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Diagnosis, prevention and control of urinary tract infections: a survey of routine practices in Belgian nursing homes

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Abstract

Background: Urinary tract infections (UTIs) are one of the most frequently reported infections in older adults and the most common reason for antimicrobial prescribing in nursing homes (NHs). In this vulnerable population, both a good diagnosis and prevention of these infections are crucial as overuse of antibiotics can lead to a variety of negative consequences including the development of multidrug-resistant organisms.

Objective: To determine infection prevention and control (IPC) and diagnostic practices for UTIs in Belgian NHs.

Methods: Local staff members had to complete an institution-level questionnaire exploring the availability of IPC practices and resources and procedures for UTI surveillance, diagnosis, and urinary catheter and incontinence care.

Results: UTIs were the second most common infections in the 87 participating NHs (prevalence: 1.0%). Dipstick tests and urine cultures were routinely performed in 30.2% and 44.6% of the facilities, respectively. In non-catheterised residents, voided or midstream urine sampling was most frequently applied. Protocols/guidelines for urine sampling, urinary catheter care and incontinence care were available in 43.7%, 45.9% and 31.0% of the NHs, respectively. Indwelling catheters were uncommon (2.3% of the residents) and urinary retention (84.9%) and wound management (48.8%) were the most commonly reported indications. Only surveillance was found to significantly impact the UTI prevalence: 2.2% versus 0.8% in NHs with or without surveillance, respectively ($P < 0.001$).

Discussion: This survey identified key areas for improving the diagnosis and prevention of UTIs, such as education and training regarding the basics of urine collection and catheter care.

Keywords

Urinary tract infections, long-term care, aged, prevention and control, urinary catheterisation, urine specimen collection

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Background

Urinary tract infections (UTIs) are among the most frequently diagnosed infections in older adults and the most common reason for antimicrobial prescribing in nursing homes (NHs) (European Centre for Disease Prevention and Control [ECDC], 2014a). Older persons in these facilities often present with atypical symptoms or have problems communicating their symptoms, making the differentiation of asymptomatic bacteriuria (ASB) from symptomatic UTI

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or other diseases challenging (Nicolle, 2000; Rowe and Juthani-Mehta, 2013). Prevention of UTIs in this specific population is an important issue as overuse of antibiotics can lead to a variety of negative consequences including the development of multidrug-resistant organisms (Nicolle, 2000).

From May to September 2010, the ECDC organised a first EU-wide point prevalence survey (PPS) of healthcare-associated infections (HAIs) and antimicrobial use in long-term care facilities (LTCFs) across Europe (called HALT). In Belgium, UTIs represented 10.1% of all reported HAIs, succeeding respiratory tract infections (RTI) (48.6%) and skin infections (19.5%). In addition, the survey revealed a high use of antimicrobials for UTIs in the Belgian participating NHs. Nearly half (49.6%) of all systemic antimicrobials were prescribed for an indication related to the urinary tract. The proportion of uroprophylaxis was high (28.4% of the total use) (ECDC, 2014a).

In order to explore the rationale of antimicrobial prescribing for UTIs and to investigate infection prevention and control (IPC) measures for this specific type of infection, Belgium participated in the UTI module that ran in parallel with the second EU-wide PPS (HALT-2) (ECDC, 2014b). The present study mainly focuses on the institution-level data that were collected during this survey. We were particularly interested in knowing which tests were performed to diagnose UTIs in Belgian NHs and how frequently they were used. Moreover, we sought to study IPC practices related to UTIs in these facilities.

Methods

The Belgian coordination centre decided to take part in both the HALT-2 PPS and UTI module and invited all NHs (n = 1539) to voluntarily participate between April and May 2013. Data were collected on one single day by local staff members using paper questionnaires with optical character recognition technology.

The Belgian institution-level questionnaire fully incorporated PPS and UTI module-specific questions on the following domains: aggregated resident characteristics; coordination of medical care; IPC practices and antibiotic policies (standard PPS form) and procedures for UTI surveillance and diagnosis; urinary catheter care; and incontinence care (UTI module) (ECDC, 2014b).

