Health Protection Scotland

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Catheter associated urinary tract infection within care of the elderly facilities

Pilot Report
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Table of Contents

List of Figures

List of Tables

Executive Summary

Urinary tract infections (UTI) are the most common infections acquired in hospitals and long-term care facilities (LTCF). A number of risk factors have been independently associated with HAI and it is now well established that the major predisposing factor for healthcare associated UTI is the presence of an indwelling urethral catheter. The use of catheters is common in LTFC and many patients are catheterised for long periods, thus increasing their risk of acquiring a catheter associated urinary tract infection (CAUTI).

Following a review of the current methodology for CAUTI surveillance in Scotland it was highlighted that the existing definitions and methodologies were not applicable for the care of the elderly patient population. A protocol was developed by Health Protection Scotland (HPS) incorporating infection definitions based on clinical signs and symptoms rather than microbiology criteria. These definitions are recommended for use in LTFC by the European Centre for Disease Prevention and Control (ECDC) as they hope to reduce the over estimation of UTI by excluding asymptomatic bacteriuria. A pilot study of the protocol was carried out in volunteer care of the elderly facilities in hospital settings across Scotland.

During the pilot study period, a total of 659 patients were admitted to the care of the elderly facilities participating in CAUTI surveillance in the six pilot hospitals and a total of 122 catheters were inserted. During the study period a total of 19 UTIs were identified of which 15 met the criteria for CAUTI.

The CAUTI surveillance protocol and data definitions appeared to be robust. The study was therefore able to provide valuable data regarding catheter use and CAUTI incidence rates.

The surveillance protocol and collection tool is easily adapted for use in care home settings providing a valuable surveillance tool for these resident populations.

List of abbreviations

AMR	Antimicrobial Resistance
BPS	Best Practice Statement
CAUTI	Catheter Associated Urinary Tract Infection
CDI	Clostridium difficile Infection
CDC	Centres for Disease Control
ECDC	European Centre for Disease Prevention and Control
HAI	Healthcare Associated Infection
HDL	Health Department Letter
HPS	Health Protection Scotland
LTCF	Long Term Care Facilities
NNIS	National Nosocomial Infection Surveillance
QIS	Quality Improvement Scotland
SSHAIP	Scottish Surveillance of Healthcare Associated Infection Programme
UTI	Urinary Tract Infection

1 Introduction

1.1 The Epidemiology of Healthcare Associated Urinary Tract Infections

Urinary tract infections (UTI) are the most common infections acquired in healthcare settings. The problem of catheter associated urinary tract infections (CAUTI) is common in care of the elderly settings as many patients are catheterised for long periods, thus increasing their risk of acquiring a CAUTI. A seminal study of male patients in a nursing home illustrated the problem of CAUTI in long term care of the elderly. During the one-year study period 80% of patients had at least one CAUTI and 48% of patients had two or more CAUTIs (Ouslander et al., 1987).

A prevalence study of all healthcare associated infections (HAI) which was carried out by Health Protection Scotland (HPS) in 2005/6 demonstrated that 20.2% of inpatients in acute hospitals had urinary catheters in situ at the time of survey and that 12.4% of inpatients in non-acute hospitals were found to have urinary catheters in situ. The study also demonstrated that UTI were accountable for 17.9% of all HAI. The highest prevalence of HAI in acute hospital inpatients was found in the specialties; Care of the Elderly (11.9%), Surgery (11.2%), Medicine (9.6%) and Orthopaedics (9.2%). Similar figures have also been found in other recent studies (Gandhi et al., 2009, Madeo et al., 2009)

1.2 Risk Factors for Healthcare Associated UTI

A number of risk factors have been independently associated with UTI and it is now well established that the major predisposing factor for UTI is the presence of an indwelling urethral catheter. Other associated risk factors for CAUTI include a history of previous catheter use, the duration the catheter is in situ, the length of hospital stay prior to catheter insertion, the reason for and location of catheter insertion (Leone et al., 2003, Stamm, 1991).

