on CAUTI in community settings were very limited. Criteria and outcome measures were variable and commonly failed to distinguish between symptomatic and asymptomatic CAUTI. A prevalence rate of 8.5% was determined by retrospective survey of patient records.

Conclusions: limitations in the quality and consistency of catheter-related information collected by healthcare services present a major obstacle to robust epidemiological analysis of risk and impact of CAUTI in primary and community care. Standardised routine data collection is essential to determine the magnitude of risk associated with CAUTI, to enable the development of a longitudinal database of long-term catheterised patients and to provide base-line data against which infection-control initiatives in primary and community care can be evaluated.

Keywords: community health services, elderly, infection control, urinary catheterisation

Background

Long-term urinary catheterisation is a commonly used management option for older people and others, where alternative treatments for bladder dysfunction are inappropriate or unsuccessful. However, catheterisation is associated with clear risks, the most common being catheter-associated urinary tract infection (CAUTI). CAUTIs are widely recognised as a major source of healthcare-associated infections (HAIs) [1, 2], and the frequency of catheter use produces substantial overall morbidity for patients and costs to healthcare services [3], often including unnecessary antibiotic therapy, which may then become a major source of antibiotic resistant pathogens. Bacterial biofilm formation on catheter surfaces reduces the susceptibility of bacteria to host defences and antimicrobial agents [4], resulting in chronic asymptomatic infection, with the potential to progress to symptomatic infection and, in some cases, life-threatening bacteraemia. CAUTIs are also associated with recurrent catheter encrustation and blockage [5], urinary tract stones and increased risk of bladder cancer [6, 7], although availability of robust long-term follow-up data is limited. None of the currently available catheter materials is fully resistant to biofilm formation, although there is increasing evidence of antimicrobial benefits of silver–alloy catheters, at least in the short term [8]. The majority of the existing research on CAUTI has been conducted in acute care settings where catheters usually remain in place for <14 days, and the health of many patients is already compromised by co-morbidities [8, 9]. Much less is known about the prevalence of CAUTIs and other HAIs in primary and community care settings [10] or about the potential for reduction in CAUTI and improved cost-benefits in the long-term catheterised population [11, 12]. Long-term catheterised patients occupy around 4% of a district nurse’s caseload in the UK [5], and the prevalence of catheterised patients in nursing homes has been estimated to be around 9% [13] but may be up to 40% or more in some places [13, 14]. In a recent study of 4010 older people (>65 years) receiving home care in 11 European countries, the prevalence

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of indwelling catheter use was 5.4% (range 0–23%), and the risk of a urinary tract infection was 6.5 times greater than that for non-catheterised individuals [15]. Another study of 1004 frail older women living in the community reported a catheter prevalence rate of 38.1%. Prevalence of a urinary tract infection was 21% versus 10% in non-catheterised subjects (P<0.001), and catheterised subjects were more likely to die within a year (RR 1.44; 95% CI 1.01–2.07) [16]. Calls have been made for further research in key areas of catheter care to include epidemiological studies of prevalence and incidence of bacteriuria and clinical UTI (asymptomatic and symptomatic CAUTI) during long-term catheterisation in different populations and different care settings [10].

**Methods**

The study aimed to examine sources and quality of evidence on the prevalence and impact of CAUTI in primary and community care. The initial stage was a mapping exercise to identify the sources of information, including published literature and other recorded data. This was followed by a retrospective prevalence survey of CAUTIs recorded within three Primary Care Trusts (PCTs) in the south of England. Specific objectives were:

(i) to identify definitions and outcome measures used in relation to the clinical and economic impact of CAUTI;

(ii) to determine the quality and content of current record keeping relating to catheter care and CAUTI by health professionals; and

(iii) to identify baseline prevalence data which could inform future evaluations of strategies/interventions to reduce CAUTIs.

