International Journal of Infection Control
www.ijic.info ISSN 1996-9783

ORIGINAL ARTICLE

Infection surveillance in nursing homes in Stockholm County, Sweden, 2005 - 2014

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doi: 10.3396/IJIC.v12i3.019.16

Abstract

Swedish nursing homes are obliged to have a management system for systematic quality work including self-monitoring of which surveillance of infections is one part. The Department of Infection Control in Stockholm County Council has provided a simple system for infection surveillance to the nursing homes in Stockholm County since 2002.

A form is filled in by registered nurses in the nursing homes at each episode of infection among the residents. A bacterial infection is defined by antibiotic prescribing and a viral infection by clinical signs and symptoms. Yearly reports of numbers of infections in each nursing home and calculated normalised figures for incidence, i.e. infections per 100 residents per year, as well as proportion of residents with urinary catheter are delivered to the medically responsible nurses in each municipality by the Department of Infection Control.

Number of included residents has varied from 4,531 in 2005 to 8,157 in 2014 with a peak of 10,051 in 2009. The yearly incidences during 2005 - 2014 (cases per 100 residents) were: Urinary tract infection (UTI) 7.9-16.0, Pneumonia 3.7-5.3, Infection of chronic ulcer 3.4–6.8, Other infection in skin or soft tissue 1.4–2.9, *Clostridium difficile*-infection 0.2–0.7, Influenza 0–0.4 and Viral gastroenteritis 1.2–3.7. About 1% of the residents have a suprapubic urinary catheter, 6–7% have an indwelling urinary catheter.

Knowledge about the incidence of UTI has contributed to the decrease of this infection both in residents with and without urinary catheter.

Keywords
Surveillance; infections; incidence; nursing homes; urniary catheters; Sweden

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Introduction

The purpose of this paper is to describe a simple system for surveillance of infections among residents in nursing homes in Stockholm County, Sweden that is ongoing since 2002 and the incidence of antibiotic treated infections and some viral infections as well as prevalence of urinary catheters during the years 2005 to 2014.

Background

In Sweden the municipalities are responsible for care of the elderly according to the Social Services Act.[1] Persons over the age of 65 can be given service – for example cooking, personal care and laundry - in their homes, but if their needs are more profound they are offered a place in a nursing home. The nursing homes are intended for permanent living. Each resident has a single room with a bathroom and a kitchenette. Food, personal care and social activities are supplied by assistant nurses. Registered nurses (RNs) are employed at the nursing homes and provide basic medical care such as injections, drug administration and wound care. Some of the nursing homes are run by private companies or foundations contracted by the municipalities. Staffing, organisation and obligations are the same in those as in the ones run by the municipality. Physicians in the nursing homes are not employed by the municipalities or the companies/foundations but the County Council, which is responsible for healthcare for all people living in the county.[2,3] The physicians are often general practitioners but can also be specialists in geriatric care.

In each municipality there is one 'medically responsible nurse' (MAS) who is responsible for control of quality of care and resident safety in all nursing homes. Her employment is not linked to any nursing home but to the political board in the municipality to which she reports.[3,4]

At the end of year 2005 there were 1,889,945 inhabitants in the 26 municipalities in Stockholm County with 266,148 (14.1%) persons over the age of 65. Corresponding figures for 2014 were 2,198,044 inhabitants and 345,103 (15.7%) over the age of 65.[5] There are unfortunately no figures available for the number of residents in nursing homes in 2005. In 2014 the total number of permanent residents in nursing homes in Stockholm County was 15,848 i.e. 4.6% of the population aged 65 or more.[6]

Figures for the number of residents in nursing homes are available for the years 2007, 2008, 2010, 2011 and 2012 as well as for 2014.[6] These are presented in Table I.

Table I. Total number of residents in nursing homes in Stockholm County, number of residents included in surveillance of infections and coverage rate 2005 – 2014.

Year	Total Number of Residents in Nursing Homes in Stockholm County (n)	Number of Residents Included in Surveillance of Infections (n)	Coverage Rate (%)
2005	Nd	4,531	-
2006	Nd	4,529	-
2007	16,515	6,519	39.5
2008	16,560	5,796	35.0
2009	Nd	10,051	-
2010	15,882	9,446	59.5
2011	15,632	9,312	59.6
2012	15,170	8,933	58.9
2013	Nd	8,736	-
2014	15,848	8,157	51.5

Nd = No Data Available.

