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SURVEILLANCE REPORT

Point prevalence survey of healthcare-associated infections and antimicrobial use in European long-term care facilities

April–May 2013

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Abbreviations

AU	Antimicrobial use
CP	Coordinating physician
EEA	European Economic Area
ECDC	European Centre for Disease Prevention and Control
ESAC-NH	European Surveillance of Antimicrobial Consumption – Nursing Home subproject
EU	European Union
GP	General practitioner
GI	Gastrointestinal infection
HAI	Healthcare-associated infection
HAI-Net	Healthcare-Associated Infections Surveillance Network
HALT	Healthcare-Associated Infections in European Long-Term Care Facilities Project
HALT-2	Healthcare-Associated Infections and Antimicrobial Use in European Long-Term Care Facilities Project
IPC	Infection prevention and control
IPSE	Improving Patient Safety in Europe Project
LoS	Length of stay
LTC	Long-term care
LTCF	Long-term care facility
MDRO	Multidrug-resistant organism
MRSA	Meticillin-resistant *Staphylococcus aureus*
NC	National centre
NH	Nursing home
NR	National representative
PI	Performance indicator
PPS	Point prevalence survey
R	Resistant
RH	Residential home
RTI	Respiratory tract infection
S	Susceptible
SSI	Surgical site infection
UK	United Kingdom
UTI	Urinary tract infection

Executive summary

Between April and May 2013, 1 181 long-term care facilities (LTCFs) in 19 European countries (including three UK administrations) participated in the HALT-2 point prevalence survey (PPS) of healthcare-associated infections (HAIs) and antimicrobial use in European LTCFs. This was the second time a Europe-wide PPS in LTCFs was organised. In 2010, a first survey (HALT) was conducted in 722 LTCFs across 28 European countries (including four UK administrations).

A two-day train-the-trainers course was organised to familiarise the national representatives from participating countries with HALT-2's curriculum and training materials so that they could deliver a national one-day training course for their countries' data collectors.

Data were collected from each LTCF on a single day, either by a local or by an external data collector, i.e. a person from the LTCF or recruited by the national centre. Two types of questionnaires had to be completed: an institutional questionnaire and a resident questionnaire. One institutional questionnaire was completed per LTCF, and one resident questionnaire was completed for each resident on a course of systemic antimicrobial(s) and/or presenting signs or symptoms of an active HAI on the day of the PPS. These data were entered into dedicated stand-alone HALT-2 software.

Countries were encouraged to draw a representative sample of LTCFs but, given the large variety in LTCFs within one country, the high number of eligible LTCFs and the limited resources both at the national and institutional level, none of the countries were able to obtain such a representative sample. National representativeness of the LTCF sample was evaluated and categorised into three levels (good, poor and very poor), based on the number of included LTCFs. National representativeness of the LTCF sample was considered as good for 10 of the 19 countries, poor for five countries, and very poor for the remaining four countries.

All types of LTCFs were given the opportunity to participate in the survey. The majority of participating LTCFs were general nursing homes (64.5%), mixed LTCFs (19.1%), rehabilitation centres (5.8%), and residential homes (5.3%). The results presented in this report are based on a subset of LTCFs: the general nursing homes, residential homes and mixed LTCFs (in total, 1 056 'selected LTCFs') to increase, as much as possible, homogeneity and therefore comparability, of data.

In total, 77 264 residents met the eligibility criteria, i.e. living fulltime in the LTCF since at least 24 hours and present at 8:00 a.m. on the day of the PPS. The majority of the residents were female (median: 71.0%) and older than 85 years (median: 49.1%). The distribution of care load indicators and risk factors for acquiring an HAI or for use of antimicrobials amongst the eligible population were investigated. The median prevalence of faecal and/or urinary incontinence in the selected LTCF residents was 66.7%, disorientation in time and/or space was 54.9%, and impaired mobility (wheelchair bound or bedridden) was 50.8%. The median prevalences of urinary catheter use, vascular catheter use and recent surgery (within 30 days prior to the PPS) were low (6.3%, 0% and 0%, respectively). Pressure sores and 'other' types of wounds were reported for a median of 4.2% and 7.7% eligible residents, respectively.

Medical residential care was mainly provided by general practitioners visiting the LTCF (58.5%) or by employed medical staff (25.6%). The median percentage of LTCFs with a medical doctor in charge of the coordination of the medical activities was 60.7%.

Three infection prevention and control (IPC) structures were explored: presence of a person with training in IPC, access to IPC advice, and presence of an IPC committee. About one third (31.3%) of the LTCFs had all three structures, while 10% had none of these structures in place. Overall, 66.5% of the LTCFs had a person with training in IPC at their disposal, and 79.1% had access to IPC advice. While these percentages could be considered high, the institutional questionnaires did not gather information on the relative activity of these persons/committees in terms of time allocation (e.g. FTE of IPC staff per resident or LTCF, or the regularity of IPC committee meetings).

Almost all (95.9%) LTCFs reported having a written protocol for hand hygiene. Hand disinfection with an alcohol-based solution was the most frequently reported hand hygiene method (56.2% LTCFs). Other LTCFs most frequently used hand washing with an antiseptic soap (25.3%) or a non-antiseptic soap (18.5%). Liquid soap (antiseptic or otherwise) and alcohol-based rub solution were available in 98.2% and 90.7% of the LTCFs, respectively.

The three antimicrobial stewardship elements most commonly present in the LTCFs were 'therapeutic formulary, comprising a list of antibiotics' (median: 33.6%), 'advice from a pharmacist for antimicrobials not included in the formulary' (20.7%) and 'written guidelines for appropriate antimicrobial use (good practice) in the facility' (20.0%).

The crude prevalence of residents with at least one HAI was 3.4% (n=2 626 of 77 264), and ranged from 0.4% in Croatia to 7.1% in Portugal. There were 2 753 HAIs reported, of which the most frequently reported types of HAI were respiratory tract infection (RTI; 31.2%), urinary tract infection (UTI; 31.2%) and skin infection (22.8%). With

a total number of 3.6 million LTCF beds (general nursing homes, residential homes and mixed LTCFs) in EU/EEA countries, the total number of residents with at least one HAI on any given day was estimated at 116 416 residents. The total number of HAIs occurring every year in European LTCFs was estimated at 4.2 million HAIs.

The crude prevalence of residents receiving at least one antimicrobial agent was 4.4% (n=3 367 of 77 264). This ranged from 1.0% in Hungary to 12.1% in Greece. A total of 3 561 antimicrobial agents were used on the day of the PPS, the majority administered orally (87.3%). Antimicrobials were most frequently prescribed for the treatment of an infection (72.8%), with RTIs (39.0%), UTIs (35.1%) and skin or wound infections (16.0%) being the most treated infections. The remaining agents were prescribed prophylactically (27.2%) and served mainly to prevent the occurrence of UTIs (80.9%). The total number of residents receiving at least one antimicrobial on any given day in LTCFs in EU/EEA countries was estimated at 150 657 residents.

Antibacterials for systemic use (ATC group J01) represented 97.0% of all reported antimicrobials. Within this group, beta-lactams and penicillins (29.3%), other antibacterials (19.8%) and quinolones (16.0%) were the most commonly used classes.

The results contained in this report are subject to limitations and restrained by certain biases. From the EU register of LTCFs and LTCF beds, it is evident that various types of facilities exist across the EU countries and that one definition cannot capture the whole concept of long-term care. In addition, national representativeness of the data was poor in 47% of the countries. Furthermore, the countries with larger numbers of participating LTCFs did not use a representative sampling methodology. Most LTCFs participated on a voluntary basis, which is likely to have resulted in a selection of LTCFs with higher awareness about prevention and control of HAIs and antimicrobial resistance.

The PPS served as a tool to increase awareness and prevention of HAIs in LTCFs at the local, national and European level, even in light of the limitations listed above. The training offered to LTCF staff provided an important step forward in the improvement of LTCF surveillance skills and awareness raising about prevention and control of HAIs and prudent antimicrobial use.

The collected PPS data provide a valuable insight into the HAI, antimicrobial use and IPC situation in participating countries and LTCFs in 2013. Reports were fed back to each participating LTCF and contained a detailed comparison of the LTCF's results with those at the national and European level. This also allowed national representatives to compare their national results with European data. These reports were designed to increase awareness of the local situation, thus empowering LTCF staff to take targeted IPC actions.

In addition to these local benefits, evaluation by the European Commission of the progress of EU Member States towards implementation of the Council Recommendation (2009/C 151/01) on patient safety, including the prevention and control of HAIs [8], identified the following priority areas for those working at the national and EU level:

- Extend patient safety strategies and programmes from hospital care to non-hospital care (Member State level).
- Ensure adequate numbers of specialised IPC staff with time set aside for this task in hospitals and other healthcare institutions (Member State level).
- Reinforce tailored basic IPC structures and practices in nursing homes and other LTCFs (Member State level).
- Repeat national point prevalence surveys of HAIs as a means to monitor the burden of HAI in all types of healthcare institutions, to identify priorities and targets for intervention, to evaluate the impact of interventions and to raise awareness (Member State level).
- Continue the development of guidance on the prevention and control of HAIs, including tailored guidance for nursing homes and other LTCFs (EU level).

The following recommendations can be made for future PPSs in European LTCFs:

- Continue monitoring of HAI and antimicrobial use using a standardised methodology across different countries.
- Explore measures to increase the representativeness of the sampled LTCFs before the next survey(s) and to increase the number of participating countries and LTCFs.
- Promote, with national authorities, the importance of having a good national/regional register of LTCFs and LTCF beds to enable calculation of burden estimates of HAIs and antimicrobial use in LTCFs.
- Continue to provide training to LTCF staff to harmonise the interpretation of case definitions and to improve the IPC skills.
- Perform further validation studies at national level giving special attention to HAI case definitions.

Background and objectives

In Europe, different types of long-term care facilities (LTCFs) exist and a denomination, such as 'nursing home', can cover different realities. The population type, admission criteria, available resources, policies and aims of these LTCFs largely depend on each country's available upstream (acute care, intermediate care) and downstream (e.g. home care, day centres) healthcare resources. Most countries have separate LTCFs for elderly (e.g. residential homes, nursing homes), physically disabled (sometimes younger population), mentally disabled and psychiatric care. In other countries, mixed LTCFs are the standard. Previous projects such as the Improving Patient Safety in Europe (IPSE) project, the ESAC nursing home study (2008) and the Healthcare-Associated Infections in Long-Term Care Facilities project (HALT) (2010), studied the number of LTCFs and LTCF beds by category in participating Member States, and found that LTCFs for elderly were the largest group in terms of beds[1].

In 2008, the coordination of surveillance of HAIs in Europe was transferred to the European Centre for Disease Prevention and Control (ECDC), which created the Healthcare-Associated Infections Surveillance Network (HAI-Net). ECDC continued the surveillance of surgical site infections (SSIs) and HAIs in intensive care units (ICUs) and also created a protocol for Europe-wide point prevalence surveys (PPSs) of HAI and antimicrobial use in acute care hospitals [1]. In December 2008, ECDC outsourced the HALT project to continue the efforts of IPSE's Work Package 7 (a feasibility study of HAI surveillance in European nursing homes). The HALT project integrated variables from the European Surveillance of Antimicrobial Consumption in Nursing Homes (ESAC-NH) subproject into a protocol for repeated PPS in LTCFs, thus providing an integrated method for continued assessment of the prevalence of antimicrobial use and HAIs in log-term care settings [2].

In May–September 2010 as part of HALT, an Europe-wide PPS of 722 LTCFs (75% were nursing homes) in 28 European countries (including three UK administrations) was performed following a pilot survey in November 2009. The crude prevalence of systemic antimicrobial use was 4.9%; antimicrobial agents were mainly prescribed for the treatment of an infection (72% vs. 28% prophylaxis). Signs and symptoms of an infection were reported for 4.0% of the eligible infections, but these signs and symptoms only allowed confirmation using standard case definitions in a small portion of these residents (crude prevalence: 2.6%) [3]. Based on these numbers, ECDC estimated that at least 2.6 million HAIs occur each year in LTCFs in EU/European Economic Area (EEA) countries [4].

In 2011, ECDC outsourced the HALT-2 project to further implement this PPS methodology in LTCFs.

The overall aim of HALT-2 was to develop a standardised tool that enables to follow trends – at local (LTCF), national and European levels – of the prevalence of HAIs and antimicrobial use. For this purpose, HALT-2 promoted a European protocol, based on a repeated PPS design, to measure the prevalence of HAIs and antimicrobial use and related IPC performance indicators in European LTCFs. As a secondary objective, HALT-2 helped identify priorities for national and local intervention and enable monitoring of their implementation, thereby improving resident safety and the quality of care in European LTCFs [2].

[1] Estimation from HALT (2010): >60 000 LTCFs and >3 million LTC beds for the elderly in Europe.

Methodology

- The results presented in this report must be interpreted with caution.
- To increase homogeneity, and therefore also comparability of data, results are presented for only a subset of LTCFs ('selected LTCFs'), i.e. general nursing homes, residential homes and mixed LTCFs.
- Large differences in participation were observed between countries (range: 2 to 236 LTCFs per country). Moreover, most countries included LTCFs based on a convenience sample, e.g. proximity to the national coordinating centre, public institutions, and voluntary participation.
- For these reasons, the data presented in this report cannot be considered representative of the participating countries or the whole of Europe.

National participation

In July 2012, ECDC sent an invitation to the HAI-Net contact points for the designation of one person per country as HALT-2 national representatives. On the request of the surveillance coordinator of the United Kingdom (UK), one representative per UK administration was appointed as well as a UK coordinator. As a consequence, data were collected independently for the UK administrations and reported separately. For simplicity, UK administrations are considered as countries in this report.

Nineteen national representatives performed the PPS in their country. The survey was held between April and May 2013 to be comparable with the HALT PPS (2010), i.e. both studies would be outside the winter period, with its higher infection and antimicrobial use rates.

LTCF participation

All types of LTCFs were given the opportunity to participate in the survey. The definition of a LTCF used in HALT-2 (and previously used in 2010 in HALT) was adapted from the definition of a 'high-skilled nursing home' originating in the IPSE project and used in the ESAC-NH PPS. Specifically, LTCFs were defined as facilities in which residents:

- need constant supervision (24 hours);
- need 'high-skilled nursing care' (i.e. more than 'basic' nursing care and assistance for daily living);
- are medically stable and do not need constant 'specialised medical care' (i.e. administered by specialised physicians);
- and do not need invasive medical procedures (e.g. ventilation).

The following types of facility were excluded:

- hospital long-term care wards
- residential care (hotel; without any kind of nursing care), sheltered care houses, day centres, home-based centres, resident flat and protected living.

After the survey, national representatives were requested to classify participating LTCFs according to (a) the type of LTCF, (b) the average length of stay in the LTCF and (c) the type of resident population. Minimal definitions were given; classification depended on the judgement of the national representative, not on the LTCF itself.

Ten categories of LTCF type were provided: general nursing home (NH), residential home (RH), psychiatric LTCF, LTCF for mentally disabled persons, LTCF for physically disabled persons, rehabilitation centre, palliative care facility, sanatorium, mixed LTCF (all or some of the above) and 'other' type of LTCF.

For each participating LTCF, the average length of stay of residents was classified into five groups: temporary short (<3 months), temporary medium (3–12 months), temporary long (>12 months, not definitive), definitive stay (i.e. until the end of life) and 'other'.

Each LTCF was assigned into one of the following eight types of resident population: mentally disabled persons only, physically disabled persons only, psychiatric residents only, rehabilitation only, convalescent only, intensive care only, all or some of the above, and 'other' resident population.

Representativeness of national samples of LTCFs

Countries were encouraged to draw a representative sample of national LTCFs, but none of the countries were able to draw such a sample. PPS results should ideally use data that are representative for all LTCFs of one country/region. However, given the large variety in LTCFs within countries, the high number of eligible institutions,

the limited resources both at the national and institutional level, and the voluntary nature of the survey, this was not feasible for many countries.

Sample representativeness was evaluated and categorised into four levels (very poor, poor, good and optimal).

Optimal	• Representative systematic random sample of national LTCFs (none of the participating countries achieved this criterion).
Good	• More than 25 LTCFs, thus including a sufficient number of residents.
Poor	• Between five and 25 included LTCFs in countries with more than 25 LTCFs. • Less than five included LTCFs in countries with more than five LTCFs, but inclusion of 50–75% of all LTCFs or occupied LTCF beds in the country.
Very poor	• Inclusion of less than five LTCFs, and less than 50% of all LTCFs and less than 50% of all occupied LTCF beds.

Data collection at LTCFs

Survey date

Data had to be collected on one single day between 1 April and 31 May 2013. In LTCFs with a large number of beds, data collection could be done on two or more consecutive days on the condition that all beds in one ward were surveyed on the same day.

Eligibility of residents

A resident was considered eligible for the study if they lived fulltime (i.e. 24/7) in the LTCF, had resided there for at least 24 hours and were present at 8:00 a.m. on the day of the PPS. 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 hospitalised (i.e. inpatient in an acute care hospital with hospital stay for at least 24 hours) on the day of the PPS.

Protocol, data collectors and tools

Revision of the HALT (2010) PPS protocol was discussed at the 2011 and 2012 annual meetings of ECDC's Antimicrobial Resistance and Healthcare-Associated Infections (ARHAI) networks. The HALT-2 protocol was finalised after the train-the-trainers course in February 2013 and distributed to national representatives by e-mail and published on the project's public website (http://halt.wiv-isp.be).

Data were collected by either a local data collector (e.g. designated physician, IPC doctor/nurse, head nurse, etc.) or an external data collector recruited by the national representative (e.g. IPC doctor/nurse). Data collectors used two types of paper questionnaire to collect data:

- An institutional questionnaire for each LTCF: structural and functional characteristics, denominator data and information about antimicrobial policies and IPC resources [15]. A ward list was offered to aid in the collection of denominator data for the entire LTCF eligible population.
- A resident questionnaire for each eligible resident using antimicrobials and/or presenting signs/symptoms of active HAI on the day of the PPS [15]. A mandatory microorganism code list was provided for the section on microorganisms and antimicrobial resistance.

Data had to be entered into the 'HALT-2 software tool'. This stand-alone software consists of two applications, one for national centres (NCs) and one for LTCFs. The NC application allows national survey coordinators to import, enter, review and, if necessary, complete or correct data from LTCFs. It also included a tool allowing NCs to generate the LTCF application. The LTCF application could be used by local data collectors to enter their HALT-2 PPS data, generate a summary report and export the data to their national centres.

Local performance indicators

One aim of HALT (2010) was to develop national and local structure and process indicators, or performance indicators (PIs) in infection prevention and control (IPC) and antimicrobial stewardship in participating countries and LTCFs. The process and results of this part of HALT (2010) have been published recently [16].

