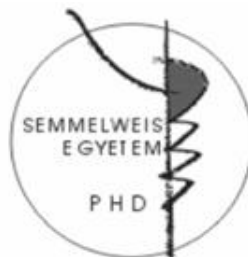


Healthcare-associated infections, antimicrobial use and infection control in  
residential long-term care facilities

Doctoral theses

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## Introduction

The number of people aged 65 years and over is increasing worldwide. In the Member States of the European Union (EU), the proportion of elders in the total population increased from 16.6% in 2005 to 18.2% in 2013. In Hungary, the number of elderly people has increased from 15.6% (2005) to 17.2% (2013). As a result of the age-related changes (e.g., impaired mobility, incontinence and disorientation) and changed healthcare system (e.g., early hospital discharge), more and more elders (63,458 in 2000 and 79,127 in 2012) live in long-term care facilities (LTCFs), corresponding to approximately 5% of the total Hungarian elderly population.

Residents of LTCFs are at high risk at infections due to their age-related anatomical and physical changes (e.g., immunosenescence) and institutional factors (e.g., overcrowding, low priority of infection prevention and control measures). Recent reports with different methodologies indicated that the prevalence of infections is between 2.7% and 32.7%. Because of infections, residents are often treated with antimicrobial agents. The most important adverse outcome of the excess use of antimicrobial agents is the emergence of multidrug resistant microorganisms, such as methicillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant *Enterococcus* sp. (VRE).

Because of their morbidity, case-fatality and cost, these issues are a significant public health concern in LTCFs. Several studies have shown that infection prevention and control programmes can decrease infection and antimicrobial resistance rates, however implementation of infection control measures have been less than optimal in LTCFs.

### **Aims of the research**

Due to the lack of EU-wide cross-country comparable data on infections and antimicrobial use in LTCFs, the European Centre for Disease Prevention and Control (ECDC) funded the HALT project (**H**ealthcare **A**ssociated Infections in **L**ong-**T**erm Care Facilities) in 2008. The overall aim of the study was to measure the prevalence of healthcare associated infections and antimicrobial use and to study infection prevention and control programmes in Hungarian long-term care facilities (LTCFs).

After a pilot survey in 2009 (including 4 Hungarian LTCFs), a first EU-wide point prevalence survey was performed between May and September 2010, including 25 countries with 722 LTCFs (including 42 Hungarian LTCFs). Based on the experience of the first HALT, the methodology was slightly improved and a repeated survey (HALT-2) was set up in 2013 including 19 countries with 1,182 LTCFs.

Our aims were to present the main characteristics (infection control and antibiotic policy) of participating long-term care facilities and explore the associations of risk factors, infections and antimicrobial use among residents.

## **Methods**

A European-wide repeated point-prevalence survey was conducted between April and May 2013 in 19 countries. Based on the protocol, the national coordinating institute (National Center for Epidemiology, NCE) organised the survey during the suggested period.

### ***Participation***

All LTCFs (e.g. general nursing care, residential care, psychiatric care, mixed care) were invited to participate voluntary in this survey.

### ***Inclusion and exclusion criteria***

It was recommended that the residents in these LTCFs:

- Need constant supervision (24/24h),
- Need ‘high-skilled nursing care’, i.e., more than ‘basic’ nursing care and assistance for activities of daily living,
- Are medically stable and do not need constant ‘specialized medical care’ (i.e., care administered by specialized physicians),
- Do not need invasive medical procedures (e.g., ventilation).

Hospital long-term care wards, residential care (e.g. hotel without any kind of nursing care), sheltered care houses, day centers, home-based centers, resident flat and protected living were excluded.

Within the participating LTCF, a resident was considered eligible for the survey if:

- she/he lived permanently in the LTCF,
- had resided there for at least one day and
- was present at 8 AM on the day of the survey.

Residents receiving chronic ambulatory care on a regular basis in the acute care hospital (e.g., haemodialysis, chemotherapy) were included in the PPS

study, as long as they were not hospitalized (i.e. inpatient in an acute care hospital with hospital stay for at least 24h) on the day of the PPS.

### ***Data collection and process***

Participating LTCFs were asked to choose one single day in the course of the survey to collect all necessary data prospectively. According to the protocol, data were collected at LTCF and resident level on standardised data collection forms (paper-based questionnaires).

The LTCF questionnaire collected data on structural and functional characteristics of LTCF demographics (e.g., availability of qualified nursing 24/24h, total number of resident rooms), denominator data (e.g., predisposing factors of all eligible residents) and information on infection control practices and antibiotic policy in the LTCF (e.g., number of infection control staff, presence of written protocols for prevention, total annual consumption of alcohol hand rubs, use of restrictive list of antimicrobial agents).