Intrinsic risk factors such as gender, increasing age and general debilitation are associated with CAUTIs. Females are at increased risk of acquiring UTIs due to the short urethra and in common with other HAIs it is frequently the elderly and debilitated that are at risk of acquiring infections (Hussain et al., 1996).

Asymptomatic bacteriuria occurs frequently in the elderly population and a recent study demonstrated that 32% of the patients on antibiotic therapy for UTI did not meet the Centres for Disease Control (CDC) definition for UTI (Gandhi et al., 2009). The prophylactic antibiotic treatment of asymptomatic bacteriuria in catheterised patients is not recommended (SIGN, 2006). Within the literature it has been suggested that reducing antimicrobial treatment of asymptomatic bacteriuria may potentially reduce colonisation/infection with antimicrobial resistant organisms (AMR) and reduce Clostridium difficile Infection (CDI) (Gross and Patel, 2007, Curran and Murdoch, 2009).

Reasons for catheter insertion in care of the elderly settings include urinary retention and urinary incontinence (Nicolle, 2001). A reduction in urinary catheterisation and therefore a reduction in CAUTI may be achieved by promoting alternative continence care (McNulty, 2009).

1.3 Catheter Associated Urinary Tract Infection

In recognition of the above and in a response to the Health Department Letter (HDL) - "Reducing the Risk of Healthcare Associated Infection: (HDL (2002)82)", the HAI Task Force in Scotland proposed urinary catheterisation and CAUTI as a priority area for the development of a Best Practice Statement (BPS) for Urinary Catheterisation and Catheter Care and an infection surveillance programme in Scotland. In 2004 Quality Improvement Scotland (QIS) developed a best practice statement on catheterisation and HPS under the guidance of the HAI Steering Group and also the CAUTI working group developed the protocol for surveillance of CAUTI throughout Scotland. CAUTI surveillance currently forms part of the voluntary list of surveillance programmes as stated within (HDL (2006)38).

In 2004, a pilot study for CAUTI surveillance was undertaken by HPS in a total of 5 volunteer NHS boards across Scotland. The pilot study methodology and protocol developed by HPS was largely based on a methodology developed by the Health Protection Agency (HPA). The protocol utilised the National Nosocomial Infections Surveillance System (NNIS) infection definitions as CDC definitions were rejected on the basis that the laboratory testing required to fulfil the criteria for infection are not routinely carried out in the UK. The pilot study demonstrated that the CAUTI surveillance protocol and data definitions were robust and easy to apply. However the definitions were not applicable for patients within care of the elderly facilities as insertion of "new" catheters is not a frequent event in this patient group many of them being admitted with catheters in situ. In complying with the pilot study definitions, only patients with catheters inserted on or after admission to hospital were included in the study.

The CAUTI pilot study report highlighted that issues for long term catheterised patients in care of the elderly facilities are different than those with short term catheters in acute care and it was proposed that a revised CAUTI surveillance methodology for use within care of the elderly facilities should be developed by HPS.

To address these concerns and to make the definition of CAUTI more applicable for use within care of the elderly facilities a protocol has been developed by HPS. The protocol incorporates infection definitions based on clinical signs and symptoms rather than microbiology criteria which may potentially reduce over reporting of UTI by excluding asymptomatic bacteriuria and aid diagnosis when many of the patients have some level of cognitive impairment (McGeer et al., 1991). European Centre for Disease Prevention and Control (ECDC) recommended the use of these definitions in LTCF. A pilot study of the protocol was conducted within care of the elderly facilities across Scotland and the results are presented in this report.

1.4 The aims of the CAUTI Care of The Elderly Surveillance Programme

- To conduct a pilot study of CAUTI within volunteer care of the elderly facilities.
- To provide pilot settings with local CAUTI rates to assist them to reduce rates of CAUTI.
- To develop a CAUTI protocol for use within care of the elderly facilities.
- To promote CAUTI surveillance within care of the elderly facilities as part of the list of HPS volunteer surveillance programmes.