Infections among residents in nursing homes are often described as "health-care associated" in contrast to "society acquired".[7,8] This is not quite appropriate in the Swedish situation as the nursing homes do not belong to the health-care sector and is a form of permanent living where each resident has her/his own flat. The situation in the nursing homes with several residents given assistance and medical care by shared staff is, however, much the same as in hospitals. Contagious infections can rapidly be spread if infection control measures are inappropriate.[9] All staff in the nursing home are legally obliged to keep to standard precautions to prevent spread of microorganisms and those who provide medical care (RNs and physicians) must perform their work according to the Swedish Health and Medical Services Act (1982:763) which states that health care should have a good hygienic standard.[3]

According to jurisdiction, since 2011the Swedish nursing homes are obliged to have a management system for systematic quality work. This should include self-monitoring to make it possible to compare the current results of the activities with earlier results.[10] Surveillance of infections is one part of such quality work. The Department of Infection Control in Stockholm County Council has provided a system for infection surveillance to the nursing homes in Stockholm County since 2002. The system was modified slightly during the first years in collaboration with the medically responsible nurses, but has been virtually the same since 2005. We have avoided to label infections as health-care associated or society acquired. This is as far as we know the only system for continuous surveillance of infections in nursing homes in Sweden and probably also in the Nordic countries.

Methods

A form for registration is published on the website for the Department of Infection Control in Stockholm County Council. The form is downloaded and filled in by RNs at the nursing homes. Registration includes total number of residents, number of residents with an indwelling urinary catheter and number of residents with a suprapubic urinary catheter.

Eight kinds of infections are registered: Pneumonia, urinary tract infection, infection of chronic ulcer, other kind of infection in skin or soft tissue, *Clostridium difficile*-infection, other infection treated with antibiotics, influenza and viral gastroenteritis. For urinary tract infection it should be indicated if the person affected has any of the two kinds of urinary catheter.

For the six presumed bacterial infections an episode is defined by antibiotic prescribing for this diagnosis. For influenza and viral gastroenteritis an episode is defined by clinical signs and symptoms.

At the start of each episode of infection the RN makes a mark in the registration form. A form is used for three months and is then sent to the medically responsible nurse in the municipality. She collects the forms from all nursing homes in the municipality and sends them further to the Department of Infection Control.

At the Department of Infection Control an assistant transcribes the figures from the registration-forms into spread-sheets, one for each municipality or company/foundation.

The spread-sheets include both the crude figures for each nursing home as well as calculated normalised figures for incidence, i.e. infections per 100 residents during each quarter. The later makes it possible to compare figures over time and also between nursing homes and municipalities.

The spread-sheets are sent back to the medically responsible nurses by email two times a year.

At the end of the year the average incidence during the year for all kinds of infections in all municipalities and companies/foundations are compiled in a separate spread-sheet that is sent to all medically responsible nurses. In this spread-sheet it is not possible to identify the individual nursing homes. The proportions of residents with an indwelling urinary catheter or a suprapubic urinary catheter are also presented.

Statistical methodology

Significance in difference between groups of patients was analysed with Fisher exact test, two-sided, using the software Epi Info™ 7.

Results

The number of nursing homes and municipalities using this method for infection surveillance has varied over the years. The total number of included residents has varied from 4531 in 2005 to 8157 in 2014 with a peak of 10051 in 2009. The highest coverage rate, 59.6%, was reached in 2011. Figures for total number of residents, included residents and coverage rates are shown in Table I.

Around 92–94% of the residents lack any kind of urinary catheter. About 1% has a suprapubic urinary catheter and 6–7% has an indwelling urinary catheter. The mean values have been quite stable over the years though there is a great variation between municipalities. The average proportions of residents with an indwelling urinary catheter or a suprapubic urinary catheter for each year are shown in Table II as well as the range between the highest and lowest proportions in municipalities/companies/foundations with more than 100 residents. For the years 2005–2007 the two kinds of catheters were not separated.

Urinary tract infection (UTI) has over the years been the most common infection among the residents lacking urinary catheter with an overall incidence of 7.9-16.0 cases per 100 residents per year as shown in Table III. The difference between the years 2006 (654 cases in 4247 residents) and 2014 (563 cases in 7513 residents) is significant ($p < 0.01$). The range of yearly incidence of UTI among residents without urinary catheter in municipalities/companies/foundations with more than 100 residents belonging to this group is shown in Table III.

The incidence of UTI among residents with urinary catheter is higher than in the group without urinary catheter. For residents with suprapubic urinary catheter the incidence has varied from 17.5–47.4 cases per 100 residents per year. For residents with an indwelling urinary catheter the incidence has varied between 33.8–54.3 cases per 100 residents per year. The difference in incidence between residents without any catheter and those with any kind of urinary catheter (2005–2007) or an indwelling catheter (2008–2014) is significant ($p < 0.001$) for each year. No comparison has been made between residents without any catheter and residents with suprapubic urinary catheter as the total number in the latter group is small. The incidence of UTI in the different groups is shown in Table III.

Table II. Average proportion of residents with an indwelling urinary catheter or a suprapubic urinary catheter as well as the range between the highest and lowest proportions in municipalities/companies/foundations with more than 100 residents.