Indicators to measure current IPC practices in LTCFs, available IPC resources and infrastructure were collected by an institutional questionnaire. In HALT (2010), some PI questions were often left unanswered, possibly because the wording of these questions was difficult to understand. Equally, in some 'check box' questions, unanswered questions were difficult to distinguish from a 'no' answer.

For HALT-2, the PI questions were re-worded, while maintaining the same seven categories of PI questions as in HALT: clinical governance (n=6 PIs), IPC parameters (n=7), hand hygiene (n=6), other protocols for IPC (n=6), antimicrobial stewardship (n=12), infection diagnosis/ laboratory support (n=3) and surveillance (n=4). The

protocol specified that the person completing the institutional questionnaire must be in charge of the LTCF and that if they could not answer any question(s), they should forward the questionnaire to those that could to do so, e.g. for the antimicrobial stewardship questions.

Antimicrobial consumption data

The Anatomical Therapeutic Chemical (ATC) classification system of the World Health Organization Collaborating Centre for Drug Statistics Methodology was used to classify substances [5]. All oral, rectal, intramuscular (IM) and intravenous (IV) treatments with antibacterials and antimycotics for systemic use, antibiotic treatments by inhalation, and drugs for systemic treatment of tuberculosis were included. Antivirals for systemic use, antimicrobials for topical use, and antiseptics were excluded.

Antimicrobial resistance data

Antimicrobial resistance data collection in LTCFs was hampered by the low frequency of laboratory testing, limited accessibility of the test results and by differences in antimicrobial susceptibility testing across Europe. Nevertheless, the resident questionnaire was designed to collect the available information. If a microbiological culture was performed to guide antimicrobial prescription, the three 'most important' isolated microorganisms were recorded and the antimicrobial susceptibility results corresponding to selected bug–drug combinations could be reported (see [15] for more information).

Healthcare-associated infections

In HALT (2010), instead of using case definitions from the start, data collectors were asked to collect data on any sign and/or symptom of infection on the resident questionnaire. During data analysis, case definitions were applied to confirm the infections, based on adapted McGeer criteria for the surveillance of infections in nursing homes [3,6]. However, a large proportion (40.4%) of the infections reported in HALT could not be confirmed by this method[2]. It was impossible to determine whether this was due to a true absence of the signs and symptoms, or failure to report all present signs and symptoms during data collection or data entry.

For HALT-2, an alternative strategy was sought, and the decision was made to include decision algorithms in HALT-2's questionnaires to simplify the identification of HAIs. These algorithms were based on case definitions of the US Centers for Disease Control and Prevention (CDC) and the Society for Healthcare Epidemiology of America (SHEA) Long-Term Care Special Interest Group (LTCSIG) [7]. Minor adaptations were made because it was assumed that European LTCFs have more limited access to microbiological and laboratory tests than US long-term care institutions. Decision algorithms were integrated into the resident questionnaire [15].

To align with the protocol of the ECDC PPS for acute hospitals, the term 'active HAI' was used and defined as follows:

> 'An infection is active when signs and symptoms of the infection are present on the survey date or if the signs and symptoms were present in the past and the resident is (still) receiving treatment for that infection on the survey date.'

Symptoms had to be new, or acutely worse, in an attempt to exclude chronic symptoms unrelated to acute infections, such as coughs or urinary urgency. Data collectors had to verify the presence of symptoms during the 14 days preceding the day of the PPS to determine whether treated infections matched HAI case definitions, and non-infectious causes had to be considered before a diagnosis of an HAI was made [15].

The onset of the symptoms had to occur >48 hours after the resident was admitted or re-admitted to the LTCF (excluding infections already present or incubating at the time of (re-)admission). Surgical site infections (SSIs) were an exception. SSIs were excluded from this PPS if the onset of symptoms occurred within 30 days of an operation, or within one year of surgery involving an implant, as they were then considered as being hospital-acquired.

National denominators

A 'European LTCF register survey' was undertaken in parallel with the PPS as part of the HALT-2 project. Its aims and scope were to update the number of LTCFs and LTCF beds by category for each Member State as reported during HALT (2010) in order to measure differences between EU LTCFs and calculate the burden of HAI and antimicrobial use in European LTCFs.

[2] In HALT (2010), 2 495 residents had signs or symptoms of an infection, 1 488 (59.6%) of which were confirmed through application of adapted McGeer criteria during data analysis.

A questionnaire was sent to national HALT coordinators in EU/EEA countries on 14 April 2013, to provide national data by 30 June 2013. LTCFs were defined as 'residential institutions that provide health/nursing care and related services to residents who are unable to function independently in the community. It classified LTCFs into five categories: (1) general nursing homes, (2) residential homes, (3) mixed LTCFs, (4) specialised LTCFs and (5) other LTCFs. Definitions for these categories were proposed by the HALT management team in consultation with national representatives. It is recognised that the characteristics of residents in each type of LTCF are neither strictly homogeneous, nor entirely consistent with the definitions, but this was deemed the most reliable way to gain a global overview of European LTCFs.

General nursing home (type A)	A general nursing home is an institution where elderly stay temporarily (long or short) or permanently. The residents in these NHs need medical and/or skilled nursing care and supervision 24 hours a day. These LTCFs provide principally care to elderly with severe illnesses or injuries.
Specialised LTCFs (type B)	Specialised LTCFs are specialised in one specific type of care, for example physical impairment, chronic diseases such as multiple sclerosis, dementia, psychiatric illnesses, rehabilitation care, palliative care, intensive care, etc.
Residential homes (type C)	In residential homes, residents are unable to live independently. They require supervision and assistance for the activities of daily living. These LTCFs usually include personal care, housekeeping and three meals a day.
Mixed LTCFs (type D)	These LTCFs provide different types of care in the same LTCFs (a mix of type A, B and C).
Other LTCFs (type E)	Other facilities, not classifiable among the above-mentioned types of LTCF.

Training

Since in the HALT-2 protocol case definitions needed to be applied by the LTCF staff rather than collecting signs and symptoms of infections, increased attention needed to be given to training. It was recommended that national/regional coordinators organise at least one 1-day information and training session for local LTCF staff. In February 2013, a 2-day train-the-trainers course was delivered to national representatives (NR) who had expressed an interest in participating in the HALT-2 PPS to familiarise them with the HALT-2 documentation and training material.

The course curriculum included surveillance, how to run a training day, how to complete PPS questionnaires and apply case definitions, how to provide feedback, the validation study and the UTI module. The course format included presentations, small group work, frequently asked questions and discussion forums. During small group sessions, participants used sample case scenarios to complete resident questionnaires and work with the HALT-2 software tool. Feedback from participants was used to refine the training material for the training of both local and external data collectors.

Training material was made available to NRs through the project's website, including the presentations and case scenarios. Following the HALT-2 PPS itself, a brief questionnaire collecting NRs' experience of data collection and training was sent to the participating countries.

Staff from an estimated 1 072 facilities were trained in at least 60 training sessions using HALT-2 PPS training material. Some facilities' training consisted only of an update (e.g. using HALT-2's training case studies, available online) as their staff had participated in HALT (2010). In one other country, where all data collection was carried out by a member of the national/regional coordination team, no training was provided to staff of participating LTCFs.

Data collectors

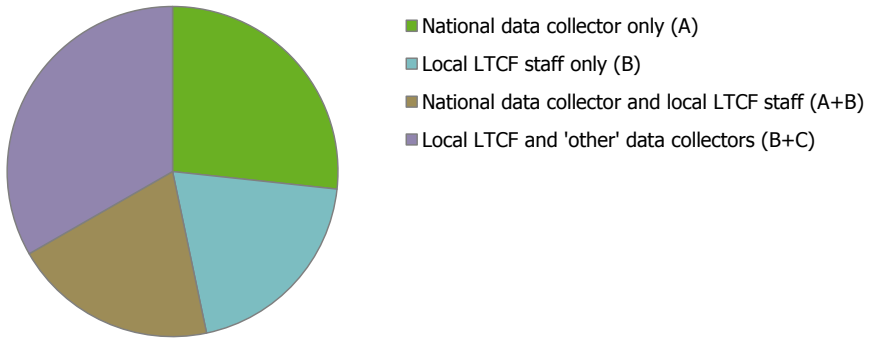
Following the completion of the HALT-2 PPS, a brief questionnaire was sent to the NRs of the 19 participating countries to obtain information on training and data collection; 15 (79%) responded.

Twelve of the 15 responding countries had local LTCF staff participate in data collection, and three countries had only national teams collect data (Table 1 and Figure 1). In five countries, 'other' data collectors were involved in data collection. These were described as IPC nurses with responsibilities for multiple facilities, doctoral students, and external IPC nurses. In some cases countries stated that these 'other' data collectors worked with local staff in collecting the PPS data. Table 1 outlines the estimated percentage of facilities where local LTCF staff, national coordinators or 'other' staff collected data.

Table 1. Persons performing data collection at the included LTCFs during the HALT-2 PPS, 2013 (n=15 countries)

Estimated proportion of participating LTCFs visited by persons who collected data	Role of persons who collected data at the LTCFs during the PPS (n=number of countries)		
	Local LTCF staff	National representative	'Other' data collectors
75–100%	6	3	1
50–74%	5	2	1
25–49%	1	0	2
1–24%	0	1	1
Total	**12**	**6**	**5**

Figure 1. How data were collected in respondent countries during HALT-2 PPS, 2013 (n=15)



Validation study

A data validation study was performed in 10 countries where a trained external data collector visited at least one LTCF on the same day as the PPS and conducted parallel, blinded data collection [11].

The protocol for the validation study was finalised in March 2013 following the train-the-trainers course. The main objectives of this validation study were to assess the validity of selected reported PIs, the accuracy of selected denominator data collected by European LTCFs, and the validity of the HAI and antimicrobial use data. The outcome measures were sensitivity, specificity, positive predictive value and negative predicted value.

Data analysis

Data were processed and analysed using Stata/SE 10.1 (StataCorp, 2009). Boxes in horizontal box plots present the median and interquartile range. Their adjacent lines indicate the boundary 1.5 times the interquartile range above/below the upper/lower quartiles. Values outside of these boundaries (i.e. outliers), when included, are plotted as individual values.

Definitions

The criteria defining 'eligible residents' are listed above (see *Eligibility of residents*). Selected LTCFs were defined as all LTCFs from general nursing homes, residential homes, or mixed LTCFs (see *Results* for full discussion, Table 3). For the purposes of this report, a 'country' is defined as a EU or EEA Member State, or one of the four UK administrations.

The crude prevalence of HAIs was defined as the total number of residents with at least one HAI detected on the day of the PPS in eligible residents in included LTCFs in HALT-2 per 100 eligible residents. Similarly, for antimicrobial use, crude prevalence is defined as the total number of eligible residents receiving at least one antimicrobial agent per 100 eligible residents on the day of the PPS. The 'median' of an indicator is the 50th percentile for that indicator in all included LTCFs in the entire HALT-2 dataset, e.g. the median HAI prevalence is the median of the HAI prevalences detected in all included LTCFs.

Antimicrobial resistance data were only collected for selected bug–drug combinations and were reported as the percentage of non-susceptible (intermediate or resistant) bacteria over the total number of isolates for which antimicrobial susceptibility testing results were available at the time of survey [15]. A cautious approach to interpreting these figures is advisable. The access to microbiological tests in European LTCFs is limited and their results can differ greatly between countries.

Calculations of HAI burden, antimicrobial use burden, and 'resident-days' denominators assumed 95% bed occupancy rates in included LTCFs.

UTI module

HALT (2010) identified that urinary tract infections (UTIs) were the second most common infection in European LTCFs (22.3% of all infections), and that almost half of all systemic antimicrobials were prescribed for an indication related to the urinary tract (48.9%). In response to these data, a 'UTI module' was developed for HALT-2 to explore the rationale for antimicrobial prescribing for UTI prevention/therapy at the individual resident level, and to investigate available resources for UTI infection prevention at national/institutional level.

The module consisted of a separate protocol including three additional questionnaires (gathering national, institutional, and resident level information), to be used in LTCFs in parallel to the main HALT-2 PPS, on the same survey day [15].

The module was used by nine of the 19 participating countries. Data from the UTI module and from the main PPS were compared at the local and/or national level, and mismatches and identified errors were corrected in the datasets. Data cleaning processes varied between countries: before data entry in some and after data entry (i.e. during data analysis) for others.

Corrections to the UTI module data added 24 UTI cases to the 531 originally reported by these nine countries (Table 2), i.e. 2.8% of the 856 cases reported by all participating countries, Table 16). This increased the crude prevalence of HAIs in these nine countries by 0.03%, but affects each participating country's crude prevalence by 0.0–1.0% (Table 2). This bias is discussed further in the section 'Discussion and conclusions'.

Table 2. Amendments to HALT-2 UTI data using optional 'UTI module' data, in countries that used the module (n=9 countries)

Country	Number of confirmed UTIs		Number of probable UTIs		Crude prevalence of HAIs (%)		Overall changes
	Without amendment	Amended using 'UTI module' data	Without amendment	Amended using 'UTI module' data	Without amendment	Amended using 'UTI module' data	
Belgium	57	57	54	54	-	-	No change**
Finland*	2	2	1	1	-	-	No change
Germany	10	11	111	116	2.4	2.5	+1 confirmed; +5 probable
Italy	89	89	101	104	3.3	3.3	+3 probable
Netherlands*	4	4	4	9	4.8	5.8	+5 probable
Portugal	23	28	34	35	9.3	9.5	+5 probable; +1 confirmed
Sweden	8	6	3	5	-	-	-2 confirmed; +2 probable
Slovenia*	0	0	0	0	-	-	No change
UK – Northern Ireland	8	8	22	26	5.5	5.8	+4 probable
Total	**201**	**205**	**330**	**350**	**3.4**	**3.4**	**+4 confirmed; +20 probable**

** Poor or very poor national representativeness of LTCF sample*
*** The 'UTI module' questionnaires were fully incorporated into Belgium's HALT-2 PPS institution-level and resident-level questionnaires.*

Results

Participation

Between April and May 2013, 1 181 LTCFs in 19 European countries (including three of the four UK administrations, considered as separate countries for the purposes of this report) conducted the PPS. The majority of these were general nursing homes (64.5%), mixed LTCFs (19.1%), rehabilitation centres (5.8%) and residential homes (5.3%) (Table 3). No sanatoria participated. Most participating LTCFs were for definitive stay (until end of life; 65.3%), or 'temporary long stay' (>12 months, not definitive; 19.1%).

Table 3. Types and numbers of LTCFs that performed the PPS, by country, HALT-2, 2013 (n=1 181 LTCFs)

	Type of LTCF									
Country	General nursing home n	Residential home n	Mixed LTCF n	Psychiatric LTCF n	LTCF for the mentally disabled n	LTCF for the physically disabled n	Rehabilitation centre n	Palliative care centre n	Other LTCF n	Total n
Belgium	87						1			**88**
Croatia		2								**2**
Czech Republic	8	1	1							**10**
Denmark	32									**32**
Finland	6									**6**
Germany	126	41	48	2					3	**220**
Greece			2							**2**
Hungary	78		12	1						**91**
Ireland	111		31	9	23	3	3	4	6	**190**
Italy	189		45			1				**235**
Malta		3	2							**5**
Netherlands	4									**4**
Norway	21									**21**
Portugal			73				65	5		**143**
Slovenia			1	1						**2**
Sweden	29		11		3					**43**
UK – England		16								**16**
UK – Northern Ireland	31									**31**
UK – Wales	40									**40**
Total	**762**	**63**	**226**	**13**	**26**	**4**	**69**	**9**	**9**	**1 181**
	64.5%	**5.3%**	**19.1%**	**1.1%**	**2.2%**	**0.3%**	**5.8%**	**0.8%**	**0.8%**	**100%**

LTCF categories that were amalgamated for further analysis are highlighted green; those that were not included in further analyses are greyed out.

Characteristics of the general nursing homes, residential homes and mixed LTCFs

To increase homogeneity and thus also comparability between countries, we selected the results from all general nursing homes (n=762), residential homes (n=63) and mixed LTCFs (n=226), and combined them for all analysis presented in this report (Table 3). In other words, n=1 051 of the 1 181 participating LTCFs were selected for analysis (89.0%).

Table 4 presents the number of the LTCFs and LTCF beds per country as well as those selected for analysis. In some countries, denominator data were estimates rather than exact figures (see section 'National denominator and burden estimates'. None of the countries recruited a systematic random sample of national or regional LTCFs. The

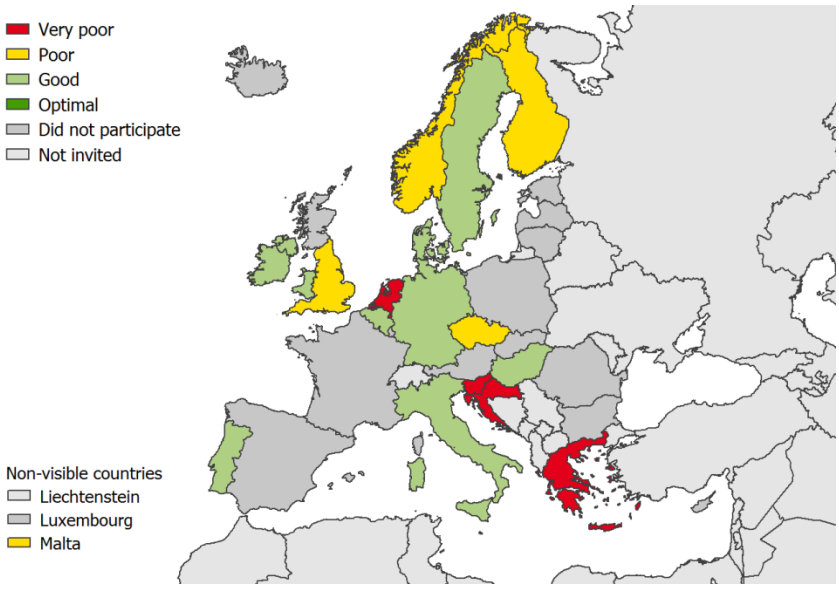
representativeness of data was good in 10 of 19 participating countries (53%), poor in 5 (26%), and very poor in four (21%) (Table 4 and Figure 2).