1.5 Additional Pilot Study Objectives

Following the development of the Care of the Elderly CAUTI Surveillance Protocol and prior to rolling out the surveillance programme across Scotland, a pilot study was carried out over a three month period from 1st February 2009 within six hospitals.

The objectives of pilot study were to:

1. Assess the overall feasibility of the surveillance programme.
2. To assist with further development and refinement of the protocol before "rolling out" to other volunteer hospitals.
3. To assess and refine the data collection tool and associated protocol.

2 Methodology

2.1 Pilot Hospitals

A total of 6 hospitals within 5 NHS boards participated in the pilot study and carried out surveillance of CAUTI in one specialty of their choice from a list representing Care of the Elderly – Care of the Elderly, Care of the Elderly – GP, Care of Elderly – Medicine and Psychiatry of Old Age using definitions specified in the study protocol.

All of the participating hospitals conducted surveillance within Care of the Elderly – Care of the Elderly facilities.

2.2 Data Collection

To ensure that national data were both reliable and comparable, a training package for data collection and surveillance methodology was developed and this was delivered to all nominated data collectors within the participating hospitals. Members of the SSHAIP team facilitated the implementation of surveillance in each volunteer hospital.

Each of the pilot hospitals were supplied with a Tablet PC to facilitate electronic data collection. An electronic data collection tool was designed; the tool comprised of a data collection form to be completed for all patients included in the surveillance and admission and ward forms to collect denominator data of number of admissions and number of patient days. The data collector entered data directly to the "on-screen" form which incorporated drop-down boxes, radio button options and alphanumeric fields. Data entry rules and internal validation of data were incorporated within the tool to assist the data collectors with data entry and to improve the quality of the data.

Data were collected from all patients with catheters who were admitted to the speciality under surveillance. The data were collected in accordance with the data definitions laid out in the study protocol. In accordance with the study protocol, patients were monitored from the date the urinary catheter was inserted until a CAUTI was diagnosed, the patient was discharged, transferred, died, until the end of the 30 day surveillance period or until 3 days following catheter removal.

Microorganism data was not required as a criterion for diagnosing CAUTI as per the study protocol and therefore it was not recorded if the patient was receiving antimicrobials prior to obtaining urine samples. Information for prescribed antimicrobials were recorded on the date of catheter insertion, however as per the study protocol it was not required to specify if antibiotics were prescribed to treat symptoms of UTI or another infection.

2.3 Analysis presented in this report

The following possible risk factors were analysed

- Gender
- Duration the catheter was in situ (< 7 days and ≥ 7 days)
- Age
- Removal of catheter before onset of infection
- Previous period of catheterisation

The incidence of CAUTI was calculated by dividing the number of CAUTIs by the number of catheter days and multiplying the result by 1000. The urinary catheter utilisation ratio was calculated by dividing the number of urinary catheter days by the number of patient days.

For statistical calculations, all analyses were carried out using STATA® software. Univariate Poisson regression analyses were performed in order to examine the relationship between specific variables and the incidence of CAUTI. A P value significant of <0.05 was reported as statistically different.

3 Results

3.1 Study Population

During the pilot study period, a total of 659 patients were admitted to the care of the elderly facilities participating in CAUTI surveillance in the six pilot hospitals. Table 3.1 summarises the number of admissions, patient days, catheters inserted and catheter days by study hospital.

Among patients included in this study 32% had the catheter in situ when admitted to the ward within the speciality and 4.9% were not recorded. The median age of the catheterised patients was 83 years and 71.3% of the patients were female.

