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Prevalence of healthcare-associated infections in Dutch nursing homes: follow-up 2010–2017

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S U M M A R Y

Following the first point-prevalence study in Dutch nursing homes conducted each November from 2007 to 2009, we conducted a follow-up point-prevalence study of healthcare-associated infections (HCAIs) each November from 2010 to 2017. Similar methods and criteria were used. Resident characteristics were recorded, data collection was performed by the attending elderly care physicians via an online survey, as well as via a specifically designed App from 2012. As of the same year, information on incontinence was added. Between 2010 until 2017 on average 1786 residents per year were included, ranging from 1571 to 2185. HCAI prevalence with respect to age (mean: 83 years) and sex (31% men and 69% women) were similar over all the years. The overall mean prevalence rate in the first four years was 6.7% versus 2.2% in the last six years. Urinary tract infection was the most prevalent HCAI (1.5%). Most HCAIs occurred among residents of rehabilitation units. The prevalence of HCAI varied by nursing home (0.0–37.0%). The average use of antibiotics was stable over the years (6.0%) irrespective of HCAI rate. Use of incontinence materials was on average 73.5% with 64.3% of residents being reported as incontinent. Those implementing improvement of infection control and surveillance within a new setting do need to continue for multiple years before seeing the success of their endeavour.
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Introduction

Nursing homes are generally characterized by having a vulnerable resident population with chronic illnesses, cognitive disorders, and functional disabilities. The increased level of care needed by the residents and the close proximity of residents to each other, including sharing of sanitary facilities, increase the risk and spread of healthcare-associated infections (HCAIs) [1].

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Each November from 2007 until 2009, Eikelenboom-Boskamp *et al.* conducted the first point-prevalence study of HCAIs in Dutch nursing homes, as part of the regional nursing home infection control network (REZON) in the south-east of The Netherlands [2]. They found HCAI prevalences of 6.7%, 7.6%, and 7.6% in 2007, 2008, and 2009, respectively. The most prevalent HCAI was urinary tract infection (UTI), accounting for >50% of all recorded infections.

At that time it was hard to compare results with those from other point-prevalence studies due to the lack of standardized international definitions, different methods of surveillance, and heterogeneous resident populations [2,3]. Between 2009 and 2011 the first European point-prevalence study was performed, called HALT (Healthcare-Associated infections in Long-Term care facilities), aiming at establishing an extensive protocol for surveillance of HCAIs, antimicrobial use and resistance [4]. Since 2011, prevalence studies have also been conducted in nursing homes in The Netherlands by the Dutch National Institute for Public Health and the Environment (RIVM) [5]. Additionally, from 2015 the REZON data were used by the RIVM to generate national reference data.

After the initial HALT study, various European countries have conducted (multiple) HALT studies, aiming to make comparison easier [6]. Additionally, independent HCAI studies in nursing homes have been conducted worldwide [3,7]. A review by Nicolle in 2014 showed a variation in prevalence of infection in long-term care facilities of 2.8—14% including five European countries and the USA [8].

The results of these studies indicate that nursing homes still face challenges in controlling HCAIs and that targeting UTIs, especially non-catheter-associated UTIs, is of highest priority [2,6].

The purpose of this study was to describe and evaluate continued surveillance efforts in infection prevention and antimicrobial use in Dutch nursing homes over a period of 11 years, taking into account case-mix variation.

Methods

The current study was a continuation and expansion of the surveillance activities described previously [2]. Most of the previous locations continued their surveillance activities, while new homes joined the project. All nursing homes in the area were eligible to participate; participation was voluntary. Included were all residents in participating homes who fell under the care of the elderly care physician; therefore residents predominantly fell within similar care profiles. Over the years of the survey some participating nursing homes closed and new ones opened, hence relocating clients over the different homes, albeit maintaining a fairly consistent population overall.