Mapping exercise: Databases of published literature (including MEDLINE, CINAHL, the Cochrane Database for Systematic Reviews, the Cochrane Central Register of Controlled trials, and Database for Abstracts for Reviews of Effects) were searched from 1996 onwards. Strategies to access information from other sources included the examination of relevant websites and printed literature, searches of databases of current research, and direct contact with recognised national and international experts in the field. Information/data were sought from national and international bodies, nosocomial infection surveillance programmes, and professional or other groups engaged in public health, infection control and/or management of bladder problems. A survey of a small, representative sample of patient records from community hospitals, nursing homes and district nurses’ in three PCTs was undertaken. A simple checklist was used to identify the type and level of detail on catheter care and CAUTI recorded. Similar attempts to view GP records were made, and the potential for cross-referencing between databases in primary care, in order to gain realistic estimates of CAUTI, was examined. Databases included community services (codes for District Nursing activities), GP databases, microbiology services and pharmaceutical prescription data. Lastly, in recognition of the variability of criteria used to define CAUTI in published literature and the fact that catheter care is largely a nursing responsibility, a survey of operational definitions of CAUTI used and actions taken by nurses working in continence care was conducted. Questionnaires were distributed to members of the Continence Forum of the Royal College of Nursing (RCN) and the Association for Continence Advice (ACA). Respondents were offered definitions from current surveillance protocols [17] or requested to provide their own working definition.

The retrospective prevalence survey of CAUTI in primary and community care organisations was conducted within three PCTs. The survey period was 1 month (October 2004). Patients currently using a long-term catheter (i.e. expected to remain catheterised for more than 14 days) [12] or whose catheter had been removed within 3 days of the survey dates were included. Data on CAUTI were sought from community nurses, GP practices and central pharmacy and microbiology records. The community nurse sample comprised of all district nurses in the three PCTs, senior nursing staff responsible for eight wards in community hospitals and senior nurses in seven large nursing homes (≥30 residents). Notes of patients discharged or transferred from community hospitals during the survey period were accessed and reviewed by the research team. Precautions were taken to avoid potential duplication of the same patients identified from different sources through rigorous checking of patient-identification codes. The survey instrument was a questionnaire developed and piloted in consultation with senior nurses in community nursing services and nursing homes. Operational definitions of CAUTI were provided as previously [17], with an option for respondents to offer their own working definition. Confidentiality and anonymity of individuals was maintained by numerical coding of data and reporting in the aggregate. The study conformed to local research ethics and research governance protocols and was supported by a reference group comprising experts in the fields of continence care, infection control, primary care and catheter development. Funding was provided by grant from Bard Ltd.

**Results**

Results of the literature search and mapping exercise demonstrated that while extensive published data on CAUTI in acute care settings existed, comparable surveillance data on CAUTI in community settings were very limited and lacked a standardised approach to reporting (Table 1). Failure to distinguish between symptomatic and asymptomatic CAUTI was common and defining criteria were variable, and often unclear or absent. The NICE [10] guidelines on ‘Prevention of healthcare associated infections in primary and community care’ provided the most comprehensive and recent review of relevant data but remained limited in terms of epidemiological data, economic data and defined outcome measures. A majority of the available data was in the form of catheter care and/or infection control ‘best practice’ guidelines derived from a combination of evidence (where this existed) and expert opinion. In some cases, these were linked to agreed continence care pathways. However, most lacked specific criteria for the identification of CAUTI or its measurement. There was no evidence of
any national or international databases which would enable correlation of infection data with long-term catheter use. Nor was there any evidence of large-scale, robust economic analyses of costs of CAUTI in primary and community care. One small-scale study on costs of long-term catheterisation in the community was identified, but CAUTI was not addressed specifically [18].

Nursing documentation on catheterised patients was largely paper-based and kept with the patient on community hospital wards, in nursing homes or at home for those patients being cared for by district nurses. District nurses were required to code and record their daily activities electronically, but the categories used were too broad to facilitate analysis of catheter care practices or identify CAUTI. Patient notes for 28 catheterised patients, including five recorded CAUTIs, were reviewed as part of the document survey. The level of detail recorded was variable both within and between service groups. Of the patients with a CAUTI, the date diagnosed, method of diagnosis (e.g. urine culture) and antibiotic treatment given were recorded in over 85% of cases, although the causative organism was reported in <40%. However, it was rarely possible to confirm whether the CAUTI was symptomatic or asymptomatic. GP practices maintained electronic patient records, but although 15/74 (20%) practices agreed to participate, practical difficulties in gaining access to the data proved insurmountable in the timeframe available. Records maintained by central pharmaceutical and microbiology services were able to provide overall figures for prescriptions for catheters and antimicrobial agents, and for bacteria isolated from urinary catheters, but were unable to discriminate between antimicrobial agents prescribed for CAUTI and other UTIs or between symptomatic and asymptomatic bacteriuria. Therefore, it was concluded that, in their current form, data from these sources could not be used to contribute to estimates of CAUTI prevalence and impact.