Table 3.1 Summary of data collected from the six participating hospitals

	H1	H2	H3	H4	H5	H6	Total
Admissions	28	199	24	18	235	155	659
Total Patient Days	3103	3820	1363	2437	5284	3030	19037
Total Number of Catheter Days	170	575	258	30	264	182	1479
Number of catheters inserted	6	54	14	1	28	19	122

3.2 Incidence Rate of CAUTI and Catheter Use

A total of 15 patients (2.3%) admitted to the pilot settings had signs and symptoms to meet the definitions of CAUTI. Four patients had signs and symptoms of a UTI that occurred within 48 hours of the catheter being inserted and for this study were not classed as CAUTI. The incidence rate of CAUTI and urinary catheter utilisation ratios were calculated for all participating hospitals and are summarised in Table 3.2.

Table 3.2 Summary of incidence of CAUTI and catheter use

Outcome Measure	H1	H2	H3	H4	H5	H6	Total
Mean length of catheterisation in days, (95% CI)	28.3 (25.0-31.6)	10.6 (8.3-13.0)	18.4 (12.2-24.6)	30.0 (-)	9.4 (6.9-12.0)	9.6 (5.8-13.3)	12.1 (10.4-13.9)
Urinary catheter utilisation ratio	0.05	0.15	0.19	0.01	0.05	0.06	0.08
Number of CAUTI	0	3	2	0	3	7	15
Incidence rate of CAUTI (95% CI)	0.0 (-)	5.2 (1.7-16.2)	7.8 (1.9-31.0)	0.0 (-)	11.4 (3.7-35.2)	38.5 (18.3-80.7)	10.1 (6.1-16.8)

Table 3.3 shows the incidence of CAUTI by age group of patients included in the study.

Table 3.3 Incidence rate of CAUTI per 1000 catheter days, by age

Age Group (years)	Number of patients with CAUTI	Number of Catheter days	Incidence rate per 1000 catheter days (95% CI)
50-59	0	4	0 (-)
60-69	0	52	0 (-)
70-79	4	281	14.2 (5.3-37.9)
80-89	7	867	8.1 (3.8-16.9)
90-99	3	270	11.1 (3.6- 34.5)
≥ 100	1	5	200 (28.2-1419.8)
Total	**15**	**1479**	**10.1 (6.1-16.8)**

Only a small number of catheterised patients were included in this study therefore these stratified outcome measures in Tables 3.2 and 3.3 should be interpreted with caution. The precision of these measures is low and this in reflected in the width of the confidence intervals.

Univariable poisson regression analyses were performed in order to examine the relationship with specific variables and the incidence of CAUTI. The results are presented in Table 3.4. The incidence of CAUTI was significantly higher in hospital H6 compared to H2 and H3 and in patients with catheters in situ for ≥ 7 days. No significant difference at the univariable level was found in this study with the incidence of CAUTI in relation to gender, age, catheter removal or previous catheterisation.

Table 3.4 Univariate Poisson regression (n = 122)

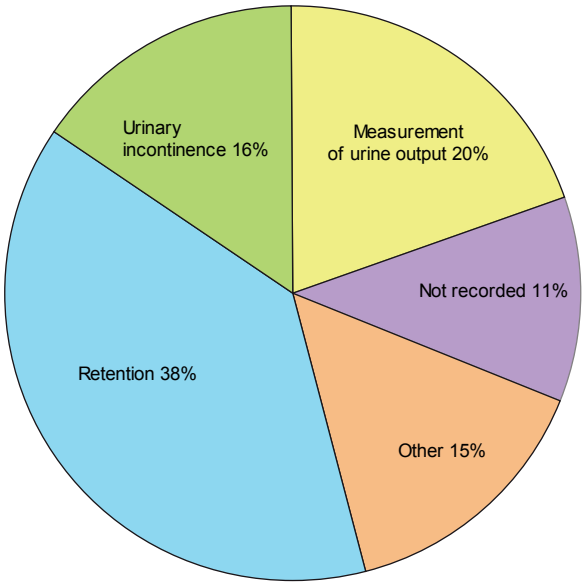
Variable	Category	Number patients	Incidence rate of CAUTI per 1000 catheter days	Rate ratio	95 % Confidence interval	Univariate Poisson p-value
Hospitals	H1	6	0.0	–	–	–
	H2	54	5.2	0.1357	0.04, 0.52	0.004
	H3	14	7.8	0.2016	0.04, 0.97	0.046
	H4	1	0	–	–	–
	H5	28	10.2	0.2955	0.08, 1.14	0.077
	H6	19	38.5	1	–	–
Gender	Female	87	11.4	1	–	–
	Male	35	7	0.6139	0.17, 2.18	0.45
Age	< 80	33	11.9	1	–	–
	≥ 80	89	9.6	0.8115	0.26, 2.55	0.72
Duration	< 7	46	55.2	1	–	–
	≥ 7	76	4.6	0.0826	0.03, 0.23	<0.0001
Catheter in situ	No	34	16	1	–	–
	Yes	88	9	0.5594	0.18, 1.76	0.32
Previous catheterisation1	Yes	23	7	1	–	–
	No	88	13.4	1.9209	0.54, 6.80	0.31