The same inclusion and exclusion criteria as well as the same definitions for HCAIs as described in the previous study were used, with the exception of the definition for UTI [2]. From 2012 the definition for UTI was applied more strictly in co-ordination with the Network for Prevention of Nosocomial Infections through Surveillance (PREZIES) of the National Institute of Public Health and the Environment (RIVM). To meet the new criteria for a UTI, the resident had to have signs or symptoms of a UTI and positive dipstick for leucocyte esterase and nitrate or positive urine culture, irrespective of the

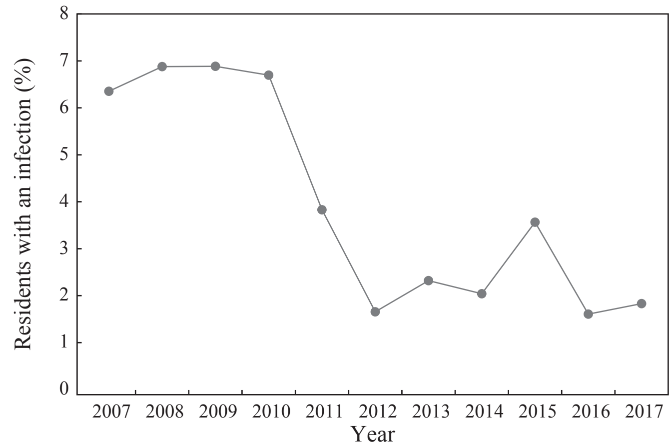

Figure 1. Trend for the percentage of residents with an infection per year.

diagnosis of the elderly care physician. Before 2012 the diagnosis by the elderly care physician was the decisive factor, not whether all criteria were met.

Similar to the previous study the following data were recorded: gender, age, use of medical devices, infections, type of unit (psychogeriatric, somatic, or rehabilitation) and antimicrobial drug use [2]. In both studies, all antimicrobials for systemic use (ATC code J01) with use for all routes were recorded and some of the other antimicrobials most frequently reported in nursing homes (antimicrobials for topical use). From 2010, the reason for use (HCAI or not HCAI) was also recorded.

From 2012 complete information on incontinence (faecal incontinence, urinary incontinence, and both) was included.

In 2010 and 2011 data were recorded via an online survey; from 2012, data were recorded using an App specifically developed for this study [9]. The data were collected annually in November and were analysed in an Excel database. Trend analyses using χ^2-tests (linear by linear association) and two-group comparison for (in)continence and UTI using a Mann—Whitney test were performed using IBM SPSS, version 22 (IBM Corp., Armonk, NY, USA).

Results

Over the study period between 2010 and 2017 the number of participating nursing homes increased from 25 to 44 locations; eight nursing homes participated in every year of the survey. As the number of locations increased, the size of the dataset tended to rise, from a minimum of 1571 to a maximum of 2185 residents. The mean age of the residents increased from 81 years in 2012 to 84 years in 2017. The distribution with regard to sex was similar in all years, around 31% men and 69% women. The overall mean prevalence rate of HCAIs was 3.1%; 3.3% for men and 2.9% for women, respectively. The trend for reduction in overall prevalence of residents with an infection over the years 2007—2017 was statistically significant ($P < 0.001$) (Figure 1). For the initial years (2007—2010) the HCAI prevalence rate remained unchanged ($P = 0.75$), with an average infection prevalence of 6.7%. For the years 2012—2017 the trend result was similar ($P = 0.93$) with an average infection prevalence of 2.2%.

The most prevalent HCAI was UTI with an overall prevalence of 1.5%. For 2010 and 2011 the prevalence of UTI was 3.5% and

2.1%, respectively. For the years 2012 until 2017 the prevalence was 0.7%, 1.2%, 0.8%, 2.6%, 0.6%, and 0.7%, respectively. The overall prevalences of other HCAIs were 1.0% for pneumonia, 0.2% for bacterial conjunctivitis, 0.1% for bloodstream infection, and 0.2% for gastroenteritis.

Most HCAIs occurred among residents of rehabilitation units (mean: 6.7%; range: 0.7–18.5%), followed by residents of somatic units (3.2%; 1.5–7.0%). Psychogeriatric residents had the lowest overall rates (2.3%; 1.2–4.7%).

The prevalence of HCAIs varied by nursing home. The lower limit of the range of HCAIs was 0% every year and the upper limit varied from 8.7% to 37.0%. The number of residents included in each nursing home varied every year, with a mean of 55 residents included at a nursing home (range: 6–268).