A resident questionnaire had to be completed for each eligible resident presenting signs/symptoms of an HAI and/or using a systemic antimicrobial on the PPS day. Residents present at 08:00 on the survey day, living full-time in the facility since at least 24 h and giving their written informed consent (or proxy consent in case of an impaired ability to decide for themselves) were considered eligible. Antibacterials, antimycotics and antimycobacterials for systemic use and antibiotic treatment by inhalation were included. An HAI was defined as any infection of which the onset of new or acutely worse symptoms occurred > 48 h after the resident was (re-)admitted to the LTCF. Local surveyors had to identify infections by applying surveillance definitions (ECDC, 2014b; Stone et al., 2012). UTIs were subdivided into two groups: 'probable UTIs' (i.e. sufficient urinary signs/symptoms but no urine culture taken or a negative or unknown result); and 'confirmed UTIs' (i.e. sufficient signs/symptoms and microbiological confirmation). A positive urine dipstick test result (in the present study defined as the impregnation of a paper stick in urine to test for the presence of white blood cells [leukocyte esterase] and/or nitrites in the NH itself) could not be used for confirmation of UTI.

Questionnaires were forwarded to the national study coordinators for optical scanning. Analyses were performed using Stata/SE version 10.1 (StataCorp, College Station, TX, USA). Categorical data are presented as percentages, continuous variables as median and interquartile range (IQR). Prevalence rates were compared using the Kruskal–Wallis or Wilcoxon–Mann–Whitney test with significance set at $P < 0.05$.

The study protocol was approved by the Ethics Committee of UZ Brussel (University Hospital of Brussels; B.U.N. 143201316892). To ensure confidentiality, each facility and resident was assigned a unique study identifier.

Results

Characteristics of the participating nursing homes and residents

Eighty-seven NHs (5.7%) and 8756 eligible residents participated (Table 1). Data were collected by either a nurse (62.2%), a physician (21.6%) or another person (e.g. a quality coordinator, 4.1%) (n = 74). Fifty-seven facilities (65.5%) had at least one person with IPC training at their disposal, i.e. a nurse in 30 NHs (52.6%), a physician in three facilities, and both a nurse and physician in 24 NHs (42.1%).

Prevalence of UTI and antimicrobial use

The median prevalence of residents with at least one HAI was 3.2% (IQR = 1.4–5.7). A total of 325 HAIs were reported. UTIs were the second most commonly reported infections (34.2%), after RTIs (36.6%). The median UTI prevalence was 1.0% (IQR = 0.0–2.1). Of all UTIs, 48.6% were classified as 'probable' and 51.4% as 'confirmed'.

The median prevalence of residents using at least one antimicrobial was 4.7% (IQR = 2.1–8.2), with 455 molecules being prescribed. Uroprophylaxis accounted for 91.0% of all prophylactic prescriptions (n = 162/178) and for 35.6% of the overall antimicrobial use. UTIs were the second most common indication for therapeutic antimicrobial use (n = 99/277, 35.7%), succeeding RTIs (42.2%).

Table 1. Characteristics of the 87 nursing homes and their eligible residents (n = 8756) participating in the second Belgian point prevalence survey of HAIs and antimicrobial use, HALT-2 (2013).

Characteristic	
NH ownership (% public/% private)	43.7/56.3
NH beds (n)	100 (77.5–131)
NHs having at least one person with training in infection prevention and control	57 (65.5)
NHs working with an external infection control team on a formal basis	66 (75.9)
Female residents (%)	76.1 (70.9–79.4)
Age of the residents (years)	86 (81–90)
Residents with impaired mobility (wheelchair bound or bedridden) (%)	41.0 (31.6–47.9)
Residents with disorientation in time and/or space (%)	55.8 (46.0–61.5)
Residents with incontinence	
Urinary incontinence (%)	57.1 (48.8–66.3)
Faecal incontinence (%)	30.8 (23.8–56.9)
Residents with a urinary catheter (%)	2.3 (1.3–4.1)

Values are given as n (%) or median (IQR).
HAI, healthcare-acquired infection; IQR, interquartile range; NH, nursing home.