1 11 Patients were excluded because no information was available on previous catheterisation

3.3 Indications for Catheterisation

The distribution of reasons for catheterisation is shown in Figure 3.1. The main indications for urinary catheterisation were identified as urinary retention (38.5%), measurement of urine output (19.7%) and for urinary incontinence (15.6%). The other recorded reasons for catheterisation included deterioration in medical condition, renal dysfunction, maintenance of skin integrity and immobility.

Figure 3.1 Distribution of Reason for Catheterisation (%)



3.4 Microbiology and Antimicrobial Use

A total of 15 patients with CAUTI (78.9%) had a positive urine culture. For CAUTI patients without a positive culture the reason is unknown whether this was due to a urine sample not taken or a negative sample. In addition 5 out of 103 (4.8%) patients had positive culture but did not have any clinical signs or symptoms of infection.

Table 3.5 shows the number of patients receiving antimicrobials either commenced on or following catheter insertion. Of the patients without a UTI, 11 (10.7%) were currently receiving antimicrobials. A total of 6 patients (4.9% of all patients with a catheter) had signs and symptoms of UTI but were not receiving antimicrobials. Table 3.6 shows a breakdown of the antimicrobials prescribed during the pilot study. The numbers in brackets indicate the number of courses of a particular antimicrobial to patients who had a met the definitions of UTI. The most commonly prescribed antimicrobial for all patients with urinary catheters were augmentin and trimethoprim for those presenting with signs and symptoms of a UTI. It should be noted that only antimicrobials commenced on the day of catheterisation were collected and the data collectors were not required to assess if a particular treatment was used to treat a UTI or if the patient had any other presenting signs of infection.

Table 3.5 Number of antimicrobials commenced on or following catheter insertion

UTI Infection	Antimicrobials commenced on or following urinary catheter insertion		
	No	Yes	Total
No	92	11	103
Yes	6	13	19
Total	**98**	**24**	**122**

Table 3.6 Breakdown of antimicrobials commenced on or following catheter insertion

Antimicrobial	Number of antimicrobials commenced (with positive UTI infection)
Augmentin	6 (1)
Ciprofloxacin	5 (2)
Clarithromycin	2
Gentamicin	1
Metronidazole	1 (1)
Nitrofurantoin	3 (3)
Other	3 (1)
Piperacillin/tazobact	1
Trimethoprim	5 (5)
Vancomycin	1 (1)

The most frequently reported micro-organisms were Coliform (unspecified) and *Escherichia coli.* A list of organisms isolated during the study period is shown in Table 3.7

Table 3.7 Organisms isolated in urine samples

Organism	Percentage isolated (%)
Citrobacter spp.	9.1
Coliform (unspecified)	27.3
Enterococcus faecalis	13.6
Escherichia coli	22.7
Klebsiella oxytoca	4.5
Klebsiella pneumoniae (aerogenes)	4.5
Other bacteria	4.5
Pseudomonas spp.	4.5
Staphylococcus aureus (MRSA) meticillin	9.1

4 Discussion

4.1 Feasibility of the surveillance programme

Results for the pilot study suggest that participation in this surveillance programme over a minimum of a three month period will generate useful information regarding catheter use and infection rates within care of the elderly facilities.