Year	Average Proportion (%) of Residents with any Kind of Urinary Catheter, (Range)[a]	Average Proportion (%) of Residents with a Suprapubic Urinary Catheter, (Range)	Average Proportion (%) of Residents with an Indwelling Urinary Catheter, (Range)
2005	5.8 (3.1 – 9.1)	-	-
2006	6.1 (3.9 – 9.2)	-	-
2007	7.1 (3.2 – 10.9)	-	-
2008	-	0.9 (0 – 2.3)	6.9 (3.3 – 9.8)
2009	-	0.9 (0 – 2.8	6.0 (1.1 – 9.1)
2010	-	0.8 (0 – 2.9)	5.7 (2.1 – 9.4)
2011	-	0.8 (0 – 2.5)	5.8 (1.5 – 12.5)
2012	-	0.9 (0 – 2.3)	5.9 (1.5 – 8.4)
2013	-	0.9 (0 – 2.1)	6.0 (3.1 – 10.9)
2014	-	0.9 (0 - 2.2)	7.0 (2.2 - 11.6)

[a] *For 2005 – 2007 Data for the Two Kinds of Catheters were not Separated.*

Table III. Yearly incidence of urinary tract infection (number of cases per 100 residents)

Year	Average Incidence among Residents with any kind of Urinary Catheter[a]	Average Incidence among Residents with Suprapubic Urinary Catheter	Average Incidence among Residents with Indwelling Urinary Catheter	Average Incidence among all Residents without Urinary Catheter (Range in Municipalities/ Companies/Foundations with more than 100 Residents belonging to this group)	p-value for Difference between Patients without Urinary Catheter and Patients with any kind of Urinary Catheter (2005-2007) or Indwelling Urinary Catheter (2008-2014)[b]
2005	51,9			12,0 (9.4 – 16.4)	< 0.001
2006	52,9			16,0 (8.9 – 21.5)	< 0.001
2007	52,5			14,2 (9.9 – 21.0)	< 0.001
2008		32,0	54,3	12,1 (8.9 – 15.9)	< 0.001
2009		47,4	35,3	9,8 (6.4 – 15.7)	< 0.001
2010		34,0	37,3	10,0 (3.6 – 13.5)	< 0.001
2011		35,0	42,1	10,5 (3.9 – 17.6)	< 0.001
2012		26,4	34,4	9,3 (4.1 – 13.8)	< 0.001
2013		34,9	39,8	9,6 (2.7 – 16.7)	< 0.001
2014		17,5	33,8	7,9 (1.3 – 12.1)	< 0.001

[a] *For 2005 – 2007 Data for the Two Kinds of Catheters were not Separated.*
[b] *Fisher exact test (two-sided) analyzed by software Epi Info™ 7.*

Table IV. Yearly incidence of pneumonia, infection of chronic ulcer, other kind of infection in skin or soft tissue, *Clostridium difficile*-infection, other infection treated with antibiotics, influenza and viral gastroenteritis (number of cases per 100 residents)

Year	Pneu-monia	Infection of chronic ulcer	Other kind of infection in skin or soft tissue	*Clostridium difficile*-infection	Other infection treated with antibiotics	Influenza	Viral gastro-enteritis
2005	4,5	3,4	1,4	0,3	3,0	0,2	1,2
2006	4,6	3,7	2,2	0,4	2,2	0,0	1,2
2007	4,3	5,0	2,3	0,4	2,6	0,2	2,1
2008	5,3	6,8	2,8	0,7	2,6	0,2	2,5
2009	3,7	5,8	2,7	0,3	2,5	0,3	3,7
2010	4,4	5,3	2,7	0,2	2,2	0,2	2,1
2011	5,0	6,0	2,9	0,3	2,9	0,4	1,8
2012	5,2	5,1	2,5	0,3	2,6	0,4	1,4
2013	4,8	5,2	2,2	0,3	3,0	0,3	2,3
2014	3,9	4,5	1,9	0,2	2,5	0,2	2,3

The yearly incidences of Pneumonia (3.7-5.3 cases per 100 residents), Infection of chronic ulcer (3.4–6.8 cases per 100 residents), Other kind of infection in skin or soft tissue (1.4–2.9 cases per 100 residents), *Clostridium difficile*-infection (0.2–0.7 cases per 100 residents), Other infection treated with antibiotics (2.2–3.0 cases per 100 residents), Influenza (0–0.4 cases per 100 residents) and Viral gastroenteritis (1.2–3.7 cases per 100 residents) are shown in Table IV.