Table 4. Number of LTCFs and beds, nationally and in LTCF categories selected for analysis, by country, HALT-2, 2013

Country	LTCFs in the country*	LTCFs selected for inclusion in HALT-2**		LTCF beds in the country*	Beds in LTCFs selected for inclusion in HALT-2**		National representativeness of LTCF sample
	N	n	%	N	n	%	
Belgium	1 540	87	5.6	136 272	9 262	6.8	Good
Croatia	361	2	0.6	34 540	450	1.3	Very poor
Czech Republic	73	10	13.7	17 204	668	3.9	Poor
Denmark	2 600	32	1.2	90 181	1 301	1.4	Good
Finland	448	6	1.3	19 016	471	2.5	Poor
Germany	12 354	215	1.7	875 549	17 643	2.0	Good
Greece	ND	2	-	ND	319	-	Very poor
Hungary	1 177	90	7.6	57 929	11 898	20.5	Good
Ireland	570	142	24.9	34 851	7 695	22.1	Good
Italy	ND	234	-	285 007	18 624	6.5	Good
Malta	45	5	11.1	4 622	1 568	33.9	Poor
Netherlands	1 700	4	0.2	165 000	613	0.4	Very poor
Norway	991	21	2.1	41 415	1 387	3.3	Poor
Portugal	178	73	41.0	4 075	1 734	42.6	Good
Slovenia	90	1	1.1	20 777	202	1.0	Very poor
Sweden	2 766	40	1.4	101 000	1 459	1.4	Good
UK – England	17 473	16	0.1	468 658	413	0.1	Poor
UK – Northern Ireland	249	31	12.4	11 708	1 255	10.7	Good
UK – Wales	680	40	5.9	22 985	2 323	10.1	Good
Total	**43 295**	**1 051**	**2.4**	**2 390 789**	**79 285**	**3.3**	

** Denominator data from the European LTCF register (see subsection 'National denominators and burden estimates' below)*
*** Aggregated data from general nursing homes, residential homes and mixed LTCFs*
ND: no data

Figure 2. National representativeness of LTCF sample, HALT-2, 2013



The mean size of the LTCFs included in this report was 80 beds. The majority of the LTCFs were private institutions (25.6% for profit, 32.2% non-profit), while 42.2% were public (Table 5).

The median size of the included LTCFs was 64 beds and varied from 23 beds in Portugal to 1 140 beds in Malta. The stay in these facilities was mostly defined as 'definitive stay' (until the end of life; 69.7%) or 'temporary long' (>12 months, not definitive; 20.4%). The resident population was almost entirely 'mixed' (98.8%).

The median percentage of single rooms (as a percentage of the total number of rooms) was 57.1%. This median percentage was low (less than 10%) in the Czech Republic, Greece, and Hungary, and reached 100% in Denmark, the Netherlands, Norway, Sweden, England and UK – Wales (Table 5). The median percentage of single room beds (as a percentage of the total number of beds) was 38.6%, with a distribution that was similar to the median percentage of single rooms (Figure 3).

The overall median percentage of residents hospitalised at the time of the survey for all included LTCFs was low (0.6%); it was highest (>1.5%) in Croatia, Germany, Greece, Hungary, Slovenia and UK – Northern Ireland.

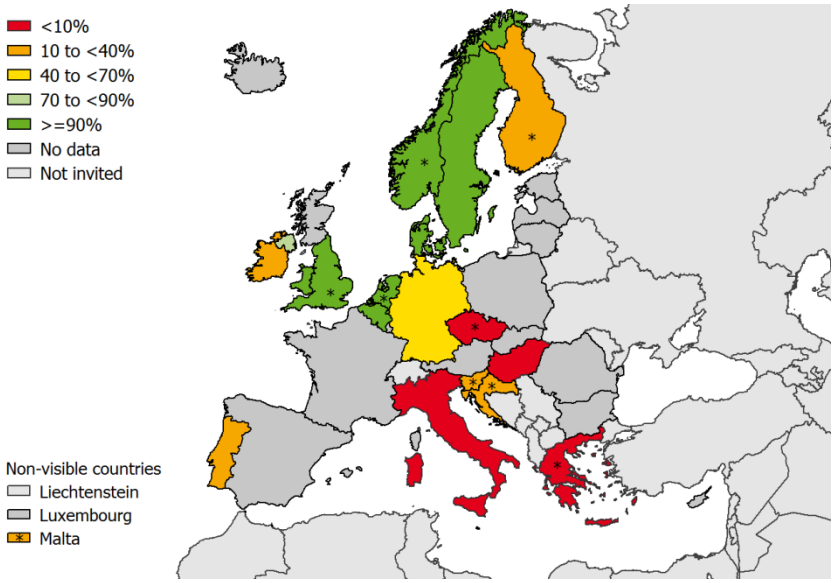
Table 5. Ownership, size and percentage of singles rooms in the included LTCFs, and the median percentage of hospitalised residents, by country, HALT-2, 2013

Country	Included LTCFs	Public LTCFs	Beds in included LTCFs	Size of included LTCFs (n of beds)				Median percentage of single rooms	Median percentage of hospitalised residents
	n	%	n	Min	Mean	Median	Max	%	%
Belgium	87	43.7	9 262	42	108.2	100	263	95.5	1.0
Croatia*	2	100	450	170	229.5	230	289	48.2	1.8
Czech Republic*	10	70.0	668	40	72.5	69	115	9.8	0.0
Denmark	32	100	1 301	25	55.4	53	111	100.0	0.0
Finland *	6	100	471	44	79.7	61	181	44.0	0.0
Germany	215	10.8	17 643	19	88.7	81	316	79.1	2.2
Greece*	2	0.0	319	125	187.5	188	250	6.0	3.3
Hungary	90	68.9	11 898	26	137.3	103	690	5.5	1.7
Ireland	142	66.2	7 695	13	58.5	50	203	54.2	0.0
Italy	234	48.9	18 624	13	84.0	74	589	10.7	0.0
Malta*	5	80.0	1 568	46	315.4	123	1 140	26.6	0.0
Netherlands*	4	100	613	136	166.3	167	195	100.0	0.6
Norway*	21	85.7	1 387	16	69.0	59	144	100.0	0.0
Portugal	73	5.5	1 734	9	24.2	23	58	22.2	0.0

Country	Included LTCFs	Public LTCFs	Beds in included LTCFs	Size of included LTCFs (n of beds)				Median percentage of single rooms	Median percentage of hospitalised residents
	n	%	n	Min	Mean	Median	Max	%	%
Slovenia*	1	100	202	205	205.0	205	205	32.3	1.5
Sweden	40	80.0	1 459	5	38.2	36	128	100.0	0.0
UK – England*	16	0.0	413	8	28.8	30	49	100.0	0.0
UK – Northern Ireland	31	0.0	1 255	12	46.5	44	87	100.0	2.0
UK – Wales	40	2.5	2 323	20	63.9	58	129	94.0	0.0
Total	**1 051**	**42.2**	**79 285**	**5**	**80.1**	**64**	**1 140**	**57.1**	**0.6**

** Poor or very poor national representativeness of the LTCF sample*

Figure 3. Median percentage of beds in the included LTCFs that were in single rooms, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample*

Characteristics of the eligible LTCF population

Age and gender

There were 77 264 residents that met the eligibility criteria, i.e. present at 8:00 a.m. on the PPS day and living fulltime in the LTCF for >24 hours. The country total varied greatly between countries, from 202 residents in Slovenia to 18 371 in Italy (Table 6).

The majority of the eligible resident population were female (crude mean: 69.3%). Half of the eligible residents were older than 85 years (crude median percentage: 49.1%). Belgium and Norway had the highest median percentage of residents older than 85 years (62.2% and 61.9%, respectively); it was lowest in Greece (8.5%), Hungary (24.8%) and Portugal (26.7%) (Table 6).

Table 6. Total number of eligible LTCF residents and percentage of male residents and residents older than 85 years in the included LTCFs, by country, HALT-2, 2013

Country	No. eligible LTCF residents	% male residents				% residents older than 85 years			
		Min	Mean	Median	Max	Min	Mean	Median	Max
Belgium	8 756	8.1	24.8	23.9	51.7	29.0	60.2	62.2	79.0
Croatia*	447	26.4	26.9	26.9	27.5	40.8	43.1	43.1	45.4
Czech Republic*	662	26.3	40.6	41.4	65.0	23.4	40.4	37.3	82.5
Denmark	1 265	18.8	34.3	33.9	50.0	27.3	51.0	52.1	75.0

Country	No. eligible LTCF residents	% male residents				% residents older than 85 years			
		Min	Mean	Median	Max	Min	Mean	Median	Max
Finland *	467	17.5	26.8	27.2	34.1	42.1	48.8	46.0	67.2
Germany	16 768	2.7	26.5	24.7	96.4	0.0	49.0	51.5	87.8
Greece*	309	40.7	52.4	52.4	64.2	2.1	8.5	8.5	15.0
Hungary	11 824	0.0	33.9	31.6	88.0	0.0	25.7	24.8	76.3
Ireland	7 535	0.0	35.4	34.8	79.3	0.0	45.2	45.8	91.7
Italy	18 371	0.0	27.6	26.5	100.0	4.2	50.4	51.2	100.0
Malta*	1 558	14.1	20.9	23.0	26.9	42.6	49.8	48.4	57.8
Netherlands*	623	29.9	37.0	37.3	43.4	23.8	40.6	44.6	49.6
Norway*	1 374	17.5	33.0	32.4	50.0	31.3	58.7	61.9	81.7
Portugal	1 717	16.7	39.9	40.0	78.6	0.0	26.8	26.7	68.8
Slovenia*	202	22.8	22.8	22.8	22.8	48.5	48.5	48.5	48.5
Sweden	1 432	0.0	31.2	32.7	53.3	0.0	52.4	57.5	81.8
UK – England*	409	7.7	36.2	25.2	91.4	0.0	45.6	54.7	80.8
UK – Northern Ireland	1 243	6.1	32.6	30.8	63.6	0.0	46.4	50.0	75.0
UK – Wales	2 302	10.5	32.4	28.6	59.4	0.0	55.5	57.4	92.6
Total	**77 264**	**0.0**	**30.7**	**29.0**	**100**	**0.0**	**46.5**	**49.1**	**100**

** Poor or very poor national representativeness of LTCF sample*

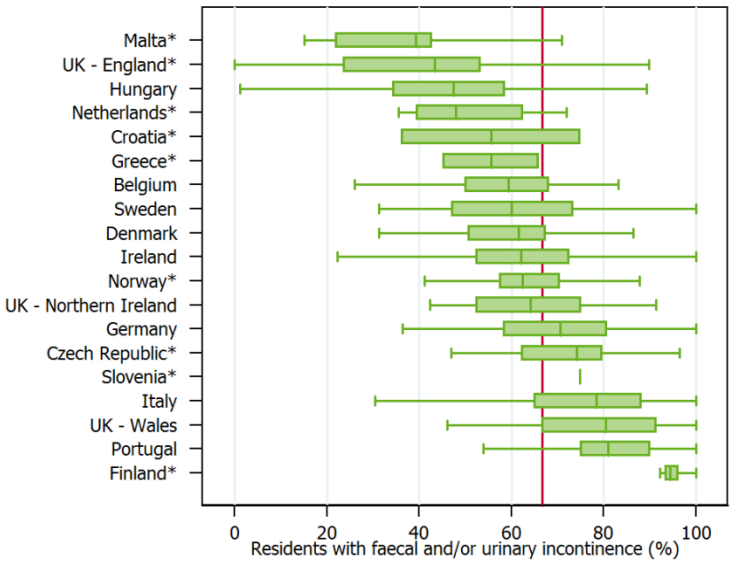
Care load indicators

The percentage of residents with faecal and/or urinary incontinence was highest in Finland (94.4%) and lowest in Malta (39.3%). The overall median percentage was 66.7% (Table 7 and Figure 4). Disorientation in time and/or space was reported for more than half of the eligible residents (overall median: 56.1%). Finland and UK – Wales scored highest on this indicator (76.8% and 75.1%, respectively); Malta lowest (17.4%) (Figure 5). Impaired mobility (wheelchair bound or bedridden) had large between-country variability (Figure 6). The highest median percentages were in Finland (77.6%), Greece (76.7%) and Portugal (77.8%), while the lowest percentages were in England (21.4%) and Malta (21.9%), although both had poorly representative samples. The overall median score for impaired mobility in residents was 50.8%.

Table 7. Distribution of care load indicators and risk factors of residents in the included LTCFs, HALT-2, 2013

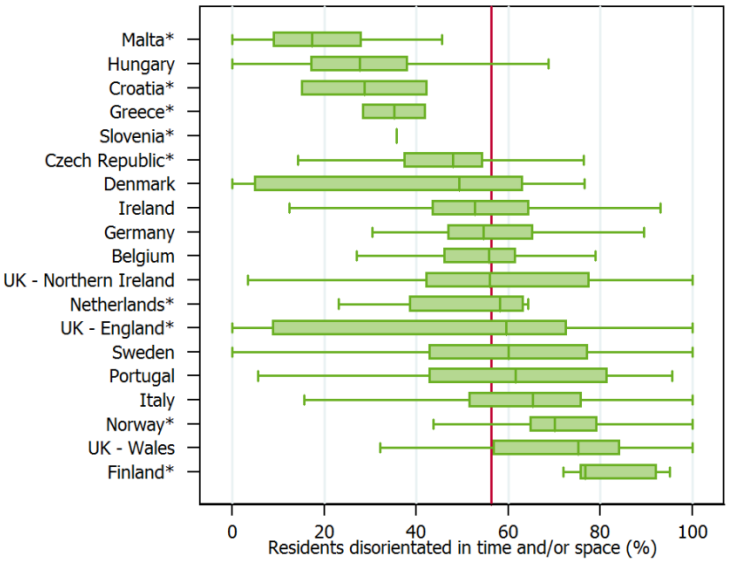
Care load indicators and risk factors	Number of LTCF residents	% LTCF residents with indicator/risk factor					
		Mean	Minimum	P25	Median	P75	Maximum
Care load indicators							
Incontinence	50 287	65.8	0	54.3	66.7	80.0	100
Disorientation	41 503	54.9	0	42.3	56.2	69.7	100
Impaired mobility	39 345	52.6	0	38.8	50.8	68.2	100
Risk factors							
Urinary catheter use	5 923	8.8	0	2.7	6.3	11.9	86.7
Vascular catheter use	899	1.4	0	0.0	0.0	0.9	66.7
Pressure sores	4 132	6.0	0	1.4	4.2	8.1	64.7
Other wounds	6 207	9.4	0	3.3	7.7	13.0	75.0
Recent surgery	916	1.5	0	0.0	0.0	1.6	50.0

Figure 4. Prevalence of incontinence (faecal and/or urine) in the eligible LTCF population by country, HALT-2, 2013



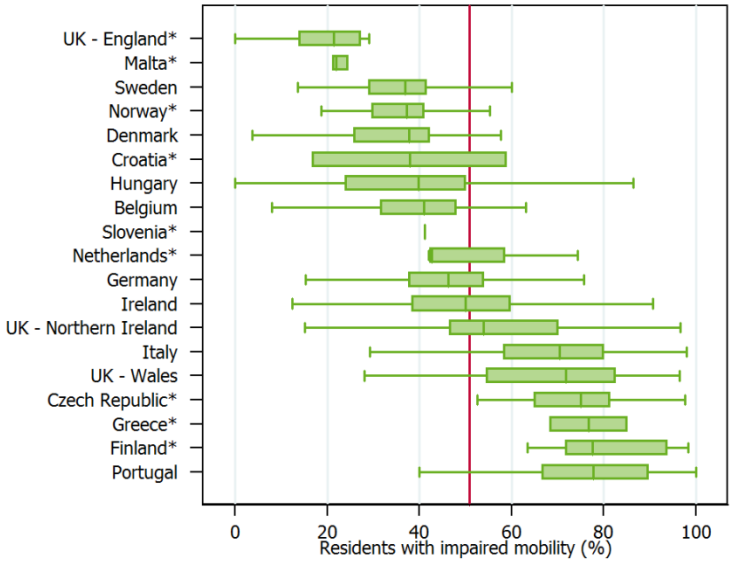
** Poor or very poor national representativeness of LTCF sample; red vertical line: crude median (66.7%), no outliers. Box plots indicate the 25th, 50th (median) and 75th percentiles; adjacent lines indicate the boundary 1.5x the interquartile range.*

Figure 5. Prevalence of disorientation (in time and/or space) in the eligible LTCF population by country, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample; red vertical line: crude median (56.1%), no outliers. Box plots indicate the 25th, 50th (median) and 75th percentiles; adjacent lines indicate the boundary 1.5x the interquartile range.*

Figure 6. Prevalence of impaired mobility (wheelchair bound or bedridden) in the eligible LTCF population by country, HALT-2, 2013



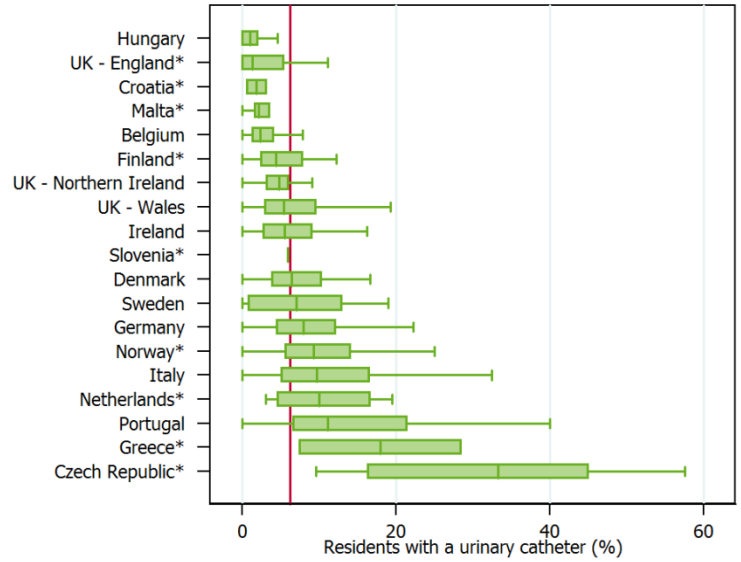
** Poor or very poor national representativeness of LTCF sample; red vertical line: crude median (50.8%), no outliers. Box plots indicate the 25th, 50th (median) and 75th percentiles; adjacent lines indicate the boundary 1.5x the interquartile range.*

Risk factors

During the HALT-2 PPS five risk factors for the acquisition of HAIs and antimicrobial use were explored: urinary and vascular catheter use, pressure sores, 'other wounds' and surgery <30 days prior to the PPS (Table 7).

The overall median percentage of urinary catheter use was low (6.3%), whilst it was reported by 33.3% and 17.9% of participating LTCFs in the Czech Republic and Greece, respectively (Figure 7).