The working definitions of CAUTI used by nurses in the survey are summarised in Table 2. Sixty-one questionnaires were returned from respondents representing a wide geographical area across the UK. A response rate is not reported since the questionnaire would not have been relevant to those RCN and ACA members who were not working with catheterised patients in community settings. The most commonly used criteria for CAUTI were a catheter specimen of urine showing >10^4 micro-organisms per millilitre plus systemic signs and symptoms; category 2: doctor diagnoses UTI + commences antibiotic therapy plus patient has two or more systemic symptoms, with no other known cause; category 3: other definitions (examples of other criteria provided by respondents and used singly or in combination: systemic signs (47.6%); urinary testing indicating nitrites (38.1%); leucocytes (28.6%); blood; urinary pH; recurrent catheter blocking; clinical judgement).

Table 1. Prevalence and economic impact data for catheter-associated urinary tract infection (CAUTI) in community settings

<table>
<thead>
<tr>
<th>Publication</th>
<th>Care setting and study design</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorbye et al. [15]</td>
<td>4010 elderly people &gt;65 years receiving home care services in 11 European countries</td>
<td>Prevalence of indwelling catheter use was 5.4% (range 0–23%). Risk of CAUTI was 6.5 times risk of UTI in non-catheterised individuals</td>
</tr>
<tr>
<td>Landi et al. [16]</td>
<td>1004 frail older women living in the community</td>
<td>Prevalence of indwelling catheter use was 38.1%. Rate of CAUTI was 21% compared with UTI rate of 10% in non-catheterised individuals.</td>
</tr>
<tr>
<td>Luchm and Fauerbach [23]</td>
<td>Florida hospital-based home care agencies</td>
<td>CAUTI rates of 2.8 per 1000 catheter days</td>
</tr>
<tr>
<td>Rosenheimer et al. [24]</td>
<td>Infection surveillance data for four home health agencies in USA</td>
<td>Mean CAUTI rates were 4.5 per 1000 device days</td>
</tr>
<tr>
<td>Zimakoff et al. [25]</td>
<td>Point prevalence study of 3665 patients in Danish hospitals (15), nursing homes (21) and home care districts (13)</td>
<td>Prevalence of CAUTI in the 349 patients with indwelling catheters was 13.2%</td>
</tr>
</tbody>
</table>

Table 2. Survey of working definitions of catheter-associated urinary tract infection (CAUTI) used by community-based nurses

<table>
<thead>
<tr>
<th>Patients’ care setting (respondents: n = 61)⁴</th>
<th>Care setting of respondent’s patients</th>
<th>Own home</th>
<th>Community hospital</th>
<th>Nursing home</th>
<th>Other (residential care, acute care, GP practice)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition of CAUTI used (n = 61)⁵</td>
<td>Category 1</td>
<td>41 (67.2%)</td>
<td>18 (29.5%)</td>
<td>18 (29.5%)</td>
<td>13 (21.3%)</td>
</tr>
<tr>
<td></td>
<td>Category 2</td>
<td>18 (29.5%)</td>
<td>18 (29.5%)</td>
<td>7 (11.5%)</td>
<td>3 (4.9%)</td>
</tr>
<tr>
<td></td>
<td>Category 3</td>
<td>1 (1.6%)</td>
<td>4 (6.6%)</td>
<td>1 (1.6%)</td>
<td>3 (4.9%)</td>
</tr>
<tr>
<td></td>
<td>Categories 1 + 2</td>
<td>7 (11.5%)</td>
<td>4 (6.6%)</td>
<td>1 (1.6%)</td>
<td>3 (4.9%)</td>
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<tr>
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</tr>
</tbody>
</table>

⁴A number of respondents cared for patients in more than one care setting.

⁵The definitions offered were adopted from [17]—category 1: specimen of urine shows >10⁴ micro-organisms per millilitre plus systemic signs and symptoms; category 2: doctor diagnoses UTI + commences antibiotic therapy plus patient has two or more systemic symptoms, with no other known cause; category 3: other definitions (examples of other criteria provided by respondents and used singly or in combination: systemic signs (47.6%); urinary testing indicating nitrites (38.1%); leucocytes (28.6%); blood; urinary pH; recurrent catheter blocking; clinical judgement).
than three-quarters of respondents (48/61, 78.7%) used catheter-maintenance solutions for a variety of reasons, mainly to remove mineral deposits (97.2%), to remove debris/clots (83.3%) and to reduce urinary pH (55.5%). However, a smaller number of respondents stated that they would use a catheter-maintenance solution to treat infection (7/48, 14.6%), with six respondents identifying chlorhexidine (12.5% of those using catheter-maintenance solutions).