Over the years 2010–2017 there was a steady increase in the number of residents residing in one-person rooms (from 62.5% to 85%).

Within the Dutch nursing home system, residents are classified by the kind of disorder or disability for which the resident needs care. This care is divided into classes, the so-called 'care profiles'. Over the years the population of residents with the care profile 'protected living with intensive dementia care' made up the majority (49.4%; range: 44.7–53.5%) with an average HCAI prevalence of 2.4% (range: 1.5–5.0%).

The most common medical device was an indwelling urethral catheter (mean: 6.5%; range: 5.2–7.7%), followed by suprapubic catheter (3.9%; 2.9–4.4%), percutaneous endoscopic gastrostomy tube (1.5%; 0.1–2.5%), and intravascular device (0.4%; 0.0–1.3%).

The overall prevalence of antibiotic use was 6.0% (range: 5.5–7.0%). On average 2.9% (1.0–3.8%) of the residents were using antibiotics due to an HCAI and 3.1% were using antibiotics for infections not classified as nosocomial. For yearly prevalence rates of antibiotic use by residents due to and not due to an HCAI, see Figure 2.

On average 64.3% of residents were incontinent in any form (faecal, urine, or both). However, the overall percentage of residents using incontinence materials was 73.5%. Consequently, 10% of residents wore incontinence material while they were not classified as incontinent. Over the years the percentage of residents who had a UTI and were incontinent was significantly higher than the percentage of residents who had a UTI and were continent (3.7 vs 0.4%; $P = 0.009$).

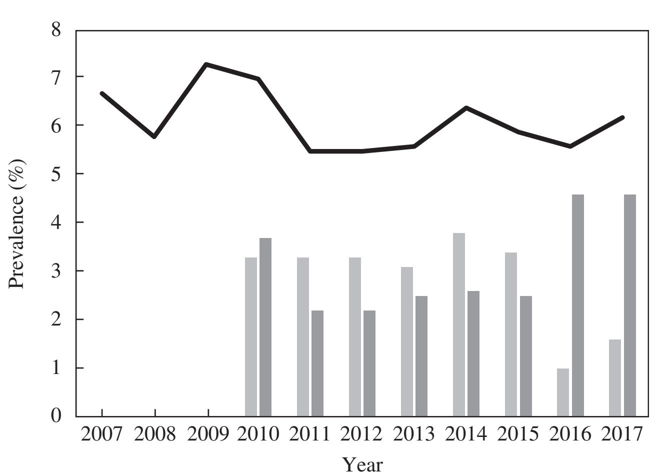

Figure 2. Yearly prevalence rates of antibiotic use due to healthcare-associated infection (HCAI; light grey bars) and not due to HCAI (dark grey bars). Black line: prevalence of antibiotic use in total. For the years 2007–2009 no data were collected on the reason for antibiotic use (HCAI or no HCAI).

Discussion

Since reporting the first point-prevalence study in Dutch nursing homes, many other reports have followed [2,4–6]. Improvements have been made over time between the various surveillance systems, by using identical definitions and timing their activities, e.g. measuring in the same season [10].

This study showed an overall mean HCAI prevalence of 3.1% which is lower than the overall mean prevalence of 7.3% published in 2011 [2]. The prevalence of 3.1%, however, is still in the range of HCAI prevalence found by Nicolle in a review of HCAIs in various countries [8]. From 2007 to 2010 the prevalence of HCAIs did not change, but it fell significantly in 2011 and stayed low over the following years.

The same effect was observed by Geubbels *et al.* after introduction of surveillance in the Dutch hospital system, but in hospitals the decrease occurred a year earlier [11]. The observed decrease in HCAI might be attributable to an increase in general attention for infection control in the nursing homes, initiated by the feedback of the surveillance results. That the decrease occurred earlier within the hospitals, as compared to the nursing homes, possibly had to do with better established infection control within the hospital setting. Structural improvements to homes over the surveillance period probably contributed to the improvement observed. Improvements to existing homes, and the opening of new homes, increased the number of residents occupying single-person rooms. One of the most important conclusions of our study is to motivate those introducing infection control and surveillance into a new setting – to lead them not to expect immediate results, but to continue their efforts for multiple years despite the fact that the improvement is not directly showing in the surveillance results. As seen, changes take time to be implemented and to impact on the infection rate.