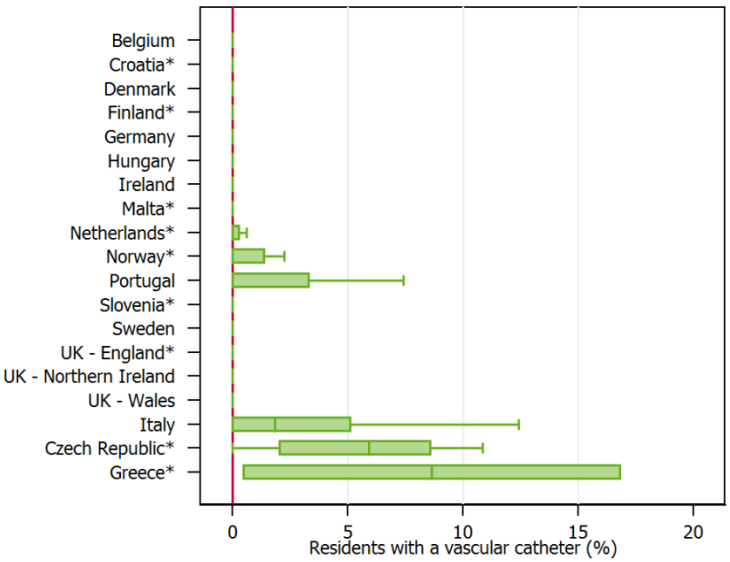
Figure 7. Prevalence of urinary catheter use in the eligible LTCF population by country, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample; red vertical line: crude median (6.3%), no outliers. Box plots indicate the 25th, 50th (median) and 75th percentiles; adjacent lines indicate the boundary 1.5x the interquartile range.*

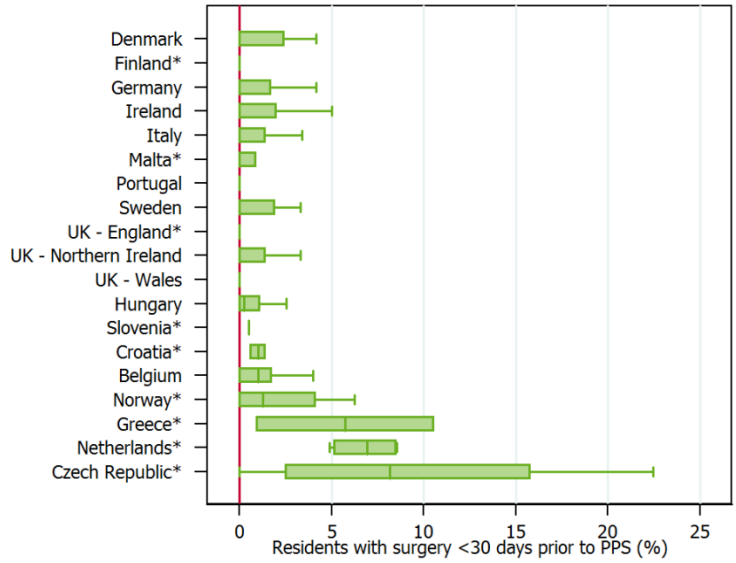
The overall median percentage of vascular catheter use and recent surgery was 0% (crude mean: 1.4% and 1.5%, respectively) (Table 7). However, higher median percentages of vascular catheter use were reported by LTCFs in the Czech Republic (5.9%), Greece (8.7%) and Italy (1.8%) (Figure 8). LTCFs in the Czech Republic, the Netherlands and Greece reported the highest median rates for recent surgery (8.2%, 6.9% and 5.7%, respectively) (Figure 9).

Figure 8. Prevalence of vascular catheter use in the eligible LTCF population by country, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample; red vertical line: crude median (0.0%), no outliers. Box plots indicate the 25th, 50th (median) and 75th percentiles; adjacent lines indicate the boundary 1.5x the interquartile range.*

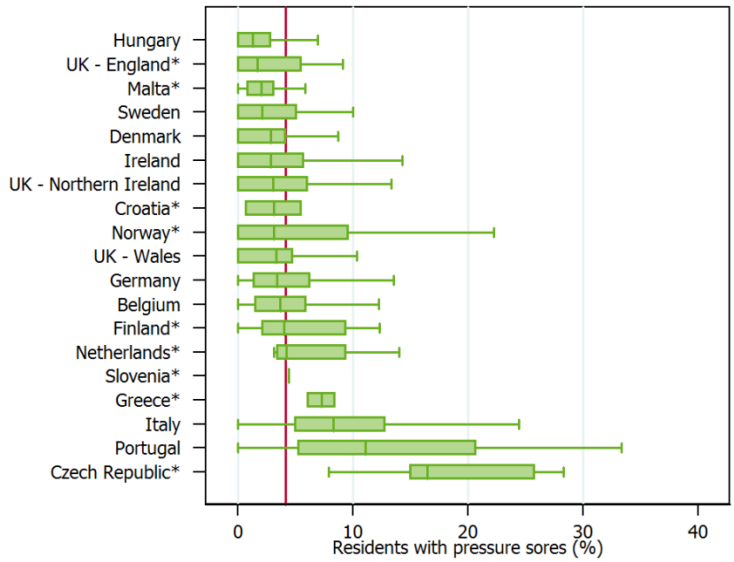
Figure 9. Prevalence of recent surgery among the eligible LTCF population by country, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample; red vertical line: crude median (0.0%), no outliers. Box plots indicate the 25th, 50th (median) and 75th percentiles; adjacent lines indicate the boundary 1.5x the interquartile range.*

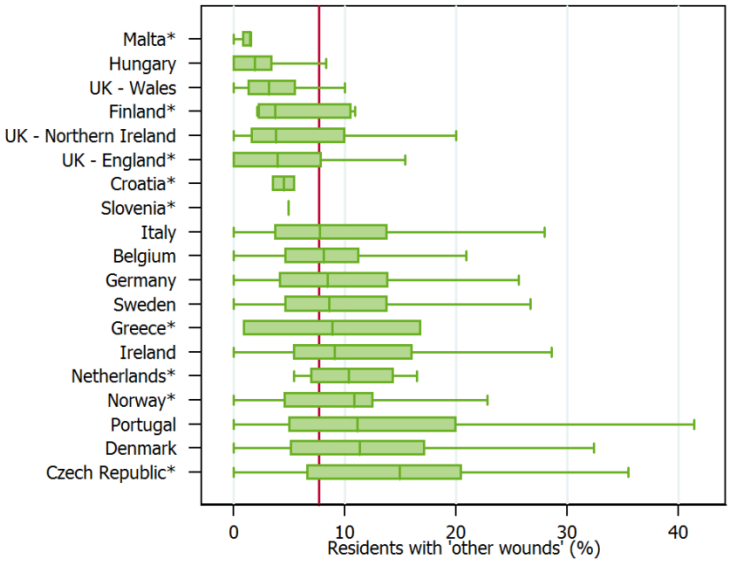
The overall median prevalence was 4.2% for pressure sores and 7.7% for other wounds (i.e. wounds other than pressure sores e.g. leg ulcers, traumatic or surgical wounds, insertion sites for gastrostomy, tracheostomy) (Table 7, Figure 10 and Figure 11). The highest median prevalence of pressure sores were observed in the Czech Republic (16.5%) and Portugal (11.1%). Hungary reported a low median prevalence for both wound groups: 1.3% for pressure sores and 1.9% for other wounds (Figure 10 and Figure 11).

Figure 10. Prevalence of pressure sores in the eligible LTCF population by country, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample; red vertical line: crude median (4.2%), no outliers. Box plots indicate the 25th, 50th (median) and 75th percentiles; adjacent lines indicate the boundary 1.5x the interquartile range.*

Figure 11. Prevalence of 'other wounds' in the eligible LTCF population by country, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample; red vertical line: crude median (7.7%), no outliers. 'Other wounds' are wounds other than pressure sores e.g. leg ulcers, traumatic or surgical wounds, insertion sites for gastrostomy, tracheostomy. Box plots indicate the 25th, 50th (median) and 75th percentiles; adjacent lines indicate the boundary 1.5x the interquartile range.*

LTCF medical care and coordination

Medical care for residents was mainly provided by general practitioners (GPs) visiting the LTCF (58.4%), or by employed medical staff (25.6%); 16.0% facilities reported that visiting GPs and employed medical staff provided care. In six countries (Croatia, Denmark, Slovenia, Sweden, UK – Northern Ireland, and UK – Wales) medical resident care was provided by GPs only, while in Greece and the Netherlands employed medical staff took on this task (Table 8).

In 39.3% of institutions, there was no medical doctor in charge of coordinating medical activities. All participating LTCFs in Croatia, the Czech Republic, Finland, Greece, the Netherlands, Slovenia and Sweden did have a coordinating physician appointed at the time of the survey, while none in UK – Wales reported having such a coordinator (Table 8). In the 60.7% LTCF that reported having a medical doctor in charge of such activities, the

physician was either from the LTCF itself (48.3%), from outside the facility (42.5%) or worked both inside and outside the facility (9.2%).

Table 8. Medical care and coordination in the included LTCFs, by country, HALT-2, 2013

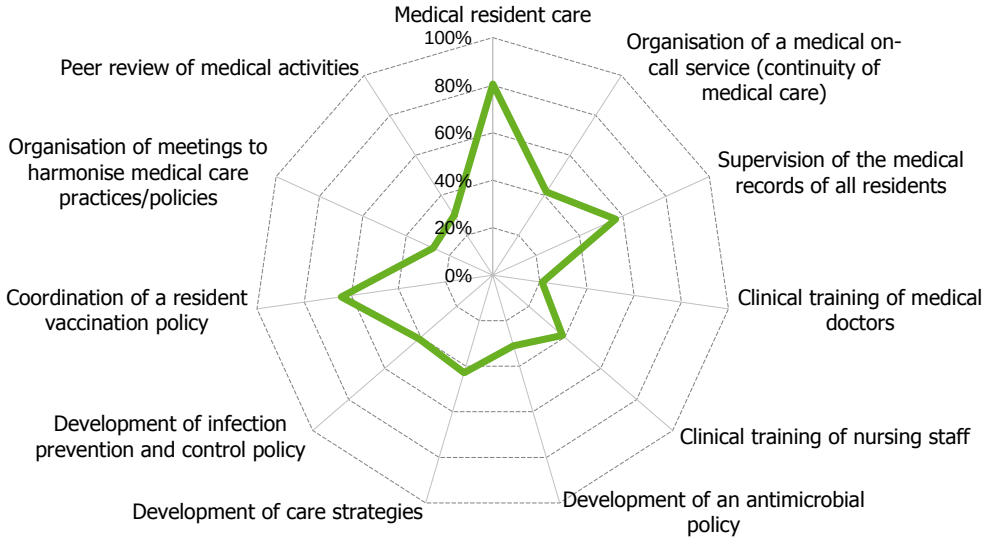
Country	Medical care providers			Coordinating physician (CP)	Tasks of the coordinating physician				
	GPs only	Employed medical staff	Both GPs and employed medical staff	Coordinating physician (CP)	Number of times tasks were reported	Development of an AM policy ***	Development of care strategies	Development of IPC policy	Coordination of vaccination policy
	% LTCFs with this medical care/coordination**					%	%	%	%
Belgium	86.2	1.2	12.6	98.9	85	62.4	49.4	72.9	87.1
Croatia*	100	0.0	0.0	100	2	0.0	50.0	50.0	100
Czech Republic*	0.0	90.0	10.0	100	10	50.0	40.0	60.0	40.0
Denmark	100	0.0	0.0	6.3	2	0.0	0.0	0.0	50.0
Finland *	0.0	66.7	33.3	100	6	100	66.7	83.3	66.7
Germany	92.6	0.5	7.0	37.7	81	0.0	2.5	3.7	55.6
Greece*	0.0	100	0.0	100	2	50.0	100	50.0	50.0
Hungary	37.8	35.6	26.7	78.9	71	18.3	8.5	11.3	59.2
Ireland	46.5	34.5	19.0	41.6	58	13.8	27.6	12.1	50.0
Italy	32.9	39.3	27.8	70.9	161	39.1	70.2	49.1	70.2
Malta*	20.0	0.0	80.0	40.0	2	0.0	50.0	0.0	0.0
Netherlands*	0.0	100	0.0	100	4	75.0	50.0	100	100
Norway*	0.0	38.1	61.9	76.2	16	31.3	25.0	56.3	68.8
Portugal	1.4	91.8	6.9	94.5	69	47.8	84.1	63.8	69.6
Slovenia*	100	0.0	0.0	100	1	0.0	0.0	0.0	100
Sweden	100	0.0	0.0	100	40	10.0	32.5	67.5	62.5
UK – England*	93.8	0.0	6.3	68.8	10	10.0	10.0	10.0	10.0
UK – Northern Ireland	100	0.0	0.0	32.3	10	0.0	10.0	10.0	0.0
UK – Wales	100	0.0	0.0	0.0	0	NA	NA	NA	NA
Total	**58.4**	**25.6**	**16.0**	**60.7**	**630**	**31.0**	**42.9**	**41.0**	**64.3**

** Poor or very poor national representativeness of LTCF sample*
*** Missing values excluded from calculation*
**** Note that in some countries the responsibility for prescription policies does not reside with the coordinating physician, e.g. in Sweden the policies are set at county level.*
AM: antimicrobial; ICP: infection prevention and control; GP: general practitioner; NA: not applicable.

The most frequently reported tasks performed by the coordinating physician (n=630; 9 missing) were 'medical resident care' (80.5%), 'coordination of the resident vaccination policy' (64.3%) and 'supervision of the medical records of all residents' (56.8%). 'Organisation of meetings to harmonise medical care practices/policies' and 'clinical training of medical doctors' were less common (27.5% and 21.0% respectively) (Figure 12).

Overall, 'development of an antimicrobial policy' (31.0%), 'development of care strategies' (42.9%) and 'development of an infection prevention and control policy' (41.0%) scored moderately, but varied largely between countries (Table 8 and Figure 12).

Figure 12. Tasks performed by the coordinating physician: overall frequencies, HALT-2, 2013 (n=630 LTCFs reporting on these tasks)



LTCF infection prevention and control practices and resources

LTCFs were asked whether there was a person with training in IPC available to the staff, an IPC committee, and/or formal access to help and advice from an external IPC team. Data from 12 LTCFs were excluded because at least one answer was missing for these three questions.

There were 691 facilities (66.5%) with a person with IPC training at their disposal (Table 9). The majority of institutions had a nurse with training in IPC (n=490/687; 71.3%), while 160 (23.3%) had both a nurse and doctor, and 37 facilities (5.4%) had only a doctor. The majority worked at the LTCF (60.0%), while in 21.7% of the LTCFs the person(s) worked externally. In the remaining facilities the person(s) worked both inside and outside the facility (18.2%).

An IPC committee (internal or external) was in place in 443 LTCFs (42.6%, Table 9) and 822 institutions (79.1%) could acquire help and advice from an external IPC team (Figure 13). Ten per cent (n=104) of the LTCFs had none of these three IPC structures in place, while 325 facilities (31.3%) had all three. Thirty-nine LTCFs (3.8%) only had a person with training in IPC, 181 LTCFs (17.4%) only counted on expert advice and 19 institutions (1.8%) only had an IPC committee.

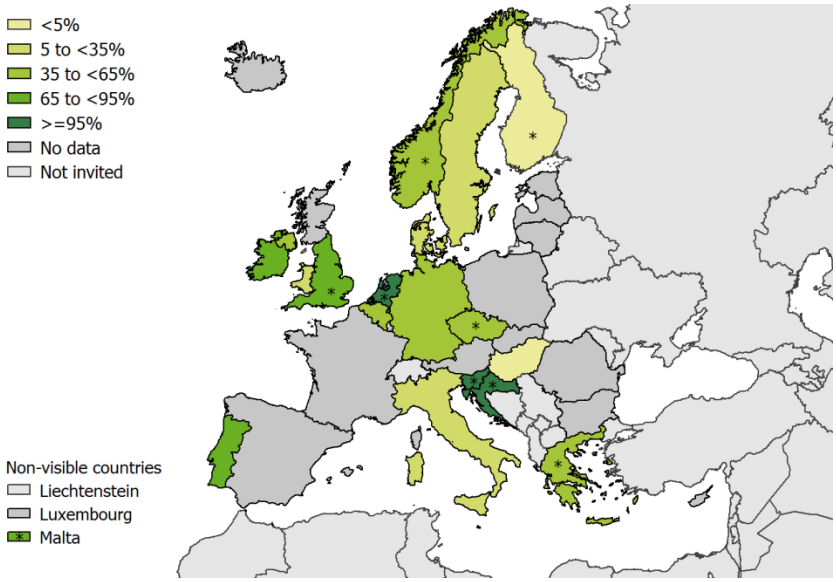
Table 9. Overview of infection prevention and control (IPC) resources and protocols available in the included LTCFs, by country, HALT-2, 2013

	IPC structures				IPC protocols					
Country	Number of included LTCFs	IPC practitioner %	IPC committee %	Expert IPC advice %	Number of included LTCFs	MRSA and/or MDRO %	Hand hygiene %	Management of urinary catheters %	Management of venous catheters %	Management of enteral feeding %
Belgium	85	65.9	43.5	77.7	81	100	97.5	63.0	32.1	54.3
Croatia*	2	50.0	100	100	2	100	100	0.0	0.0	0.0
Czech Republic*	10	50.0	50.0	90.0	9	100	100	88.9	88.9	77.8
Denmark	32	46.9	28.1	81.3	32	90.6	100	56.3	21.9	31.3
Finland *	6	100	0.0	0.0	6	100	100	100	66.7	66.7
Germany	211	85.8	64.0	85.3	206	100	100	98.1	44.7	97.6
Greece*	2	50.0	50.0	100	2	100	100	50.0	50.0	50.0
Hungary	90	8.9	2.2	72.2	90	33.3	86.7	55.6	12.2	37.8
Ireland	140	68.6	67.9	64.3	138	98.6	97.1	89.9	46.4	90.6

Country	IPC structures				IPC protocols					
	Number of included LTCFs	IPC practitioner	IPC committee	Expert IPC advice	Number of included LTCFs	MRSA and/or MDRO	Hand hygiene	Management of urinary catheters	Management of venous catheters	Management of enteral feeding
		%	%	%		%	%	%	%	%
Italy	231	50.2	24.2	81.0	229	49.3	92.6	93.5	85.2	84.3
Malta*	5	80.0	80.0	100	3	100	100	100	66.7	33.3
Netherlands*	4	75.0	100	75.0	4	100	100	100	50.0	75.0
Norway*	21	85.7	38.1	90.5	21	95.2	100	100	95.2	90.5
Portugal	73	76.7	67.1	65.8	59	22.0	93.2	74.6	61.0	45.8
Slovenia*	1	100	100	100	1	100	100	100	100	100
Sweden	40	97.5	25.0	70.0	40	97.5	97.5	57.5	52.5	85.0
UK – England*	16	93.8	68.8	100	13	76.9	92.3	53.9	7.7	15.4
UK – Northern Ireland	30	100	36.7	100	30	100	100	100	23.3	96.7
UK – Wales	40	100	7.5	97.5	39	100	100	94.9	10.3	94.9
Total	**1 039**	**66.5**	**42.6**	**79.1**	**1 005**	**76.9**	**95.9**	**84.0**	**50.0**	**76.8**