Surveillance of UTIs

Surveillance of UTIs was in place in 22.9% of the NHs (n = 19/83). Only 7 (36.8%) NHs provided feedback of the rates of UTI to direct care providers. Facilities monitoring rates of UTI had a higher median UTI prevalence compared to NHs without UTI surveillance (2.2% vs. 0.8%; $P < 0.001$).

UTI diagnosis

Table 2 presents the frequency of diagnostic tests and techniques of urine collection as reported by the local surveyors. Seventy-one facilities (82.6%) reported to routinely or occasionally use urine dipstick tests. In general, nitrite tests were more frequently used than leukocyte esterase tests. Thirty-three NHs (44.6%) routinely ordered urine cultures. Of the institutions performing both diagnostic tests (n = 59), 64.4% said the choice of taking a urine culture depends on the dipstick test result.

A protocol or guideline for urine specimen collection was available in 38/87 (43.7%) of the NHs. Cleansing of the meatus before urine collection was recommended with either non-antiseptic soap and water (38.8%), antiseptics (20.0%), water (16.5%) or saline (2.4%) (n = 85). Cleansing was not recommended in 22.4% of the facilities.

In both male and female non-catheterised residents, voided and midstream sampling were the most frequently applied techniques for urine specimen collection. Urine collection via in-and-out catheterisation was more often used in women (Table 2).

In residents with an indwelling catheter, urine specimens were either taken via the sampling port (53.3%), directly from the drainage outlet (33.8%) or catheter bag (5.2%), or using another non-specified method (7.8%) (n = 77).

Prevention and control of UTIs

IPC practices such as adequate fluid intake, good personal hygiene and avoidance of (unnecessary) chronic urinary devices were promoted in most facilities. The use of vitamin C supplements and oestrogen therapy as a UTI prevention strategy were uncommon (Table 3). No significant differences in prevalence of UTI were found between NHs applying these IPC strategies and those not applying them.

A protocol/guideline for urinary catheter care was more frequently available compared to a protocol/guideline for the management of urinary incontinence. However, more facilities gave yearly training in continence care than in urinary catheter care (Table 3). Having a protocol or providing yearly training in urinary catheter care and/or continence care did not significantly impact the prevalence of UTIs.

Twenty-eight NHs (35.0%) had none of the three quality improvement actions in place for the prevention of catheter-acquired UTIs (CA-UTI; i.e. alerts, multidisciplinary rounds and stop orders) (Table 3).

Only 2.3% of the residents had a urinary catheter on the PPS day. In-and-out catheterisation, indwelling urethral catheters and suprapubic catheters or cystostomy tubes were sporadically used as urinary drainage methods (Table 2). Urinary retention (84.9%), open sacral or perineal wound management (48.8%), resident comfort (30.2%) and terminal illness (24.4%) were the most frequently reported indications for long-term bladder drainage (n = 86). Urinary incontinence (7.0%), monitory of fluid balance/urinary output (5.8%), physical impairment/immobilisation (4.7%) and cognitive impairment (1.2%) were less common reasons. Most NHs (91.8%; n = 78/85) used a closed drainage system (i.e. no disconnection needed to empty the bag).

Almost all NHs (97.7%; n = 83/85) had a written hand hygiene (HH) protocol. Hand disinfection with an alcohol-based solution was the preferred method for HH in 80.0% of the facilities, preceding hand washing with antiseptic soap and water (14.1%) or with non-antiseptic soap and water (5.9%) (n = 85). The preferred HH technique did not significantly influence the overall infection or UTI prevalence.