The range for maximum HCAI prevalence obtained was 8.7–37%, thus showing a larger than expected range. Care needs to be taken when interpreting these data, since the number of residents included in each location varied widely. When the prevalence of HCAI is recurrently high, and the percentage of a certain HCAI – e.g. UTI – is disproportionally high, interventions need to be implemented after in-depth analysis of the local situation in co-operation with the local care team (elderly care physician and nurses). Therefore, it is recommended to conduct point-prevalence studies for several continuous years, if possible multiple times a year, in order to obtain more accurate estimates of a possible incidence.

In the present study the average use of antibiotics was 6.0% and was comparable with the 6.6% found in the previous point-prevalence study by Eikelenboom-Boskamp and well within the crude antibiotic prevalence range of 1.0–12.1% found in the European HALT-2 study [2,6]. However, as a reduction in HCAI was found, we expected to see a decrease in antibiotic use as of 2012. This was not the case. This may in part be explained by the fact that about 50% of all antibiotics were used by residents who were not classified as having a nosocomial infection. This may be partly due to the possibility that, despite the (partial) absence of diagnostic criteria for an infection, antibiotics were still prescribed [12]. Another explanation may be that residents were still receiving suppressive/prophylactic antibiotic treatment for recurrent UTI, despite the recommendation by the Dutch Society of Elderly Care Physicians to limit that practice [13].

Compared to the previous point-prevalence study where the overall prevalence of UTI was 3.8%, this study found an overall UTI prevalence of 1.5%, which is a remarkable reduction measured in the same case-mix population. Based on the results of the previous study, where non-catheter-associated UTI was the most frequently recorded HCAI, attention has been directed to incontinence and the use of incontinence materials, which might explain the drop in UTI rates, as one of the improvements in the nursing homes was directed at the prevention of prolonged use of incontinence materials [2]. Previously, incontinence material was not changed until maximum level of saturation was reached (complete saturation according to the built-in indicator strip). In addition, the availability of incontinence material per resident may have been insufficient due to financial reasons. While it seems conceivable that prolonged exposure, especially to faeces, should be prevented in order to prevent UTIs, the only study reporting on the frequency of change of incontinence material showed no evidence for an increased risk of developing UTI in relation to use of incontinence material [14].

This study shows a significant difference in the percentage of residents who have a UTI and who were incontinent compared to the percentage of residents who have a UTI and were continent. Other studies show that incontinence is a risk factor for bacteriuria [15,16]. Recently, Dutch care for the elderly has seen a shift in the focus on incontinence toward focusing on maintaining residents' continence for as long as possible. We included measurements of incontinence and use of incontinence materials in our surveillance as of 2012. Thus we were able to show that about 10% of the nursing home residents using incontinence materials had no established medical need for their use. There is a lack of studies investigating whether wearing incontinence materials can lead to incontinence and therefore promote UTI. However, we assume that a sufficient 'toilet policy' is preferred over providing incontinence material to residents. The assessment of incontinence and use of incontinence materials seems to be an important step in the management and prevention of UTIs, although more research is necessary.

Last but not least, the adaptation in the definition of UTI might explain a part of the reduction in UTI found. From 2012 the national definition of UTI was strictly applied, based on diagnostic criteria creating more standardized results. However, these aspects do not explain the major reduction in UTI from 3.8% over the years 2007–2009 to 2.1% in 2011.

Since prevalence studies are easy to perform and may provide valuable information to guide future healthcare improvement projects, increased awareness of the problem of HCAIs and possible risk factors, such as the use of incontinence materials, is an important motivator to implement improvements and thereby increase client safety. The effect of those improvements may take years to result in decreased HCAI rates. The HCAI point-prevalence studies can furthermore easily be combined with gathering data on antibiotic use, which is needed to establish antimicrobial stewardship in nursing homes.

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Conflict of interest statement

None declared.

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