** Poor or very poor national representativeness of LTCF sample.*
IPC: infection prevention and control; MRSA: meticillin-resistant Staphylococcus aureus; MDRO: multidrug-resistant microorganisms

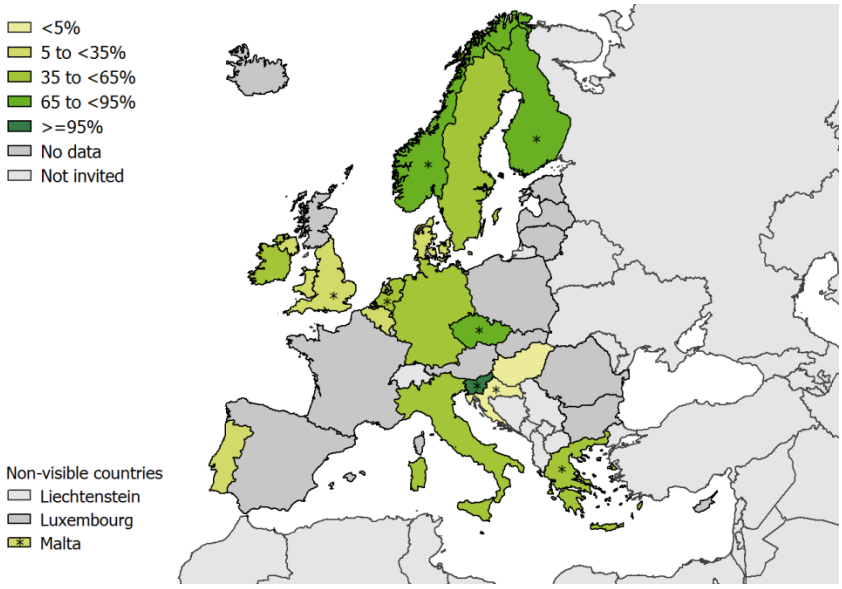
Figure 13. Percentage of included LTCFs with an infection prevention and control committee, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample*

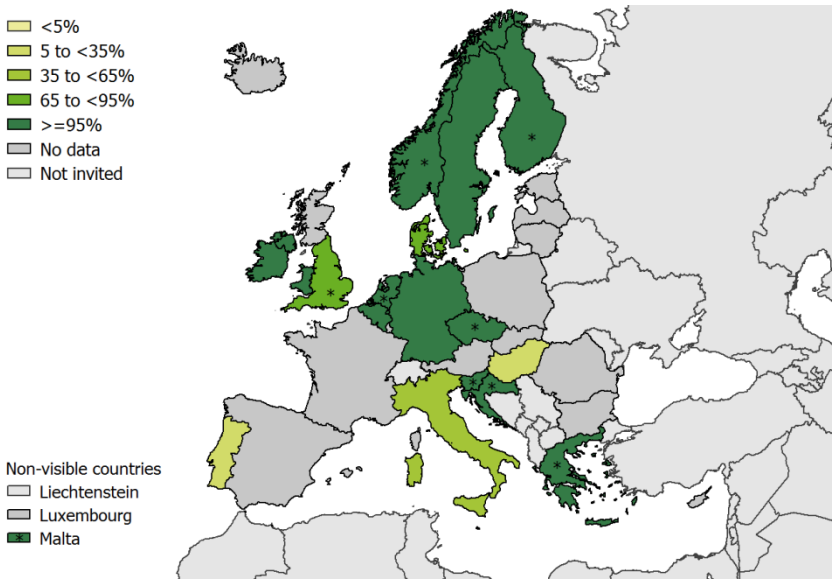
The availability of five IPC protocols was also explored in the institutional questionnaire (Table 9). Data from 46 LTCFs were excluded because at least one answer was missing for the five items. Almost all LTCFs (95.9%) had a written protocol for hand hygiene. There was also a high availability of a protocol for the management of MRSA and/or other multidrug-resistant microorganisms (76.9%, Figure 15), urinary catheters (84.0%) and enteral feeding (76.8%). Only half of the institutions had a protocol for the management of venous catheters/lines (50.0%). Eighteen facilities (1.8%) had none of the five written protocols in place, and 358 LTCFs (35.6%) reported having all five protocols (Figure 14).

Figure 14. Percentage of included LTCFs with written protocols for all five selected infection prevention and control protocols, HALT-2, 2013**



** Poor or very poor national representativeness of LTCF sample*
*** Protocols for management of MRSA and/or other multidrug-resistant microorganisms, urinary catheters, enteral feeding, venous catheters/lines, and hand hygiene.*

Figure 15. Percentage of LTCFs with written protocols for MRSA and/or other multidrug-resistant microorganisms, HALT-2, 2013

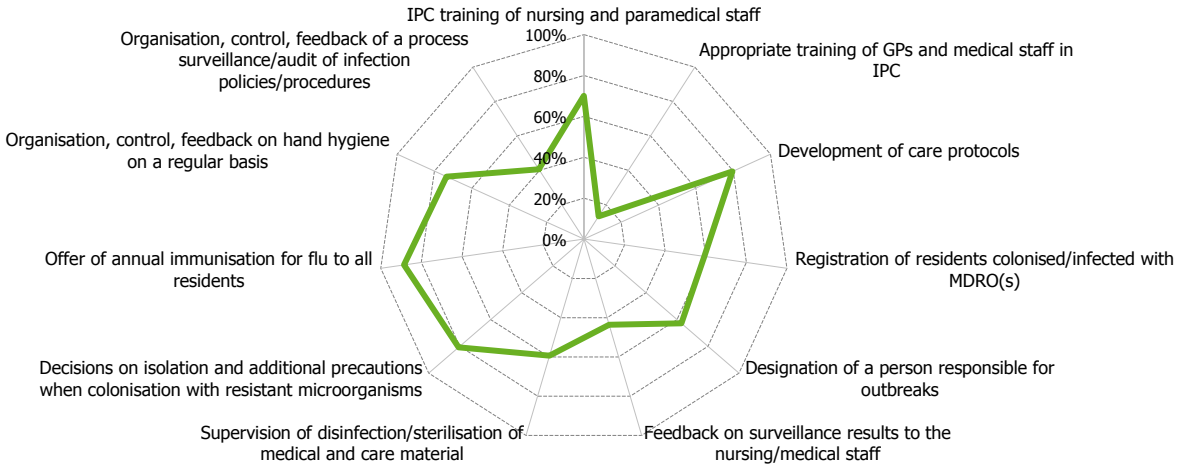


** Poor or very poor national representativeness of LTCF sample*

Figure 16 shows systems of IPC practices present in the LTCFs. Five LTCFs did not respond to the question and were thus excluded. Commonly performed practices included 'offer of annual immunisation for flu to all residents' (88.5%), 'decisions on isolation and additional precautions for residents colonised with resistant microorganisms' (80.8%) and 'development of care protocols' (79.6%). 'Appropriate training of GPs and medical staff in infection prevention and control' was uncommon (13.3%).

Complete data was obtained from 1 009 LTCFs on the availability of personal protection equipment. All facilities had gloves at their disposal, and the vast majority had access to masks (95.0%), gowns (long sleeves; 93.1%) and aprons (short sleeves; 81.5%). Goggles were available in 65.1% LTCFs.

Figure 16. Infection prevention and control (IPC) practices present in the included LTCFs, HALT-2, 2013 (n=1 046 LTCFs)



IPC: Infection prevention and control; MDRO: multidrug-resistant microorganisms

Hand hygiene in the LTCFs

Almost all LTCFs reported having a written hand hygiene protocol (95.9%, Table 9). Institutions were asked which of three methods they used most frequently. Over half of the LTCFs used hand disinfection with an alcohol-based solution most frequently (56.2%). Hand washing with water and an antiseptic soap or non-antiseptic soap was most frequently used by 25.3% and 18.5%, respectively (Table 10).

Table 10. Hand hygiene methods, products and training in the included LTCFs, by country, HALT-2, 2013

	Hand hygiene method				Hand hygiene products					Hand hygiene training	
Country	Number of LTCFs	Disinfection with alcohol-based solution	Washing with water and non-antiseptic soap	Washing with water and antiseptic soap	Number of LTCFs	Alcohol-based rub solution	Wipes (alcoholic)	Liquid soap (antiseptic/other)	Bar soap in clinical areas	Number of LTCFs	Training in the previous year
		%	%	%		%	%	%	%		%
Belgium	85	80.0	5.9	14.1	80	100	48.8	97.5	7.5	86	70.9
Croatia*	2	0.0	100	0.0	2	100	50.0	100	50.0	2	50.0
Czech Republic*	10	100	0.0	0.0	10	100	50.0	100	10.0	10	100
Denmark	32	87.5	12.5	0.0	32	100	28.1	96.9	6.3	32	31.3
Finland *	6	83.3	16.7	0.0	6	100	0.0	100	16.7	6	66.7
Germany	210	99.5	0.0	0.5	189	100	19.6	95.8	0.0	213	98.1
Greece*	2	50.0	0.0	50.0	2	100	0.0	100	50.0	2	50.0
Hungary	90	21.1	2.2	76.7	90	67.8	17.8	98.9	21.1	90	42.2
Ireland	140	53.6	35.0	11.4	133	100	41.4	100	0.8	140	92.9
Italy	233	26.6	31.8	41.6	218	73.4	8.3	97.7	2.8	232	46.1
Malta*	5	100	0.0	0.0	5	100	100	100	0.0	5	40.0
Netherlands*	4	50.0	25.0	25.0	3	100	33.3	100	0.0	4	100
Norway*	20	95.0	5.0	0.0	21	100	42.9	95.2	0.0	21	85.7
Portugal	72	51.4	26.4	22.2	70	97.1	5.7	100	4.3	71	78.9
Slovenia*	1	100	0.0	0.0	1	100	0.0	100	0.0	1	100
Sweden	40	92.5	7.5	0.0	40	100	17.5	100	2.5	40	72.5

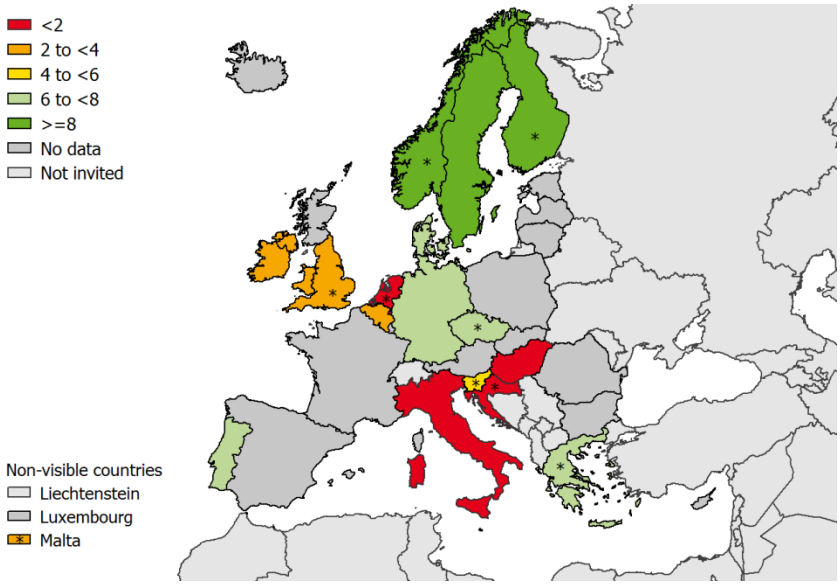
Country	Hand hygiene method				Hand hygiene products					Hand hygiene training	
	Number of LTCFs	Disinfection with alcohol-based solution	Washing with water and non-antiseptic soap	Washing with water and antiseptic soap	Number of LTCFs	Alcohol-based rub solution	Wipes (alcoholic)	Liquid soap (antiseptic/other)	Bar soap in clinical areas	Number of LTCFs	Training in the previous year
		%	%	%		%	%	%	%		%
UK – England*	16	12.5	62.5	25.0	16	100	25.0	100	0.0	16	100
UK – Northern Ireland	30	3.3	26.7	70.0	29	100	51.7	100	10.3	29	93.1
UK – Wales	40	5.0	32.5	62.5	39	92.3	12.8	100	0.0	40	97.5
Total	**1 038**	**56.2**	**18.5**	**25.3**	**986**	**90.7**	**23.3**	**98.2**	**4.6**	**1 040**	**73.4**

** Poor or very poor national representativeness of LTCF sample. Only LTCFs with complete hand hygiene method, products and training data were included.*

Complete data on hand hygiene products were obtained from 986 institutions. While liquid soap (antiseptic or other; 98.2%) and an alcohol-based rub solution (90.7%) were highly available in the LTCFs; bar soap in clinical areas (4.6%) and (alcohol) wipes (23.3%) were less common (Table 10).

In total, 836 LTCFs (79.5%) reported the number of litres of hand alcohol that were used in 2012, i.e. the previous year. The median usage reported by these 836 facilities was 4.2 litres per 1 000 resident days, assuming 95% occupancy (mean: 8.0). The median consumption rates reported by the LTCFs from any one country ranged from 0.3 to 16.1 (Figure 17).

Figure 17. Median alcohol-based hand rub use (litres per 1 000 resident-days) in the previous year in the included LTCFs, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample*

Hand hygiene training for care professionals was organised during the previous year in 73.4% LTCFs. Nurses and nurse aides (98.9%) and cleaning staff (71.3%) were most frequently invited. Medical staff and the category 'physiotherapists/occupational therapists/speech therapists/etc.' were invited by 27.5% and 34.5% LTCFs, respectively.

Antimicrobial stewardship resources

The majority of LTCFs did not have a restrictive list of antimicrobials for prescription (n=797/1043; 76.4%). Responses from 233 LTCFs indicated their restricted antimicrobials, the most common of which were vancomycin (60.5%), carbapenems (59.7%), intravenously administered antibiotics (51.1%), third generation cephalosporins (48.1%), glycopeptides (46.4%), fluoroquinolones (42.9%), broad-spectrum antibiotics (38.6%) and mupirocin (36.9%).

Table 11 presents information on the presence of 10 antimicrobial stewardship elements in the participating LTCFs. Overall, 46.0% had none of these elements present (Table 11 and Figure 18).

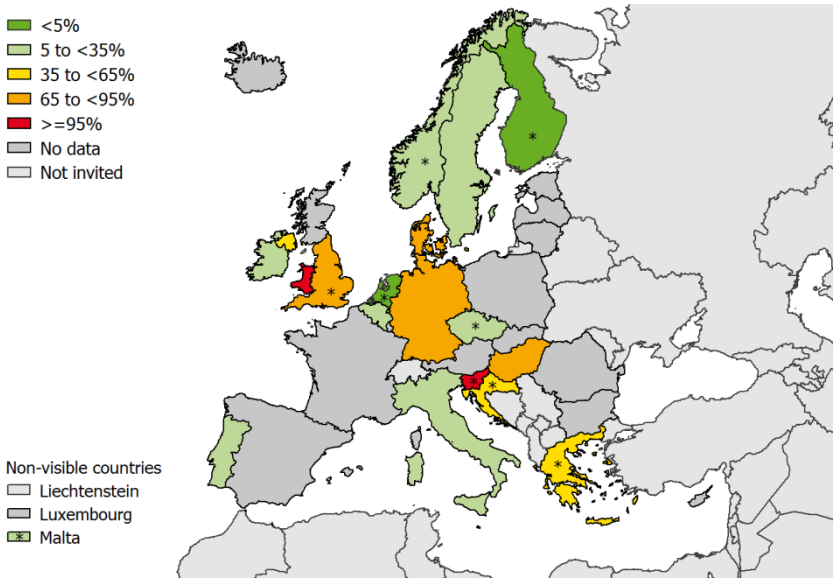
The most commonly present elements were a 'therapeutic formulary, comprising a list of antibiotics' (33.6%), 'advice from a pharmacist for antimicrobials not included in the formulary' (20.7%) and 'written guidelines for appropriate antimicrobial use (good practice) in the facility' (20.0%). The presence of 'data on annual antimicrobial consumption by antimicrobial class' (16.0%) and 'local antimicrobial resistance profile summaries' (11.0%) were reported infrequently (Table 11).

Table 11. Antimicrobial stewardship elements present in the included LTCFs, by country, HALT-2, 2013

Country	Number of LTCFs	Antimicrobial committee	Training on appropriate prescribing	Written guidelines for antimicrobial use	Data on annual antimicrobial consumption	Reminder of importance samples	Local antimicrobial resistance profiles	Permission for prescribing restricted antimicrobials	Advice from a pharmacist	Therapeutic formulary	Feedback to GPs on antimicrobial consumption	None of these elements
		%	%	%	%	%	%	%	%	%	%	%
Belgium	84	6.0	9.5	39.3	25.0	8.3	4.8	3.6	20.2	70.2	10.7	15.5
Croatia*	2	0.0	0.0	0.0	50.0	50.0	50.0	0.0	0.0	0.0	0.0	50.0
Czech Republic*	10	50.0	0.0	20.0	40.0	10.0	30.0	60.0	30.0	30.0	10.0	20.0
Denmark	32	0.0	0.0	3.1	0.0	6.3	0.0	0.0	9.4	3.1	6.3	84.4
Finland *	6	0.0	50.0	66.7	100	100	50.0	66.7	50.0	100	50.0	0.0
Germany	208	0.0	4.8	0.0	5.3	1.0	2.9	1.9	5.3	0.0	4.8	82.2
Greece*	2	0.0	0.0	0.0	50.0	0.0	0.0	0.0	0.0	0.0	0.0	50.0
Hungary	90	1.1	3.3	7.8	1.1	1.1	0.0	0.0	1.1	1.1	4.4	84.4
Ireland	138	5.1	4.3	34.8	13.8	21.0	8.0	5.1	37.0	34.8	11.6	31.2
Italy	225	4.9	10.2	25.8	26.2	23.6	12.4	42.7	31.6	62.7	24.4	20.4
Malta*	5	0.0	0.0	60.0	0.0	0.0	0.0	80.0	40.0	20.0	0.0	20.0
Netherlands*	4	0.0	75.0	75.0	50.0	50.0	50.0	25.0	50.0	100	25.0	0.0
Norway*	21	0.0	23.8	71.4	42.9	42.9	33.3	28.6	33.3	52.4	19.0	19.0
Portugal	71	15.5	11.3	21.1	36.6	33.8	19.7	16.9	36.6	60.6	31.0	19.7
Slovenia*	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Sweden	40	15.0	40.0	25.0	2.5	2.5	70.0	2.5	22.5	55.0	42.5	12.5
UK – England*	15	0.0	0.0	0.0	0.0	0.0	6.7	0.0	6.7	6.7	0.0	86.7
UK – Northern Ireland	31	0.0	3.2	19.4	9.7	22.6	16.1	0.0	16.1	9.7	0.0	45.2
UK – Wales	40	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100
Total	**1 025**	**4.5**	**8.4**	**20.0**	**16.0**	**14.1**	**11.0**	**14.0**	**20.7**	**33.6**	**14.0**	**46.0**

** Poor or very poor national representativeness of LTCF sample*
GP: general practitioner
Note that in some countries, some antimicrobial stewardship responsibilities are held by professional bodies outside of the LTCFs, e.g. in Sweden; a therapeutic formulary is available to the GPs in all counties.