Table 2. Frequency of diagnostic tests and techniques of urine collection performed to diagnose urinary tract infections and of urine drainage methods applied in the participating nursing homes (n = 87) as reported by the local surveyors, Belgium (2013).

	Responses (n)	Routinely (%)	Sometimes (%)	Never (%)
Diagnostic tests				
Urinary dipstick	86	30.2	52.3	17.4
Nitrite test	60	43.3	50.0	6.7
Leukocyte esterase test	56	39.3	48.2	12.5
Urine culture	74	44.6	52.7	2.7
Urine collection techniques				
In female non-catheterised residents				
Voided sampling (natural micturition)	85	40.0	32.9	27.0
Midstream sampling	85	48.2	38.8	12.9
In-and-out catheterisation	85	21.2	75.3	3.5
Suprapubic aspiration	84	0.0	2.4	97.6
Sampling from diapers or pads	84	0.0	16.7	83.3
Sampling via external urine collection device	84	2.4	26.2	71.4
In male non-catheterised residents				
Voided sampling (natural micturition)	84	42.9	33.3	23.8
Midstream sampling	86	54.7	32.6	12.8
In-and-out catheterisation	84	6.0	64.3	29.8
Suprapubic aspiration	85	1.2	5.9	92.9
Sampling from diapers or pads	84	0.0	11.9	88.1
Sampling via condom catheter	83	3.6	57.8	38.6
Urine drainage methods (urinary catheterisation)				
Indwelling urethral catheter	86	7.0	76.7	16.3
Suprapubic catheter / cystostomy tube	84	8.3	71.4	20.2
Nephrostomy tube	82	0.0	18.3	81.7
In-and-out urethral catheterisation	85	16.5	70.6	12.9
Condom catheter	86	5.8	70.9	23.3

Discussion

After several reports of high antimicrobial use for UTIs, our research team wanted to know more about IPC practices currently applied for UTIs in our Belgian NHs. The results demonstrate that there is still room for improvement regarding this topic.

More than half of the participating NHs had a person with IPC training. No information about the number of hours weekly spent by this person on IPC, his/her training level and years of experience was collected. A US survey reported that the persons in charge of IPC programs spent, on average, 29% of their time on IPC activities and have at least two other responsibilities within the NH (Herzig et al., 2016).

Currently, there are no legal minimal requirements for having a person with IPC training in Belgian NHs. Each NH should however have a coordinating physician (CP). A recent law (Royal Decree of March 9, 2014) stipulates that the tasks of this CP should include the development of a policy for the control of HAIs in collaboration with the head nurse(s). In the 2013 survey, 71.3% of the Belgian CPs already indicated the development of such policy as one of their main tasks (unpublished data).

The same law also states that each NH should have a written HH protocol and that staff should have products that allow good HH at their disposal. In this survey, almost all NHs had a HH protocol. One-fifth of the facilities did not indicate hand disinfection with an alcohol-based solution as the preferred HH method. With this result, Belgian NHs score better than the European average (43.8% of NHs not applying hand disinfection) but there is still room for improvement (ECDC, 2014c).

The proportion of UTIs among residents with a HAI was much higher in the current survey compared to the 2010 results (34.2% vs. 10.1%) (ECDC, 2014a). The HAI rates

Table 3. Infection prevention and control strategies in the participating nursing homes (n = 87) as reported by the local surveyors, Belgium (2013).

	Responses (n)	NHs with an affirmative answer (%)
Prevention strategies		
Adequate fluid intake	86	100
Good personal hygiene	85	96.5
Avoidance of (unnecessary) chronic urinary devices	85	95.3
Alternatives to indwelling catheter use	84	79.8
Cranberry juice, tablets or capsules	78	39.7
Antimicrobial prophylaxis	77	37.7
Vitamin C supplements	78	18.0
Oestrogen therapy in women	75	8.0
Urinary catheter care		
Protocol or guideline for catheter care	85	45.9
Person with training in catheter care	86	12.8
Yearly training sessions in catheter care	85	3.5
Alerts or reminders for removing unnecessary catheters	81	37.0
Multidisciplinary urinary catheter rounds	82	48.8
Stop orders for urinary catheters	84	25.0
Continence care		
Protocol or guideline for the management of urinary incontinence	87	31.0
Person with training in continence care	87	29.9
Yearly training sessions in continence care	86	41.9