Discussion

What is regarded an infection, and subsequently the prevalence or incidence of infection in the population studied, is set by the definition of infection. A definition based on predefined signs, symptoms and laboratory findings ascertains a high reliability and avoids over-diagnosing. The everyday situation in the Swedish nursing homes differs a lot from what would be the ideal situation for a surveillance based on criteria for infection possible to obtain in a hospital setting. In the nursing homes the possibilities to use laboratory resources for microbiological analysis and x-rays are limited. For urinary samples dipsticks or dip-slide cultures are available in some nursing homes but not in all. The access to a physician differs and most of the time physicians are only possible to reach by telephone by the RN at the nursing home. Antibiotic prescription after indirect contact with the resident has been described earlier by Pettersson *et al*.[11] Diagnosing of infections in the Swedish nursing homes are thus to a large extent based on available information about the resident from the RN and the physicians professional experience. Accordingly, in our surveillance system the definition of bacterial infection is based on a clinical decision made by a physician to prescribe antibiotics and for the viral infections to put a diagnosis. Compared with a more sophisticated system this might of course lead to both false high and false low incidences. The physician could for example prescribe an antibiotic for safety's sake if the patient's symptoms are vague. On the other hand not all *Clostridium difficile*-infections are treated with antibiotics. The influence of definition on infections rates has among others been described by Dicks *et al*.[12]

According to our surveillance system, urinary tract infection (UTI) is the infection with the highest incidence during each year 2005-2014. This is consistent with several international and Swedish studies.[8,11,13,14,15,16] The appropriateness of antibiotic prescribing in Dutch nursing homes has been studied by van Buul *et al*. who found that it was only about 68% for UTI.[17] As UTI is the most common reason for antibiotic prescription in nursing homes there is strong reason to use diagnostic methods that can be handled by the local RNs as an effort to improve appropriateness. Sundvall *et al*. has shown that "when dipstick urinalyses for nitrite and leukocyte esterase are simultaneously negative it is unlikely that the urine culture will show growth of potentially pathogenic bacteria".[18] The importance of correct diagnosing is emphasised in the national recommendations on prevention of healthcare associated UTI published by the Swedish Association of Local Authorities and Regions (SALAR) in 2008 and revised in 2011.[19]

Around 6–7% of the residents have an indwelling urinary catheter. This is equal to the prevalence found by others.[20,21] In this group the incidence of UTI was around 55 cases per 100 residents in 2008 meaning that more than every second resident with an indwelling catheter was treated with antibiotics for a presumed UTI. Correct diagnosing is especially important for this group to avoid prescribing antibiotics for asymptomatic bacteriuria.[22,23] We believe that the publication by SALAR mentioned above and the awareness of antibiotic resistance and correct use of antibiotics continuously promoted by Strama (The Swedish strategic program against antibiotic resistance) has contributed to the decline of incidence of UTI both in residents with and without urinary catheter.

The annual reports from our surveillance system make it possible for the medically responsible nurses and the physicians to compare infection rates and proportion of residents with different kinds of urinary catheters between municipalities and companies/foundations all over the Stockholm County. As the criteria for elderly to obtain a place in a nursing home mainly are social and moreover are the same in all municipalities there should not be major medical differences between the residents. The wide variation in prevalence of suprapubic and indwelling urinary catheters as well as in incidence of UTI could reflect differences in adherence to the SALAR guidelines and low incidence rates might reflect a more extensive

use of the combined dipsticks and thus avoiding over-diagnosing. There are encouraging reports from quality improvement projects showing that it is possible to reduce antibiotic prescribing in nursing homes.[24]

In Sweden vaccination against seasonal influenza is recommended for persons 65 years of age and older and is free of charge for this group in Stockholm County. The incidence of influenza in the nursing homes was low throughout the period probably due to high vaccination coverage. There are no specific figures for vaccination coverage in the nursing homes but vaccination was encouraged by the medically responsible nurses and thus probably more common than for all persons aged > 65 where it was around 65% during the years 2005–2010.[25]

The incidence of antibiotic treated *Clostridium difficile*-infection has been low over the years and we have not found any correlation with low or high total prescription of antibiotics as has been found by others.[26]

A weakness with our surveillance system is that validation of surveillance data against patient records or other sources has to be done locally by physicians and/or medically responsible nurses, as staff at the Department of Infection Control in Stockholm County Council doesn't have access to this other data. This means that quality of surveillance data might differ between the municipalities/companies/foundations. We can only encourage those who are responsible for control of resident safety and systematic quality work to ensure that their surveillance data are reliable.

As far as we know the surveillance system has been perceived as easy to handle by the RNs in the nursing homes thanks to the short instruction available at the website for the Department of Infection Control in Stockholm County Council. An improvement would be to make registration possible on the web and also to report results via the web.

Conclusions

A simple surveillance system has made it possible to compare infection rates and proportion of residents with urinary catheters between municipalities in Stockholm County. Knowledge about the incidence of UTI has contributed to the decrease of this infection both in residents with and without urinary catheter.

Acknowledgements

The author thanks Ms Eva Jakobson for her patient work with transferring figures from registration forms to spread sheets.

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