Figure 18. Percentage of the included LTCFs reporting having 'none' of 10 selected antimicrobial stewardship elements in place, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample*
The 10 elements are: antimicrobial committee; training on appropriate prescribing; written guidelines for antimicrobial use; data on annual AM consumption; reminder of importance samples; local AM resistance profiles; permission for prescribing restricted AM; advice from a pharmacist; therapeutic formulary; feedback to GPs on AM consumption.

Of the 917 responding LTCFs, 34.8% reported having a written therapeutic guideline for UTIs, 28.9% for RTIs and 35.3% for wound and soft tissue infections (35.3%) (Table 12). Figure 19 presents the percentage of LTCFs that had all three of these protocols, by country (country mean: 20.1%).

Surveillance programmes were uncommon in LTCFs, e.g. only one participating LTCF in Malta had a programme. The most frequently reported programme was surveillance of resistant microorganisms (38.5%), followed by surveillance of HAIs (29.7%) and antimicrobial consumption (16.1%) (Table 12 and Figure 20).

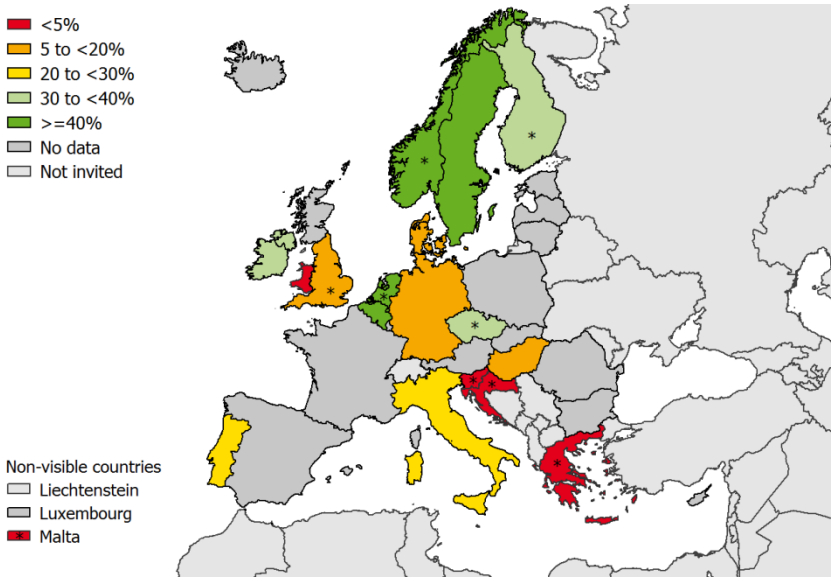
Table 12. Available written therapeutic antimicrobial guidelines and surveillance programmes in the included LTCFs, by country, HALT-2, 2013

	Written therapeutic guidelines				Surveillance programmes			
Country	Number of included LTCFs**	Respiratory tract infections %	Urinary tract infections %	Wound and soft tissue infections %	Number of included LTCFs**	Healthcare-associated infections %	Antimicrobial consumption %	Resistant micro-organisms %
Belgium	56	55.4	58.9	67.9	75	38.7	24.0	73.3
Croatia*	2	0.0	0.0	0.0	2	50.0	50.0	50.0
Czech Republic*	10	80.0	80.0	30.0	10	40.0	30.0	90.0
Denmark	32	6.3	15.6	43.8	30	6.7	0.0	10.0
Finland *	6	33.3	100	33.3	6	33.3	66.7	83.3
Germany	156	9.0	9.0	9.0	208	13.5	3.4	40.4
Greece*	2	50.0	50.0	0.0	2	50.0	50.0	50.0
Hungary	90	18.9	21.1	35.6	89	3.4	2.3	2.3
Ireland	131	34.4	43.5	43.5	135	37.0	21.5	48.2
Italy	218	33.9	45.0	42.2	228	30.7	26.3	30.3
Malta*	5	0.0	0.0	0.0	5	0.0	0.0	20.0
Netherlands*	4	100	100	75.0	4	50.0	0.0	0.0
Norway*	18	55.6	72.2	50.0	20	95.0	25.0	65.0
Portugal	64	35.9	43.8	37.5	67	49.3	31.3	20.9
Slovenia*	1	0.0	0.0	0.0	1	100	0.0	100
Sweden	39	53.9	53.9	53.9	40	37.5	2.5	57.5
UK – England*	15	6.7	6.7	6.7	15	6.7	6.7	6.7

Country	Written therapeutic guidelines				Surveillance programmes			
	Number of included LTCFs**	Respiratory tract infections	Urinary tract infections	Wound and soft tissue infections	Number of included LTCFs**	Healthcare-associated infections	Antimicrobial consumption	Resistant micro-organisms
		%	%	%		%	%	%
UK – Northern Ireland	28	42.9	39.3	50.0	28	35.7	32.1	39.3
UK – Wales	40	0.0	0.0	0.0	39	69.2	0.0	71.8
Total	**917**	**28.9**	**34.8**	**35.3**	**1 004**	**29.7**	**16.1**	**38.5**

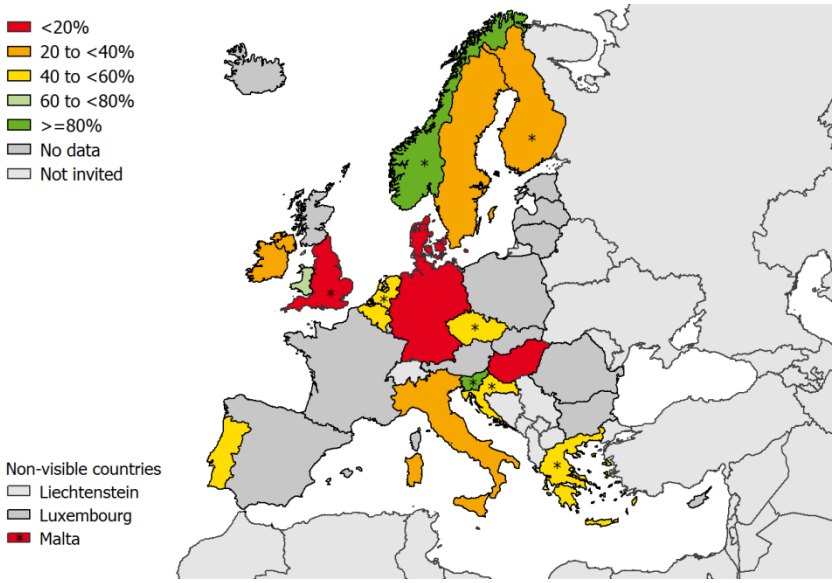
** Poor or very poor national representativeness of LTCF sample*
*** Excludes LTCFs with missing responses to all questions on therapeutic guidelines/surveillance programmes*

Figure 19. Percentage of the included LTCFs with written therapeutic guidelines for UTIs, RTIs and wound and soft tissue infections, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample*

Figure 20. Percentage of the included LTCFs with surveillance programmes for HAIs, HALT-2, 2013



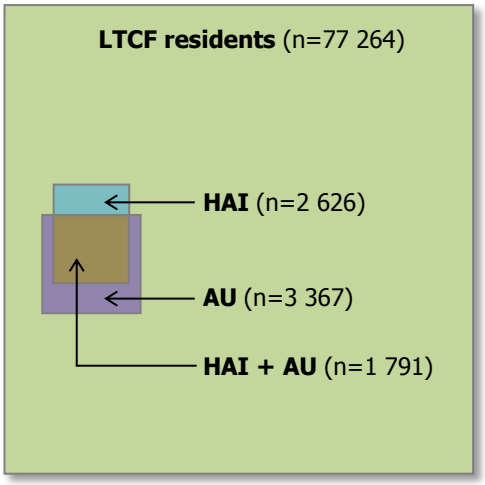
** Poor or very poor national representativeness of LTCF sample*

Healthcare-associated infections and antimicrobial use

Overview

On the day of the PPS, 2 626 (3.4%) of the 77 264 eligible residents had at least one healthcare-associated infection (HAI) and 3 367 residents (4.4%) received at least one antimicrobial agent. There were 1 791 residents (2.3%) with both an HAI and antimicrobial use, 1 576 residents (2.0%) with antimicrobial use but no HAI reported, and 835 (1.1%) with an HAI, but no antimicrobial use. In total, 4 202 residents (5.4%) were either receiving an antimicrobial or presenting with an HAI on the day of the PPS (Figure 21 and Table 13).

Figure 21. Proportionate Euler diagram of the number of residents receiving an antimicrobial and/or afflicted with healthcare-associated infection(s) within the eligible LTCF population (n=77 264 residents)



Note: Each box size is proportionate to the number of residents
HAI: healthcare-associated infection; AU: antimicrobial use.

Characteristics of residents receiving antimicrobial(s) and/or presenting with HAI(s)

Age and gender

While institution-level information was gathered on the percentage of residents older than 85 years (crude median: 49.1%), more detailed information (birth year) was only gathered for residents receiving antimicrobials and/or presenting with an HAI on the day of the PPS.

The overall median age of the residents with an HAI was comparable to the age of the residents receiving an antimicrobial (84 and 85 years, respectively). The overall age of residents was also similar between countries, although residents in Greece and Hungary were somewhat younger than the overall median (Table 13).

While the crude proportion of male residents in the total eligible population was 30.0% (n=23 221/77 390), the proportion with an HAI that were male was 33.7%, and the proportion of those receiving an antimicrobial that were male was 32.4% (Table 13).

Table 13. Age and gender of the LTCF residents presenting an HAI and of the LTCF residents receiving an antimicrobial, by country, HALT-2, 2013

Country	Residents with an HAI						Residents receiving an antimicrobial					
	Number of residents	% male	Age				Number of residents	% male	Age			
			Min	Mean	Median	Max			Min	Mean	Median	Max
Belgium	314	22.6	57.0	86.2	87.0	109.0	443	21.2	53	85.7	87	104
Croatia*	2	0.0	80.0	83.5	83.5	87.0	8	12.5	71	80.6	80	87
Czech Republic*	37	35.1	42.0	78.7	82.0	94.0	75	41.3	36	78.8	84	98
Denmark	43	30.2	58.0	83.2	84.0	99.0	143	26.6	48	84.1	86	100

Country	Residents with an HAI						Residents receiving an antimicrobial					
	Number of residents	% male	Age				Number of residents	% male	Age			
			Min	Mean	Median	Max			Min	Mean	Median	Max
Finland *	17	23.5	64.0	83.5	84.0	95.0	31	29	64	85.5	85	102
Germany	411	31.6	2.0	80.7	84.0	101.0	312	32.1	2	80.6	85	101
Greece*	10	60.0	35.0	66.9	67.5	82.0	23	47.8	19	64.9	71	93
Hungary	238	34.9	11.0	73.7	78.0	95.0	155	40	11	71.8	77	94
Ireland	400	35.3	4.0	81.8	83.0	101.0	734	35.4	4	80.8	83	103
Italy	613	35.9	20.0	83.4	85.0	102.0	725	35.4	20	83.3	85	101
Malta*	48	25.0	38.0	79.0	82.5	95.0	50	24	38	80.0	82	95
Netherlands*	36	38.9	59.0	83.1	85.0	97.0	38	31.6	39	81.2	85	97
Norway*	65	29.2	49.0	83.0	85.0	96.0	114	25.4	53	85.4	87	103
Portugal	163	47.9	36.0	75.8	80.0	99.0	133	44.4	29	74.5	80	98
Slovenia*	2	0.0	78.0	83.5	83.5	89.0	3	0	78	85.3	89	89
Sweden	40	42.5	28.0	83.5	87.0	100.0	39	30.8	50	84.0	88	94
UK – England*	28	42.9	20.0	84.1	85.0	103.0	37	40.5	20	85.1	87	103
UK – Northern Ireland	72	29.2	35.0	82.5	86.0	104.0	132	26.7	33	82.4	86	104
UK – Wales	87	36.8	43.0	85.3	88.0	102.0	172	30.8	26	83.9	86	104
Total	**2 626**	**33.7**	**2.0**	**81.5**	**84.0**	**109.0**	**3 367**	**32.4**	**2**	**81.8**	**85**	**104**

** Poor or very poor national representativeness of LTCF sample*

Care load indicators, risk factors, length of stay and recent hospitalisation

All studied care load indicators and risk factors were more frequently present in residents with an HAI and/or receiving antimicrobial(s) than in the population of eligible LTCF residents, while the percentages were similar between residents with HAI(s) and those receiving antimicrobial(s) (Figure 21 and Table 14).

Residents with an HAI and residents receiving an antimicrobial had similar lengths of stay: 39.6 % and 38.1%, respectively, had been in the facility for less than a year. The recent hospitalisation rate (i.e. in the three months preceding the PPS) was also similar (26.8% of all residents with HAI and 25.9% of all residents receiving antimicrobials) (Table 14).

Figure 21. Prevalence of care load indicators and risk factors among LTCF residents receiving an antimicrobial, among LTCF residents with an HAI and in the total eligible LTCF population, HALT-2, 2013

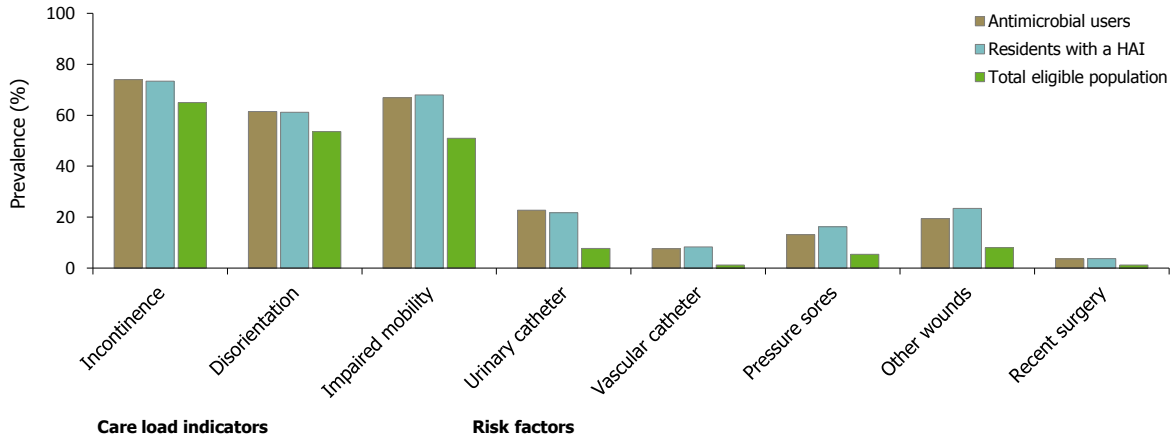


Table 14. Length of stay, recent hospitalisation, care load indicators and risk factors among LTCF residents with an HAI and among LTCF residents receiving an antimicrobial, by country, HALT-2, 2013

Country	Residents with an HAI										Residents receiving an antimicrobial									
			Care load			Risk factors							Care load			Risk factors				
	Length of stay (<1 year)	Recent hospitalisation (three months prior to PPS)	Incontinence (urine and/or faecal)	Disorientation (time and/or space)	Impaired mobility (wheelchair or bedridden)	Urinary catheter	Vascular catheter	Pressure sores	Other wounds	Recent surgery (<30 days prior to PPS)	Length of Stay (<1 year)	Recent hospitalisation (three months prior to PPS)	Incontinence (urine and/or faecal)	Disorientation (time and/or space)	Impaired mobility (wheelchair or bedridden)	Urinary catheter	Vascular catheter	Pressure sores	Other wounds	Recent surgery (<30 days prior to PPS)
	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
Belgium	27.8	17.8	67.5	58.3	59.5	6.7	0.0	7.6	16.2	3.5	25.3	16.6	68.0	58.2	59.6	9.0	0.0	7.2	16.5	3.2
Croatia*	0.0	0.0	100	50.0	100	50.0	0.0	0.0	0.0	0.0	37.5	25.0	75.0	37.5	62.5	12.5	0.0	0.0	0.0	0.0
Czech Republic*	94.6	83.8	83.8	54.1	89.2	67.6	35.1	37.8	37.8	13.5	94.7	88.0	81.3	60.0	90.7	68.0	21.3	37.3	29.3	9.3
Denmark	27.9	7.1	67.4	30.2	39.5	11.6	0.0	0.0	25.6	2.3	31.5	17.6	73.4	49.0	51.1	23.1	0.0	2.8	16.8	1.4
Finland *	41.2	8.3	100	82.4	76.5	17.7	0.0	29.4	35.3	0.0	35.5	8.0	96.8	83.9	80.7	19.4	0.0	12.9	12.9	0.0
Germany	28.8	29.4	72.8	55.9	64.3	23.7	1.5	12.0	29.8	4.6	31.3	30.9	74.7	53.9	63.5	27.7	1.0	7.2	24.4	3.9
Greece*	90.0	50.0	80.0	70.0	90.0	70.0	60.0	30.0	60.0	20.0	95.7	39.1	78.3	56.5	87.0	43.5	47.8	17.4	39.1	17.4
Hungary	33.2	26.5	63.9	42.4	68.5	8.4	2.1	18.1	24.0	4.2	30.3	28.4	61.3	37.4	63.2	13.6	3.9	11.6	14.2	5.8
Ireland	34.5	25.2	64.8	64.8	55.3	10.0	2.5	7.3	25.3	2.0	30.9	20.4	67.4	62.0	58.5	13.2	1.8	6.0	21.6	1.8
Italy	45.7	26.6	84.3	71.6	82.3	36.5	26.0	26.9	20.7	3.6	46.3	29.4	83.3	68.7	82.7	37.3	24.9	27.6	20.2	4.7
Malta*	22.9	18.8	77.1	52.1	64.6	20.8	10.4	14.6	14.6	6.3	28.0	22.0	76.0	50.0	62.0	26.0	14.0	14.0	18.0	10.0
Netherlands*	58.3	27.8	61.1	42.9	63.9	22.2	0.0	11.1	22.2	8.3	54.1	39.5	57.9	50.0	63.2	23.7	0.0	10.5	29.0	13.2
Norway*	58.5	32.8	52.3	48.4	46.9	28.1	7.8	14.5	37.5	6.3	48.7	28.2	69.3	68.8	45.5	19.5	7.3	7.1	17.7	4.5
Portugal	72.4	32.1	86.5	66.3	87.7	36.8	4.9	30.1	24.7	3.1	72.9	34.4	82.7	65.4	91.7	34.6	8.3	26.3	21.2	2.3
Slovenia*	50.0	50.0	100	50.0	100	0.0	0.0	0.0	0.0	0.0	33.3	33.3	0.0	33.3	66.7	0.0	0.0	0.0	0.0	0.0
Sweden	40.0	30.0	65.0	67.5	45.0	12.5	0.0	10	22.5	2.5	41.0	30.8	64.1	52.6	61.5	12.8	0.0	10.3	23.1	5.1
UK – England*	28.6	32.1	67.9	46.4	25.0	17.9	0.0	10.7	10.7	0.0	24.3	36.1	67.6	48.7	29.7	18.9	0.0	10.8	16.2	0.0
UK – Northern Ireland	31.0	31.0	73.6	72.1	65.7	13.9	1.4	18.8	23.5	4.2	26.0	17.6	78.0	69.3	68.5	12.2	0.8	10.1	14.1	3.8
UK – Wales	44.8	23.0	77.0	78.2	59.8	11.5	0.0	3.5	12.6	0.0	36.6	20.4	80.2	78.5	67.4	16.9	0.0	5.2	9.9	1.2
Total	**39.6**	**26.8**	**73.4**	**61.2**	**68.0**	**21.7**	**8.3**	**16.2**	**23.4**	**3.7**	**38.1**	**25.9**	**74.0**	**61.5**	**66.9**	**22.7**	**7.6**	**13.1**	**19.4**	**3.6**

** Poor or very poor national representativeness of LTCF sample*

Healthcare-associated infections

Prevalence of HAIs

On the day of the PPS, 2 626 residents among the 77 264 eligible residents were reported to have at least one HAI, i.e. the crude prevalence of eligible residents with at least one HAI on the day of the PPS was 3.4%. Of those, 2 517 residents (95.9%) had one HAI, 96 (3.7%) had two HAIs, and 13 residents (0.5%) suffered from three or more. In total 2 753 infections were reported. Of all residents with an HAI, 68.2% received at least one antimicrobial on the PPS day.