For each eligible resident who showed a sign/symptom of an active infection and/or treated with an antibacterial agent on the day of the survey, a resident questionnaire was completed. This form also included questions on resident demographics (e.g., age, sex, length of LTCF stay, admission to an acute care hospital in the last three months, surgery in the previous 30 days) and predisposing factors (e.g., presence of urinary catheter and/or vascular catheter, pressure sore or other wounds, urinary and/or faecal incontinence, disorientation in time and/or space, mobility). Infection data included the infection type corresponding to one of the case definitions by applying decision algorithm. Data on antimicrobial use included the antimicrobial name, administration route, type of treatment (prophylactic or therapeutic), indication for antimicrobial use (the site of diagnosis for treatment intention of an infection), place and person of prescription, isolated microorganisms

and selected antimicrobial resistance data (oxacillin-sensitive/resistant *Staphylococcus aureus*, glycopeptides- sensitive/resistant *Enterococcus* species, 3<sup>rd</sup> generation cephalosporin and carbapenem-sensitive/resistant Enterobacteriaceae, carbapenem-sensitive/resistant *Pseudomonas aeruginosa*, carbapenem-sensitive/resistant *Acinetobacter baumannii*).

### ***Case definitions for infections***

Centers for Disease Control and Prevention (CDC) case definitions for infections were used where these had been developed previously for LTCFs (McGeer criteria). An infection was defined as active on the day of the survey when signs and symptoms of the infection were present on the survey day or presented in the past and the resident were received antimicrobial treatment for that infection on the survey day.

### ***Inclusion of antimicrobial agents***

All oral, rectal, intramuscular and intravenous treatment with antibacterials, antimycotics and antimycobacterials for systemic use and antibiotic treatment by inhalation were included. Antivirals for systemic use, antimicrobials for topical use and antiseptics were excluded.

### ***Data analysis***

We used descriptive statistics to summarize data – number (%) for categorical variables and number, mean and median (with range) for continuous variables.

The prevalence of infections/antimicrobial use and risk factors was reported as the percentage of residents with infection/antimicrobial/risk factor. The prevalence was reported as the percentage.

The Mann-Whitney  $U$  test was used to compare the differences between the prevalence of risk factors, infections and antimicrobial use. A  $P$  value of less than 0.05 was considered statistically significant.

Data were processed and analysed using EpiData 3.1 (<http://www.epidata.dk>).

## **Results**

During the survey period (May 2013), 91 LTCFs participated in the HALT-2 project. The majority of these institutions were general nursing homes (93,4%), psychiatric LTCF (5,5%) and LTCF for physically disabled persons (1,1%).

### ***Characteristics of participating long-term care facilities***

Most LTCFs (78%) had a qualified nurse. The mean bed number was 136.9 (median:102; range: 50-690). 33% of LTCFs did not have single rooms (i.e., possible for isolation).

### ***Characteristics of residents of long-term care facilities***

In total, 11,823 residents met the eligibility criteria. The figures varied greatly between LTCFs: from 50 to 671 eligible residents. A minority of residents were male (36.7%). On average, 21.2% of these residents were older than 85 years. The most common care load indicators were faecal and/or urinary incontinence (44.4%), followed by impaired mobility (36.9%) and disorientation in time and/or space (30.4%). The presence of vascular (0.1%) and urinary catheters (1.4%) were uncommon.

### ***Infection prevention and control practices***

A minority of LTCFs (8.8%) had assigned an infection control practitioner. 'Offer of annual immunisation for flu to all residents' (59.3%), 'development of care protocols' (53.8%) and 'supervision of disinfection and sterilization of medical and care material' (49.5%) belonged to the most frequent tasks performed by the infection control practitioners. All LTCFs were lacking the



task of 'appropriate training of general practitioners and medical staff in infection prevention and control'.

The most common written protocols concerned hand hygiene (85.7%), followed by management of urinary catheters (54.9%), management of enteral feeding (37.4%) and the management of methicillin-resistant *Staphylococcus aureus* and/or other multidrug resistant microorganisms (32.9%).

Only 3.3% of LTCFs had an institutional programme of surveillance for infections (i.e., annual report of number of urinary tract infections, respiratory tract infections, etc.).

### ***Antibiotic policy***

In 90.2% of LTCFs were lacking the elements of an antibiotic policy. Of all LTCFs 17.6% had a restrictive list of antimicrobials to be prescribed. The most frequent written therapeutic guidelines concerned wound and soft tissue infections (35%), followed by urinary tract infections (21%) and respiratory tract infections (19%).

Written guidelines for appropriate antimicrobial use (good practice) in the facility' (7.7%) were the most common elements present in the LTCFs. Overall, 84.6% had none of the elements present in their LTCFs.

Only 2.2% of LTCFs had an institutional programme of surveillance of antimicrobial consumption and resistant microorganisms (i.e., annual report for *Clostridium difficile*, etc.).

### ***Healthcare associated infections among eligible residents***

In total, 252 eligible residents were presented signs/symptoms of an infection. The overall prevalence of the recorded infections was 2.1%. Skin and soft tissues (36.5 %) was the most frequent infection type, followed by the infection of respiratory tract (28.6%) and urinary tract (21.8%).

Among residents with at least one infection, 65.3% were male and 28.9% were over 85 years. The most frequent risk factors were the impaired mobility (68.3%), followed by incontinence (64.3%) and > 1 year length of stay in the LTCF (63.9%).