The retrospective prevalence survey of CAUTI in community-based patients resulted in >50% response rate from both the nursing homes and community hospitals (57% and 62.5% respectively) but only 6.5% from the district nurses. This was partially due to difficulties in distribution of questionnaires to some district nurses, arising from organisational changes during the study period and partially because patients’ notes in hospitals and nursing homes were readily accessible to survey respondents, but the notes for each individual cared for by district nurses were held in the patients’ homes, necessitating planned visits to extract data. Nevertheless, data on 101 catheterised patients cared for by district nurses and 129 catheterised patients in total were collected. Results are summarised in Table 3. In this survey, the prevalence of CAUTI in community-based, catheterised patients, during October 2004, was 8.5%. A primary course of antibiotics was prescribed in 6/11 (54.5%) cases. Examination of 612 patient discharge/transfer notes identified 11 catheterised patients (1.8%), of whom four had a CAUTI (36.4% of catheterised patients and 0.65% of the total patients discharged/ transferred). The CAUTI prevalence determined from the combined survey data was 15/140 catheterised patients (10.7%). Since the potential for some patients to have been discharged into care by district nurses and counted twice cannot be totally excluded, the true prevalence rate probably lies between 8.5 and 10.7%.

### Discussion

Although CAUTI is a well-recognised problem in acute care settings, with significant clinical and economic consequences, it is more difficult to assess the impact of CAUTI in primary and community care. There is a notable lack of published research addressing this issue. Limitations in the quality and consistency of catheter-related information collected routinely by healthcare services or recorded in patient notes present a major obstacle to robust epidemiological analysis. This is compounded by a lack of clear, standardised criteria used to define CAUTI, to distinguish between symptomatic and asymptomatic CAUTI and to report outcomes. Although pharmaceutical and microbiological data could theoretically provide a valuable source of information, current records lacked the necessary sensitivity in key areas to enable comparative analysis of data from different sources. Survey data indicated a relatively high use of prophylactic antibiotics for this patient population, and this suggests an ongoing need for further work to provide and disseminate robust evidence to guide care of long-term catheterised patients, including agreed antibiotic policies. Use of chlorhexidine catheter maintenance solution to treat CAUTI is not supported by research [19], and therefore its continued use, albeit in a small number of cases, also raises concerns.

In this retrospective prevalence survey, the patient sample size was relatively small and therefore numbers must be treated with caution; however, prevalence rates of between 8.5 and 10.7% are in keeping with the few other studies reported in the literature (Table 1). Data collection over a longer period than 1 month would have captured more cases, but it was recognised that this would place an unreasonable burden on community staff at this time. This was born out by the relatively low response rate, particularly from district nurses. To date, there is little robust quantitative data available to monitor the clinical and/or economic impact of CAUTI in primary and community care, and there is a need for improved surveillance [20, 21] and effective infection-control programmes [22]. Community-based catheterised patients are a heterogeneous group including short-term catheter users (often in community hospitals or recently discharged from acute care) and long-term users, many of whom will require a catheter for the rest of their lives. As increasing numbers of patients are cared for in community settings, it is clear that CAUTI presents a risk of increased patient morbidity in both the short and longer term. However, the current lack of long-term follow-up data makes it difficult to predict risks of longer-term sequelae. CAUTIs also contribute to reservoirs of infection in the community with associated dangers of cross-infections (including antibiotic-resistant pathogens), within care facilities or if patients require hospital admission. The economic impact of CAUTI in primary and community care, including direct and indirect costs to services, patients and carers, is unknown and will remain so until such time as better, standardised routine data collection is established which enables cross-checking between services, comparative analysis between surveillance studies and the development of a longitudinal database of long-term catheterised patients. This is essential in order to be able to determine the magnitude of risk associated with CAUTI in primary and community care and to provide baseline data against which initiatives designed to reduce CAUTI, such as antimicrobial catheters, can be evaluated.

### Key points
- Older people comprise the largest group of catheterised patients in primary and community care settings.
• There is a lack of data on the prevalence and clinical and economic impact of CAUTI in primary and community care.
• Prevalence of CAUTI in this study was 8.5%.
• Agreed, standardised recording of a minimum set of data on catheterised patients is urgently required to enable robust epidemiological analyses.

References