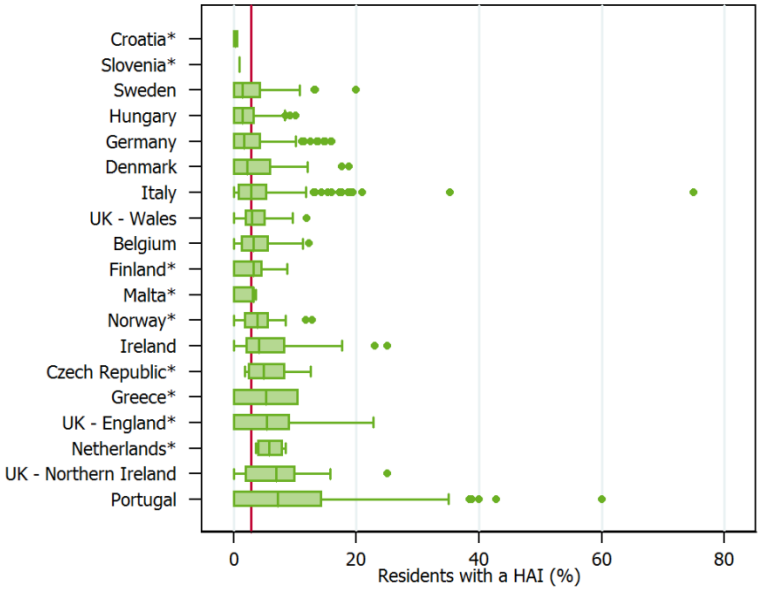
At country level, the crude prevalence of patients with at least one HAI in LTCFs ranged from 0.4% in Croatia to 9.5% in Portugal (Table 15). The median prevalence in LTCFs ranged from 0.4% in Croatia to 7.1% in Portugal (Figure 22). The largest reported prevalence (75.0%) was reported for a very small Italian LTCF with only four eligible residents. Overall, 273 institutions reported no residents with a confirmed HAI (0% HAI prevalence). All countries with good representativeness of their LTCF sample had at least one LTCF reporting no HAIs (Table 15).

Table 15. Number and prevalence of LTCF residents with at least one HAI on the day of survey, by country, HALT-2, 2013

Country	Number of eligible residents	Number of included LTCFs	Number of residents with HAI	Prevalence (%) of residents with at least one HAI					
				HAI%	Min	P25	Median	P75	Max
Belgium	8 756	87	314	3.6	0.0	1.4	3.2	5.7	12.3
Croatia*	447	2	2	0.4	0.0	0.0	0.4	0.7	0.7
Czech Republic*	662	10	37	5.6	1.9	2.5	4.9	8.3	12.5
Denmark	1 265	32	43	3.4	0.0	0.0	2.3	6.0	18.8
Finland *	467	6	17	3.6	0.0	0.0	3.2	4.7	8.8
Germany	16 768	215	411	2.5	0.0	0.0	1.7	4.3	16.0
Greece*	309	2	10	3.2	0.0	0.0	5.3	10.5	10.5
Hungary	11 824	90	238	2.0	0.0	0.0	1.5	3.3	10.1
Ireland	7 535	142	400	5.3	0.0	2.1	4.2	8.3	25.0
Italy	18 371	234	613	3.3	0.0	0.8	2.8	5.4	75.0
Malta*	1 558	5	48	3.1	0.0	0.0	3.3	3.3	3.6
Netherlands*	623	4	36	5.8	3.7	3.9	5.8	7.9	8.5
Norway*	1 374	21	65	4.7	0.0	1.9	3.8	5.6	12.8
Portugal	1 717	73	163	9.5	0.0	0.0	7.1	14.3	60.0
Slovenia*	202	1	2	1.0	1.0	1.0	1.0	1.0	1.0
Sweden	1 432	40	40	2.8	0.0	0.0	1.4	4.4	20.0
UK – England*	409	16	28	6.8	0.0	0.0	5.4	9.1	22.7
UK – Northern Ireland	1 243	31	72	5.8	0.0	2.0	6.9	10.0	25.0
UK – Wales	2 302	40	87	3.8	0.0	2.0	3.0	5.1	11.9
Total	**77 264**	**1 051**	**2 626**	**3.4**	**0.0**	**0.0**	**2.8**	**40.0**	**75.0**

** Poor or very poor national representativeness of LTCF sample*
HAI%: crude HAI prevalence, i.e. ((eligible residents with at least one HAI on the day of the PPS)/(eligible residents)) x 100

Figure 22. Prevalence of eligible LTCF residents with at least one HAI, by country, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample*
Red vertical line: crude median (2.8%)
Box plots indicate the 25th, 50th (median) and 75th percentiles; adjacent lines indicate the boundary 1.5x the interquartile range.

Types of HAI

The infection types most frequently present on the day of the PPS were RTIs (n=857; 31.2%), UTIs (n=856; 31.2%) and skin infections (n=629; 22.8%) (Figure 23 and Table 16).

RTIs were mainly lower RTIs other than pneumonia (n=505), common colds/pharyngitis (n=247), pneumonia (n=71) and flu (n=34).

Most UTIs were classified as 'probable infections' (n=580; 67.8%) as although sufficient signs/symptoms of a UTI were present there was no corresponding microbiological confirmation (i.e. negative culture, unknown results, or no culture taken). In 32.2% of all UTI cases, the infections were confirmed as per case definition.

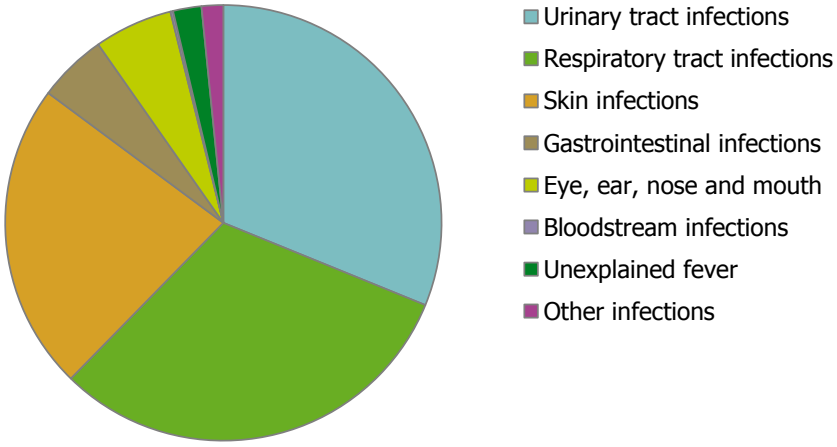
Skin infections were primarily 'cellulitis, soft tissue or wound infections' (n=550; 87.4%). The other skin infections were fungal infections (8.3%), herpes simplex or herpes zoster infections (n=15; 2.4%) and scabies (n=12; 1.9%).

'Eye, ear, nose and mouth infections' were the fourth largest infection group. These included eye infections (n=126; 78.3% of this group), ear infections (n=17; 10.6%), oral candidiasis (n=13; 8.1%) and sinusitis (n=5; 3.1%).

Gastrointestinal infections (GIs) represented 5.1% of all HAIs. Most cases were gastroenteritis (n=116; 82.3% of all GIs), or caused by *Clostridium difficile* (n=25, 17.7%). In the six countries reporting 10 GIs or more, the percentage of *C. difficile* infections among all GIs ranged from 0% in Portugal and 12.1% in Italy to 18.2% in Ireland and 20.6% in Germany.

The remaining infection groups were bloodstream infections (0.2% of all HAIs), unexplained cases of fever (n=59, 2.1%) and other infections (n=44; 1.6%). This latter group consisted mainly of genital infections, 'dental infections not classified under mouth infections' and bone infections.

Figure 23. Distribution of types of HAI in the included LTCFs, HALT-2, 2013



Overall, the three most commonly reported infections were UTIs (31.1% (probable: 21.1%, confirmed: 10.0%)), followed by 'cellulitis, soft tissue or wound infections' (20.0%) and 'lower RTIs other than pneumonia' (18.3%). These infections were closely followed by common colds/pharyngitis (9.0%), eye infections (4.6%) and gastroenteritis (4.2%). Detailed information of the distribution of these HAI types by country is presented in Table 16.

Table 16. Distribution of types of HAI (number and relative frequency) in the included LTCFs, by country, HALT-2, 2013

	All countries		Belgium		Croatia**		Czech Republic**		Denmark		Finland**		Germany		Greece**		Hungary		Ireland	
Types of HAI	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
All types of HAI	**2 753**	**100**	325	100	2	100	40	100	46	100	17	100	425	100	12	100	252	100	410	100
Urinary tract infections (UTIs)	**856**		111		2		12		16		3		127		3		55		132	
Confirmed UTIs	**276**	**10.0**	57	17.5	0	0.0	3	7.5	5	10.9	2	11.8	11	2.6	1	8.3	3	1.2	42	10.2
Probable UTIs	**580**	**21.1**	54	16.6	2	100	9	22.5	11	23.9	1	5.9	116	27.3	2	16.7	52	20.6	90	22.0
Respiratory tract infections (RTIs)	**857**		119		0		13		4		2		95		4		72		139	
Common cold/pharyngitis	**247**	**9.0**	35	10.8	0	0.0	1	2.5	3	6.5	0	0.0	58	13.6	0	0.0	37	14.7	27	6.6
'Flu'*	**34**	**1.2**	5	1.5	0	0.0	0	0.0	0	0.0	0	0.0	5	1.2	0	0.0	4	1.6	3	0.7
Pneumonia	**71**	**2.6**	10	3.1	0	0.0	4	10.0	1	2.2	0	0.0	5	1.2	2	16.7	8	3.2	10	2.4
Other lower RTIs	**505**	**18.3**	69	21.2	0	0.0	8	20.0	0	0.0	2	11.8	27	6.4	2	16.7	23	9.1	99	24.1
Skin infections	**629**		45		0		10		21		8		122		4		92		93	
Cellulitis/soft tissue/ wound infection	**550**	**20.0**	43	13.2	0	0.0	8	20.0	14	30.4	8	47.1	105	24.7	4	33.3	74	29.4	87	21.2
Herpes simplex or zoster infections	**15**	**0.5**	1	0.3	0	0.0	0	0.0	0	0.0	0	0.0	5	1.2	0	0.0	1	0.4	3	0.7
Fungal infections	**52**	**1.9**	1	0.3	0	0.0	2	5.0	7	15.2	0	0.0	12	2.8	0	0.0	5	2.0	3	0.7
Scabies	**12**	**0.4**	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	12	4.8	0	0.0
Gastrointestinal infections	**141**		20		0		2		1		0		34		0		18		11	
Gastroenteritis	**116**	**4.2**	17	5.2	0	0.0	0	0.0	0	0.0	0	0.0	27	6.4	0	0.0	15	6.0	9	2.2
Clostridium difficile infection	**25**	**0.9**	3	0.9	0	0.0	2	5.0	1	2.2	0	0.0	7	1.6	0	0.0	3	1.2	2	0.5
Eye, ear, nose and mouth infections	**161**		15		0		0		3		3		38		0		11		22	
Conjunctivitis	**126**	**4.6**	10	3.1	0	0.0	0	0.0	3	6.5	1	5.9	33	7.8	0	0.0	10	4.0	17	4.1
Ear infections	**17**	**0.6**	3	0.9	0	0.0	0	0.0	0	0.0	2	11.8	3	0.7	0	0.0	1	0.4	2	0.5
Sinusitis	**5**	**0.2**	1	0.3	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0	1	0.2
Oral candidiasis	**13**	**0.5**	1	0.3	0	0.0	0	0.0	0	0.0	0	0.0	1	0.2	0	0.0	0	0.0	2	0.5

	All countries		Belgium		Croatia**		Czech Republic**		Denmark		Finland**		Germany		Greece**		Hungary		Ireland	
Types of HAI	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Bloodstream infections	**6**	**0.2**	1	0.3	0	0.0	1	2.5	0	0.0	0	0.0	0	0.0	1	8.3	0	0.0	0	0.0
Unexplained fever	**59**	**2.1**	9	2.8	0	0.0	0	0.0	1	2.2	1	5.9	7	1.6	0	0.0	2	0.8	3	0.7
Other infections	**44**	**1.6**	5	1.5	0	0.0	2	5.0	0	0.0	0	0.0	2	0.5	0	0.0	2	0.8	10	2.4

** In HALT-2, 'flu' was defined as fever – a) single >37.8 °C oral/tympanic membrane OR b) repeated >37.2 °C oral OR >37.5 °C rectal OR c) >1.1 °C above baseline from any site – and at least three of the following symptoms: chills, new headache or eye pain, myalgia or body aches, malaise or loss of appetite, sore throat, or new/increased dry cough.*
*** Poor or very poor national representativeness of LTCF sample*

Table 16. Distribution of types of HAI (number and relative frequency) in the included LTCFs, by country, HALT-2, 2013 (continued)

	Italy		Malta**		Netherlands**		Norway**		Portugal		Slovenia**		Sweden		UK – England**		UK – Northern Ireland		UK – Wales	
Types of HAI	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
All types of HAI	652	100	48	100	37	100	71	100	180	100	2	100	41	100	28	100	78	100	87	100
Urinary tract infections (UTIs)	193		10		13		27		63		0		11		10		34		34	
Confirmed UTIs	89	13.7	4	8.3	4	10.8	10	14.1	28	15.6	0	0.0	6	14.6	0	0.0	8	10.3	3	3.4
Probable UTIs	104	16.0	6	12.5	9	24.3	17	23.9	35	19.4	0	0.0	5	12.2	10	35.7	26	33.3	31	35.6
Respiratory tract infections (RTIs)	242		19		13		15		34		2		15		11		20		38	
Common cold/pharyngitis	50	7.7	5	10.4	0	0.0	1	1.4	6	3.3	0	0.0	10	24.4	3	10.7	5	6.4	6	6.9
'Flu' *	13	2.0	0	0.0	0	0.0	0	0.0	1	0.6	0	0.0	2	4.9	0	0.0	1	1.3	0	0.0
Pneumonia	24	3.7	0	0.0	0	0.0	6	8.5	1	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Other lower RTIs	155	23.8	14	29.2	13	35.1	8	11.3	26	14.4	2	100	3	7.3	8	28.6	14	17.9	32	36.8
Skin infections	106		13		10		18		52		0		5		3		19		8	
Cellulitis/soft tissue/wound infection	92	14.1	12	25.0	6	16.2	18	25.4	48	26.7	0	0.0	5	12.2	1	3.6	17	21.8	8	9.2
Herpes simplex or zoster infections	4	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.3	0	0.0
Fungal infections	10	1.5	1	2.1	4	10.8	0	0.0	4	2.2	0	0.0	0	0.0	2	7.1	1	1.3	0	0.0
Scabies	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Gastrointestinal infections	33		1		0	0	4		10		0		5		0		1		1	
Gastroenteritis	29	4.4	1	2.1	0	0.0	2	2.8	10	5.6	0	0.0	5	12.2	0	0.0	1	1.3	0	0.0
Clostridium difficile infection	4	0.6	0	0.0	0	0.0	2	2.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	1.1
Eye, ear, nose and mouth infections	31		4		1		6		16		0		4		1		2		4	
Conjunctivitis	24	3.7	3	6.3	1	2.7	4	5.6	12	6.7	0	0.0	2	4.9	0	0.0	2	2.6	4	4.6
Ear infections	4	0.6	0	0.0	0	0.0	1	1.4	1	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Sinusitis	1	0.2	0	0.0	0	0.0	0	0.0	1	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Oral candidiasis	2	0.3	1	2.1	0	0.0	1	1.4	2	1.1	0	0.0	2	4.9	1	3.6	0	0.0	0	0.0
Bloodstream infections	3	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Unexplained fever	30	4.6	0	0.0	0	0.0	0	0.0	5	2.8	0	0.0	1	2.4	0	0.0	0	0.0	0	0.0
Other infections	14	2.1	1	2.1	0	0.0	1	1.4	0	0.0	0	0.0	0	0.0	3	10.7	2	2.6	2	2.3

** In HALT-2, 'flu' was defined as fever – a) single >37.8 °C oral/tympanic membrane OR b) repeated >37.2 °C oral OR >37.5 °C rectal OR c) >1.1 °C above baseline from any site – and at least three of the following symptoms: chills, new headache or eye pain, myalgia or body aches, malaise or loss of appetite, sore throat, or new/increased dry cough.*
*** Poor or very poor national representativeness of LTCF sample*

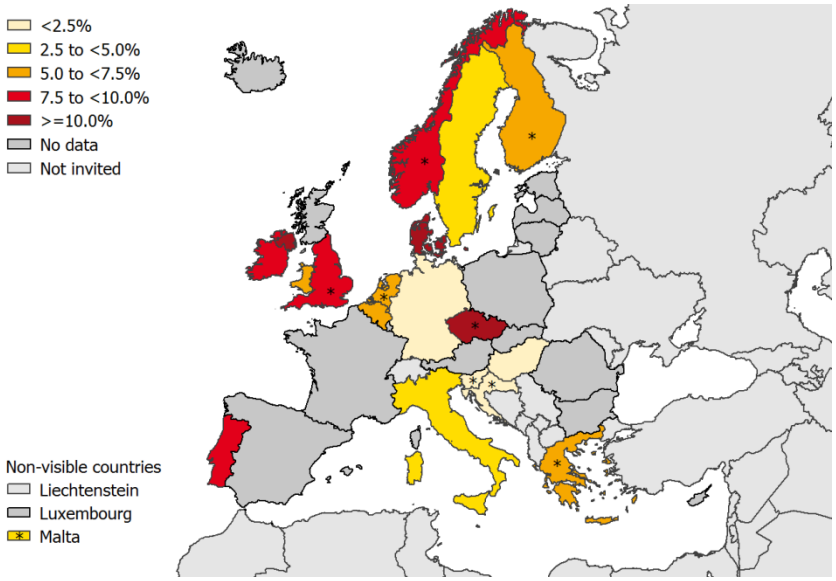
Antimicrobial use

Prevalence of antimicrobial use

On the day of the PPS, 3 367 out of 77 264 eligible LTCF residents received at least one antimicrobial agent (crude prevalence: 4.4%). Of these 3 367 residents, 94.5% received one antimicrobial and 5.2% received two agents. Eight residents received three antimicrobials; one resident received four. In total, 3 561 antimicrobials were administered on the survey day.