### ***Antimicrobials agents prescribed in the LTCFs***

In total, 156 were receiving one or more antimicrobial agents. The prevalence of antimicrobial use was 1.3%.

During the survey period, 150 eligible residents (96.8%) were given antimicrobial agent for treatment of an infection. The most common indication for antimicrobial use was the treatment of respiratory tract infections (40.9%), urinary tract infections (36.4%) and skin and soft tissue infections (15.9%). The most common therapeutic antimicrobial agent (97.3%) belonged to the ATC J01 class of 'antibacterials for systemic use'. The most important J01 subclasses were J01M quinolone antibacterials (34.2%), J01C beta-lactam antibacterials (26%), J01F macrolides, lincosamides and streptogramins (12.4%) and J01D other beta-lactam antibacterials (10.9%).

Antimicrobials were mostly prescribed empirically whereas 3.8% was microbiologically documented treatments. 3 positive microbiology results were available for gastrointestinal infection (*Clostridium difficile*), 2 for urinary tract infection (*Enterobacter cloacae*, *Escherichia coli*) and one for other infection (*Staphylococcus aureus*). No resistant strains were found.

A total of 3.2% of all prescribed antimicrobial agents was used for prophylactic purposes. Antimicrobials were prescribed for the prevention of urinary tract infections (60%) and ear, nose, mouth infections (40%).

Among residents receiving antimicrobial, 39.1% were male and 26.3% were over 85 years. The most common risk factors were the impaired mobility (64.7%), followed by incontinence (62.8%) and > 1 year length of stay in the LTCF (50%).

## Conclusions

1. In Hungary, the infection prevalence of healthcare associated infections and antimicrobial use (2.1% és 1.3%) is lower than those found in other European countries (2.7-32.7% és 2.4-15%). The excess use of antimicrobials is not common, although prescription of quinolone antibacterials (ATC J01M) was frequent (34.2%) in LTCFs compared with results from other European surveys (6-38.5%).
2. Infection control practices – including surveillance, antibiotic policy and hand hygiene – is not common in Hungarian long-term care facilities.
3. There is a need of regularly conducted surveys to measure the prevalence of healthcare associated infections and antimicrobial use at national level. Results of analysis of the national database is important tool for national methodical and professional management institutes, management and personnel of long-term care facilities, and infection control practitioners with the aim of elaboration, implementation and application of appropriate infection control guidelines at national and institutional level.

## Publications

### *Publications related to the PhD dissertation in scientific journals:*

- **Szabó R,** Böröcz K. (2012) Az egészségügyi ellátással összefüggő fertőzések és antibiotikum-használat prevalencia vizsgálata a hosszú ápolási idejű intézményekben. Családorvosi Fórum, 12: 34-36.
- **Szabó R,** Böröcz K. (2013) Infekciókontroll tevékenység és antibiotikum politika a bentlakásos szociális intézményekben. IME, 12: 24-27.
- **Szabó R,** Böröcz K. (2013) Egészségügyi ellátással összefüggő fertőzések, antibiotikum-használat és infekciókontroll a szociális intézményekben – HALT-2 projekt hazai eredményei. Epinfo, 20: 469-473.
- **Szabó R,** Böröcz K. (2014) Kézhigiéne a bentlakásos szociális intézményekben. IME, 13: 18-21.
- **Szabó R,** Böröcz K. (2014) Fertőzések és antibiotikum használata bentlakásos szociális intézményekben. Orv Hetil, 155: 910-916.
- **Szabó R,** Böröcz K. (2014) Antimicrobial use in Hungarian long-term care facilities: high proportion of quinolone antibacterials. Arch Geront Geriatr, 59: 190-193. **IF: 1,525**
- **Szabó R.** (2014) Infection control personnel and implementation of infection control measures in Hungarian long-term care

facilities: national results from a European-wide survey. *Int J Infect Control*, 10: 1-5.

- **Szabó R**, Böröcz K. (2014) Kézhygiéne a bentlakásos szociális intézményekben. *Epinfo*, 21: 297-301.
- **Szabó R**, Kurcz A, Morvai J, Benkó A. (2015) Kézfertőtlenítő szer felhasználás a hazai bentlakásos szociális intézményekben. *IME*, 14: 11-16.
- **Szabó R**, Pusztai Zs. (2015) Kézhygiéne a bentlakásos szociális intézményekben. *IME*, 14: 12-16.
- **Szabó R**, Böröcz K. (2015) Infections and antimicrobial use among institutionalized residents in Hungary: increasing need of microbiological surveillance. *Acta Microbiol Immunol Hung*, 62: 29-44. **IF: 0,78**

*Publications non-related to the PhD dissertation in scientific journals:*

- **Szabó R**, Böröcz K, Nagy O, Takács M, Szomor KN. (2013) Hand hygiene perception among health care workers in Hungarian hospitals: prior to a nationwide microbiological survey. *Acta Microbiol Immunol Hung*, 60: 55-61. **IF: 0,78**
- **Szabó R**, Morvai J. (2015) A mobil kommunikációs eszközök szerepe a fertőzések átvitelében. *Orv Hetil*, 156: 802-807.