NH, nursing home.

of both surveys are, however, difficult to compare as different HAI case definitions were used (ECDC, 2014a, 2014b; McGeer et al., 1991; Stone et al., 2012). In particular, the UTI surveillance definition was impacted: criteria changed and two levels of confirmation were built into the HALT-2 definition (ECDC, 2014b).

Nearly half of all UTIs in the current survey were classified as probable infections. This probable infection level was added to the UTI case definition because of the more limited access European LTCFs have to microbiological tests compared the US/Canadian facilities (ECDC, 2014c).

Less than half of our facilities reported to routinely use urine cultures for the diagnosis of UTIs. Although in an era of increasing antimicrobial resistance it is important to know the causing uropathogen and its susceptibility, there are plausible reasons why some physicians might not always solely rely on urine culture testing for UTI diagnosis in an older NH resident. First, ASB (i.e. the presence of 10^5 colony-forming units per milliliter) of the same bacterial strain in two consecutive urine samples in women, or of the one bacterial species in a single urine specimen in men, in the absence of clinical signs and symptoms of UTI, is common in older adults and occurs even more frequently in LTCF residents: 25%–50% in elderly women and 15%–40% of elderly men (Nicolle et al., 2005). Although no benefits for the treatment of ASB in LTCF residents have been reported, general practitioners still frequently prescribe antimicrobials for this condition. Walker et al. (2000) observed that ordering urine cultures and prescribing antibiotics for residents with ASB was influenced by a wide range of non-specific signs and/or symptoms (e.g. delirium or fever), especially in residents with cognitive impairment and/or in those unable to communicate their symptoms. We assume this partially explains why antibiotics are so frequently prescribed for UTIs in our NHs.

Another possible reason why urine cultures are not routinely requested in NHs might be that samples from older persons are often contaminated due to errors during the pre-analytic phase (LaRocco et al., 2016). Urine samples are not always immediately refrigerated when timely transport to the laboratory is not possible. Moreover, most guidelines recommend collection of a clean-catch midstream urine specimen, without specific details on how the meatus should be cleaned. Obtaining such a sample is, however, not straightforward in older residents who are not able to cooperate, are cognitively impaired and/or suffer from incontinence (Brazier and Palmer, 1995; Hooton et al., 2010; Nicolle et al., 2001). A literature search identified only few studies that explored the validity of alternative sampling methods (e.g. clean-catch samples or specimens obtained from diapers or via condom catheters) in older adults compared to more invasive techniques such as suprapubic aspiration. The test performance results of these methods were promising but cannot be generalised because the studies were conducted in well-defined settings and had small sample sizes (Latour et al., 2013).

In order to reduce contamination rates, specific guidelines for the collection of urine specimens in older LTCF residents are urgently needed. Less than half of our participating facilities had such protocols or guidelines. Midstream sampling was most commonly reported as routine urine collection technique in both female and male non-catheterised residents in our survey, but large variations were observed in whether or not NH staff clean the meatus before urine sample taking and in the products they use.

Less than one-third of our NHs routinely used urinary dipstick tests. A meta-analysis demonstrated that these tests are useful in different populations, including older adults, to exclude the presence of an infection if the results for both nitrites and leukocyte esterase are negative (Deville et al., 2004). This finding was confirmed by two more recent studies conducted in NH residents (Juthani-Mehta et al., 2007; Sundvall and Gunnarsson, 2009).