There were previous concerns that surveillance of CAUTI in care of the elderly facilities using the definitions contained in the current CAUTI protocol would not fully represent the burden of CAUTIs in this group of patients. From the numbers of catheters inserted prior to admission to the chosen speciality it can be calculated that 32% patients would have been excluded in the previous version of the CAUTI surveillance protocol.

A user satisfaction survey was conducted following the pilot study and feedback was very positive. Participation in the pilot study was deemed a rewarding experience and volunteer settings are keen to continue to participate in the programme of surveillance.

4.2 Further development and refinement of the protocol and data collection tool

The CAUTI Surveillance protocol and data definitions were relatively robust and the data collection tool worked well. The protocol, data definitions and data collection tool require only minor refinements such as development of further validation rules to maximise data validity prior to "rolling out" this volunteer surveillance programme across Scotland.

The tablet PCs were well received by surveillance co-ordinators and following the training sessions with the SSHAIP team the surveillance co-ordinators were able to use the tablet PC with ease.

Due to the number of internal validation checks built within the tablet PC data collected electronically enhanced the quality of data, reduced the burden of data management.

4.3 Incidence of CAUTI and Catheter Use

The quantity of the data from this 3 month pilot study was sufficient to provide valuable data to catheter use and CAUTI incidence rates which can be then reported locally. The overall incidence of CAUTI found in this study of 10.1 per 1000 catheter-days was comparable to that found in other studies (Crouzet et al., 2007, Huang et al., 2004) although in these studies the rate was reduced by introducing a system to remind physicians to review catheter need and remove unnecessary urinary catheters.

Implementation of the surveillance system on a larger scale will allow robust comparisons between hospitals and other risk factor analyses to be carried out with an increased precision.

4.4 Microbiology and Antimicrobial Treatment

The use of microbiology of urine samples to diagnosis infection in catheterised patients can lead to the overtreatment of UTIs and lead to increase risk of colonisation by antibiotic resistant bacteria (Tambyah and Maki, 2000, Gross and Patel, 2007, SIGN, 2006). Using the McGeer definition of infection based of clinical signs and systems it is hoped that patients are not unnecessarily treated for asymptomatic bacteriuria which accounted for 4.8% of patients included in this study.

The SIGN guidelines recommend ciprofloxacin or co-amoxiclav for symptomatic bacteriuria in catheterised patients (SIGN, 2006). The most commonly prescribed antimicrobial in patients with positive signs and symptoms for was trimethoprim. From the returned questionnaires the data collectors were aware that the NHS Board had guidelines for treating UTI but they were unsure if they were adhered to.

5 Conclusions

- The CAUTI surveillance protocol and data definitions were relatively robust.
- The results from this 3 month pilot provided valuable data regarding catheter use and CAUTI incidence rates.
- The surveillance protocol and collection tool could be easily adapted to be used within care homes and other long term care facilities.

6 Recommendations

As previously noted within this report a major predisposing factor for the development of a UTI is the presence of an indwelling urinary catheter. The results from this pilot study provided valuable information with regards to indications for urinary catheterisation for care of the elderly patients. The QIS BPS for urinary catheterisation and care advise that prior to inserting an indwelling urinary catheter other urinary care options must be considered, such as intermittent urinary catheterisation, in association with local urinary nurse specialists or continence nurse specialists/advisors. If an indwelling urinary catheter is inserted it is recommended that the catheter is removed at the earliest opportunity as appropriate for each individual patient (QIS, 2004). It is recommended that the HPS audit tool for urinary catheterisation is used in conjunction with the QIS BPS and should be considered for further policy development by the SGHD and potential roll out by NHS boards as part of their planned infection control programmes within care of the elderly facilities where urinary catheters are inserted.

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