Guidelines for IPC of UTIs mainly focus on CA-UTIs and are primarily written for acute care hospitals. They are, however, often adapted so they can also apply to long-term care (Gould et al., 2009; Hooton et al., 2010; Tenke et al., 2008). While 60%–80% of the UTIs in acute care hospitals are device-associated, it is expected that the proportion of CA-UTIs in LTCFs is much smaller. In Europe, use of catheters in LTCFs is less common than in acute care hospitals (7.6% vs. 17.2%), although large variations between countries are seen (ECDC, 2013; Herzig et al., 2016). In the present study, we found that 2.3% of the residents had a urinary catheter. We were not able to determine how many UTIs could be attributed to the use of a urinary catheter.

Key strategies in limiting CA-UTIs in healthcare facilities include the use of indwelling catheters only when indicated and the removal of catheters as soon as they are no longer required (Gould et al., 2009; Hooton et al., 2010; Tenke et al., 2008). Catheter disconnection must be avoided and alternatives to indwelling urethral catheterisation should be considered in appropriate patients. In elderly men, condom catheters can be used as an alternative to an indwelling catheter but they should be managed appropriately in order to reduce potential risks such as skin breakdown and infection due to an obstructed drainage. In-and-out catheterisation can also be an alternative in both men and women, but the associated costs and workload for nurses prohibit general application of this technique in NHs (Gammack, 2002).

Condom catheters were less often than expected used in our NHs. We were, however, pleased to learn that most facilities used closed drainage systems. Quality improvement programmes such as reminder systems and automatic stop-orders to reduce appropriate use of catheters were not yet implemented in most of our facilities.

The present study showed that uroprophylaxis accounted for a very large part of the total antimicrobial use in our Belgian NHs. The proportion was even higher than in the 2010 survey (35.6% vs. 28.4%), but this increase might be due to increased emphasis on UTIs as a result of the additional UTI module (ECDC, 2014a).

Behavioural modification (e.g. fluid intake and personal hygiene) and the use of non-antibiotic prevention measures before applying antimicrobial prophylaxis should be promoted in NHs (Grabe et al., 2015). There is, however, much conflicting evidence regarding the efficacy of these alternatives in reducing the rate of recurrent UTIs in NHs. Only few studies are well-designed and older adults are often excluded from trials due to medical, ethical or methodological implications. The most recent update of a Cochrane Review showed no evidence that cranberry juice can prevent UTIs (Jepson et al, 2012). A more recent randomised clinical trial saw no effect of cranberry capsules on bacteriuria in female nursing home residents, while another randomised trial found only a reduced incidence of UTI in LTCF residents with high risk of UTI at baseline (Caljouw et al., 2014; Juthani-Mehta et al., 2016).

We explored whether differences in rates of UTI could be explained by the IPC and diagnostic practices, but found that only facilities monitoring rates of UTI had a higher median prevalence of UTI compared to NHs without UTI surveillance. This might be explained by the fact that those who (actively) seek will find more.

The present study has limitations. The survey was part of a larger study of HAIs and antimicrobial use in LTCFs and was conducted on a voluntary basis. The national NH participation rate was low (5.7%) and thus results cannot be generalised. We assume NHs with more resources in terms of IPC and staffing were more likely to take part in the survey. The results presented in this paper can therefore be an overestimation of the current status of available resources for IPC of UTIs. Moreover, the results presented in the current paper reflect the responses of local surveyors to a questionnaire and are not based on direct observation of practices within the NHs. Respondents could have answered questions according to what guidelines recommend instead of reporting the real situation within the NHs (socially desirable answers). Finally, this survey mainly focused on IPC resources and practices in Belgian NHs. Future studies should explore antibiotic policies specifically targeting UTIs in NHs and assess how specific interventions can impact antibiotic prescriptions for this infection.

Notwithstanding these limitations, the results of the present study can be used to identify key areas for improvement of the diagnosis and prevention of UTIs. Education and training regarding the basics of urine specimen collection in both catheterised and non-catheterised older NH residents can help reduce urine sample contamination rates and thus aid in better diagnosis of UTIs in this setting.

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