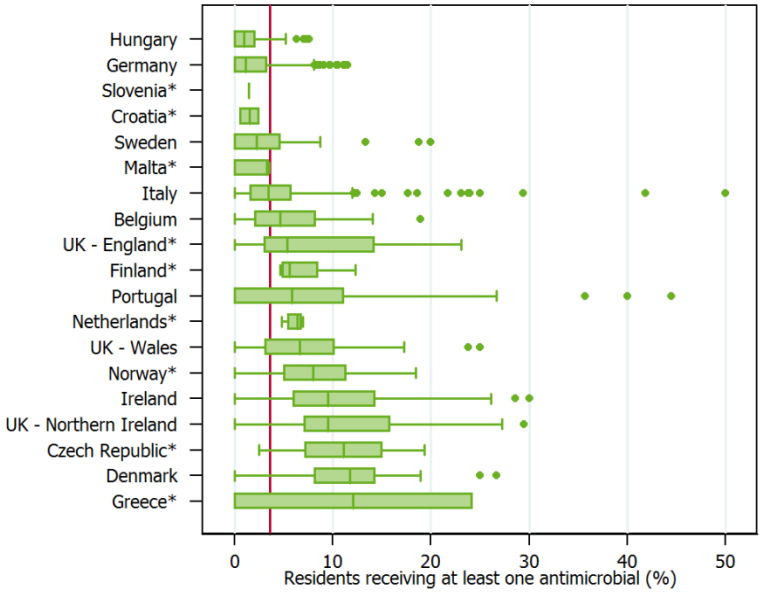
The crude prevalence of antimicrobial use varied between less than 2% in Croatia, Germany, Hungary and Croatia to more than 10% in the Czech Republic, Denmark and UK – Northern Ireland (Figure 24 and Table 17). The overall median prevalence in LTCFs for residents receiving at least one antimicrobial was 3.6%, varying between 1.0% in Hungary to 12.1% in Greece (Figure 25 and Table 17). There were 212 LTCFs (20.2%) that reported that no residents received an antimicrobial on the survey day (0% prevalence).

Figure 24. Prevalence of eligible LTCF residents receiving at least one antimicrobial agent on the day of the PPS, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample*

Figure 25. Prevalence of eligible LTCF residents receiving at least one antimicrobial agent, by country, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample*
Red vertical line: crude median (3.6%)
Box plots indicate the 25th, 50th (median) and 75th percentiles; adjacent lines indicate the boundary 1.5x the interquartile range.

Table 17. Number and prevalence of eligible LTCF residents receiving at least one antimicrobial agent on the day of the PPS, by country, HALT-2, 2013

Country	Number of eligible residents	Number of included LTCFs	Number of residents with antimicrobial use	Number of antimicrobials	Prevalence (%) of residents receiving at least one antimicrobial agent					
					Prev AU%	Min	P25	Median	P75	Max
Belgium	8 756	87	443	455	5.1	0.0	2.1	4.7	8.2	19.0
Croatia*	447	2	8	8	1.8	0.6	0.6	1.5	2.5	2.5
Czech Republic*	662	10	75	79	11.3	2.5	7.2	11.1	15.1	19.3
Denmark	1 265	32	143	150	11.3	0.0	8.2	11.8	14.3	26.7
Finland*	467	6	31	31	6.6	4.7	4.9	5.6	8.5	12.3
Germany	16 768	215	312	322	1.9	0.0	0.0	1.1	3.3	11.5
Greece*	309	2	23	32	7.4	0.0	0.0	12.1	24.2	24.2
Hungary	11 824	90	155	159	1.3	0.0	0.0	1.0	2.1	7.6
Ireland	7 535	142	734	777	9.7	0.0	6.0	9.5	14.3	30.0
Italy	18 371	234	725	772	3.9	0.0	1.7	3.4	5.8	50.0
Malta*	1 558	5	50	64	3.2	0.0	0.0	3.3	3.5	3.6
Netherlands*	623	4	38	41	6.1	4.8	5.5	6.4	6.8	7.0
Norway*	1 374	21	114	123	8.3	0.0	5.1	8.0	11.4	18.4
Portugal	1 717	73	133	149	7.7	0.0	0.0	5.9	11.1	44.4
Slovenia*	202	1	3	3	1.5	1.5	1.5	1.5	1.5	1.5
Sweden	1 432	40	39	41	2.7	0.0	0.0	2.3	4.7	20.0
UK – England*	409	16	37	38	9.0	0.0	3.0	5.4	14.2	23.1
UK – Northern Ireland	1 243	31	132	135	10.6	0.0	7.1	9.5	15.8	29.5
UK – Wales	2 302	40	172	182	7.5	0.0	3.1	6.7	10.1	25.0
Total	**77 264**	**1 051**	**3 367**	**3 561**	**4.4**	**0.0**	**0.0**	**3.6**	**40.0**	**50.0**

** Poor or very poor national representativeness of LTCF sample*
Prev AU%: crude antimicrobial use prevalence, i.e. ((eligible residents with at least one antimicrobial on the day of the PPS)/(eligible residents)) x 100

Characteristics and indications for antimicrobial prescribing

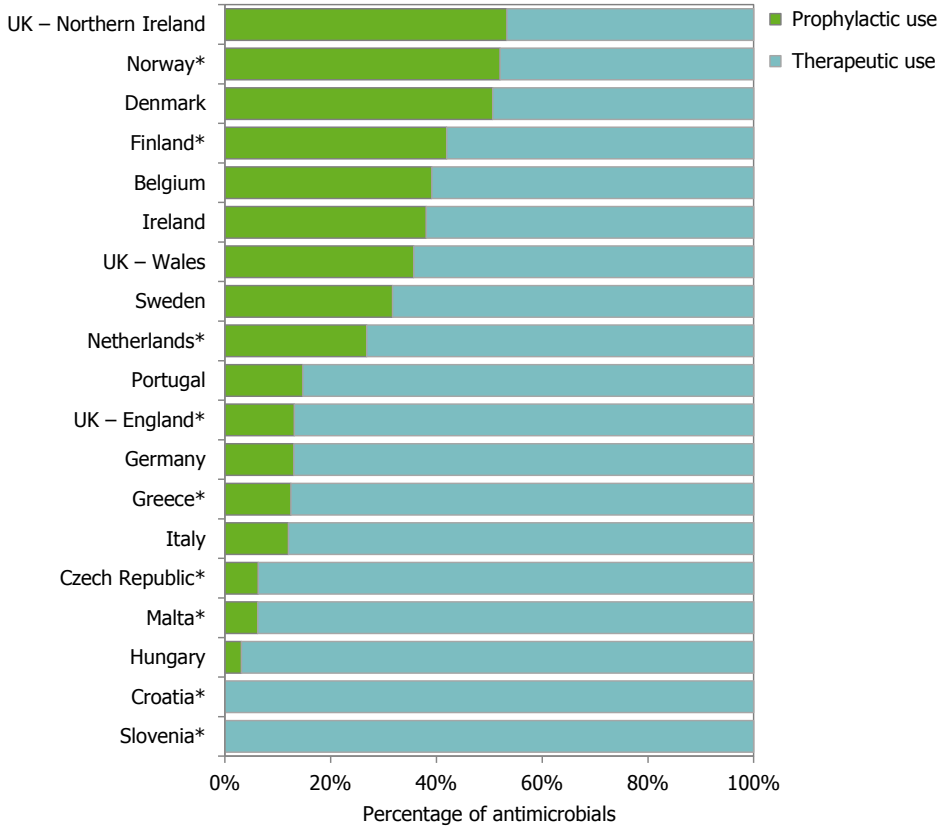
On the survey day, 3 561 antimicrobial agents were prescribed. These were mainly administered orally (87.3%); a parenteral route (intramuscular or intravenous) was used in 11.6% prescriptions, and 'other administration route' (e.g. inhalation, rectal) was reported for 1.1% (n=39), but misclassifications or erroneous reporting of local antimicrobial use cannot be ruled out for this group.

Antimicrobials were mainly prescribed in the LTCF itself (84.6% of 3 529), 11.0% were prescribed in the hospital, and 4.1% elsewhere. They were primarily prescribed by general practitioners (54.0% of 3 517) and medical doctors (32.2%) employed by the LTCF, and otherwise by a specialist (12.0%), or another person such as a pharmacist or nurse (1.9%).

Antimicrobials were most frequently prescribed for the treatment of an infection (72.8%); the remaining antimicrobials were prescribed for prophylactic use (27.2%) (Figure 26). The percentage of antimicrobials prescribed for prophylaxis was highest in UK – Northern Ireland (53.3%), Norway (52.0%) and Denmark (50.7%). Croatia and Slovenia only reported therapeutic, and not prophylactic, prescriptions (Figure 26).

The end date for antimicrobial use was documented in the residents' records for the majority of prescriptions (67.1%), more so for therapeutic prescriptions (84.6%), but only for 20.5% of prophylactic prescriptions.

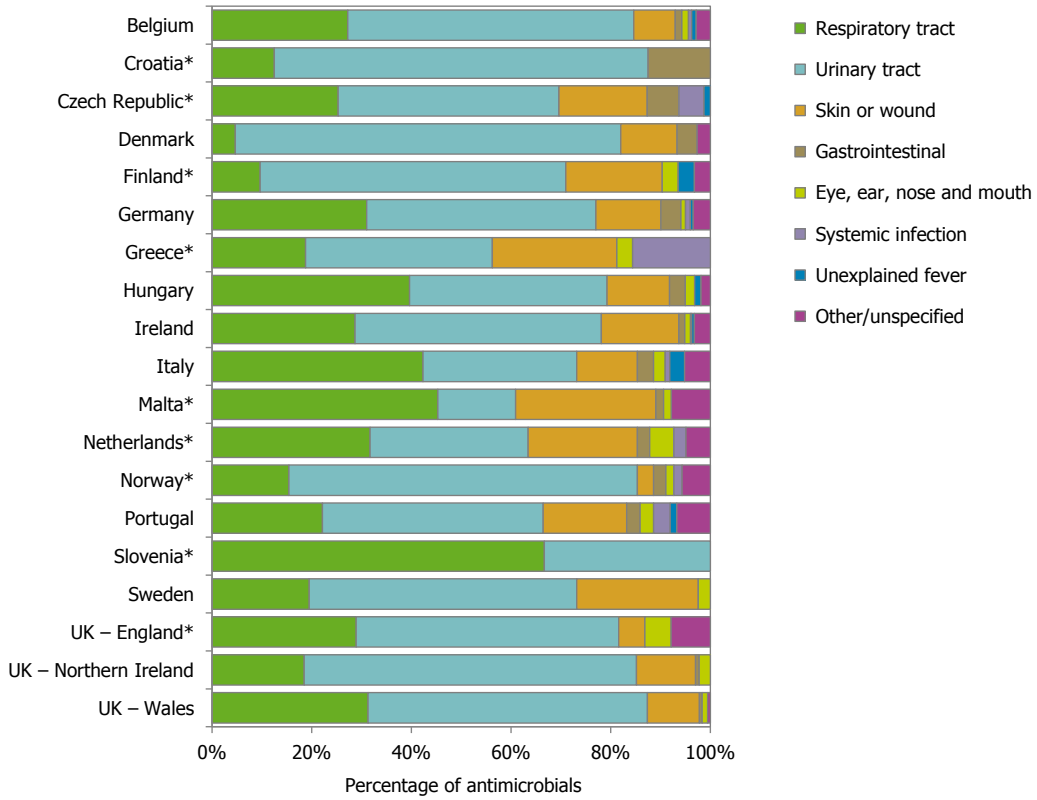
Figure 26. Indication for antimicrobial use, by country, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample*

Antimicrobials were most frequently prescribed for prophylaxis or treatment of a UTI (47.5%) or of a RTI (30.1%). Skin or wound infections were the third most commonly reported indication (13.0%), followed by 'other infection' (2.8%) and gastrointestinal infections (2.3%) (Figure 27 and Table 18).

Figure 27. Site of diagnosis for antimicrobial use, by country, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample*

Table 18. Indications for antimicrobial prescribing in the included LTCFs, by country, HALT-2, 2013

Indication and site of diagnosis	All countries		Belgium		Croatia*		Czech Republic*		Denmark		Finland*		Germany		Greece*		Hungary		Ireland	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Prophylactic prescriptions	**968**	**27.2**	178	39.1	0	0.0	5	6.3	76	50.7	13	41.9	42	13.0	4	12.5	5	3.1	296	38.1
Urinary tract	**783**	**80.9**	162	91.0	0	0.0	4	80.0	67	88.2	13	100	31	73.8	1	25.0	3	60.0	241	81.4
Genital tract	**3**	**0.3**	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.4	0	0.0	0	0.0	0	0.0
Skin or wound	**47**	**4.9**	3	1.7	0	0.0	1	20.0	2	2.6	0	0.0	4	9.5	1	25.0	0	0.0	20	6.8
Respiratory tract	**60**	**6.2**	7	3.9	0	0.0	0	0.0	0	0.0	0	0.0	1	2.4	0	0.0	0	0.0	27	9.1
Gastrointestinal	**10**	**1.0**	0	0.0	0	0.0	0	0.0	5	6.6	0	0.0	2	4.8	0	0.0	0	0.0	0	0.0
Eye	**0**	**0.0**	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Ear, nose, mouth	**9**	**0.9**	1	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	25.0	2	40.0	4	1.4
Systemic infection	**5**	**0.5**	1	0.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	25.0	0	0.0	0	0.0
Unexplained fever	**5**	**0.5**	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.3
Other	**46**	**4.8**	4	2.2	0	0.0	0	0.0	2	2.6	0	0.0	3	7.1	0	0.0	0	0.0	3	1.0
Treatment	**2 593**	**72.8**	277	60.9	8	100	74	93.7	74	49.3	18	58.1	280	87.0	28	87.5	154	96.9	481	61.9
Urinary tract	**909**	**35.1**	99	35.7	6	75.0	31	41.9	49	66.2	6	33.3	117	41.8	11	39.3	60	39.0	143	29.7
Genital tract	**22**	**0.9**	3	1.1	0	0.0	0	0.0	0	0.0	0	0.0	3	1.1	0	0.0	0	0.0	7	1.5
Skin or wound	**416**	**16.0**	35	12.6	0	0.0	13	17.6	15	20.3	6	33.3	38	13.6	7	25.0	20	13.0	101	21.0
Respiratory tract	**1 011**	**39.0**	117	42.2	1	12.5	20	27.0	7	9.5	3	16.7	99	35.4	6	21.4	63	40.9	196	40.7
Gastrointestinal	**71**	**2.7**	6	2.2	1	12.5	5	6.8	1	1.4	0	0.0	11	3.9	0	0.0	5	3.2	9	1.9
Eye	**10**	**0.4**	1	0.4	0	0.0	0	0.0	0	0.0	0	0.0	1	0.4	0	0.0	0	0.0	1	0.2
Ear, nose, mouth	**39**	**1.5**	4	1.4	0	0.0	0	0.0	0	0.0	1	5.6	2	0.7	0	0.0	1	0.6	4	0.8
Systemic infection	**27**	**1.0**	2	0.7	0	0.0	4	5.4	0	0.0	0	0.0	3	1.1	4	14.3	0	0.0	2	0.4
Unexplained fever	**34**	**1.3**	4	1.4	0	0.0	1	1.4	0	0.0	1	5.6	2	0.7	0	0.0	2	1.3	3	0.6
Other	**54**	**2.1**	6	2.2	0	0.0	0	0.0	2	2.7	1	5.6	4	1.4	0	0.0	3	1.9	15	3.1

** Poor or very poor national representativeness of LTCF sample*

Table 18. Indications for antimicrobial prescribing in the included LTCFs, by country, HALT-2, 2013 (continued)

Indication and site of diagnosis	Italy		Malta*		Netherlands*		Norway*		Portugal		Slovenia*		Sweden		UK – England*		UK – Northern Ireland		UK – Wales	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Prophylactic prescriptions	93	12.0	4	6.3	11	26.8	64	52.0	22	14.8	0	0.0	13	31.7	5	13.2	72	53.3	65	35.7
Urinary tract	47	50.5	0	0.0	5	45.5	61	95.3	6	27.3	0	0.0	11	84.6	5	100	67	93.1	59	90.8
Genital tract	2	2.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Skin or wound	10	10.8	0	0.0	1	9.1	0	0.0	0	0.0	0	0.0	1	7.7	0	0.0	1	1.4	3	4.6
Respiratory tract	8	8.6	0	0.0	3	27.3	1	1.6	5	22.7	0	0.0	1	7.7	0	0.0	4	5.6	3	4.6
Gastrointestinal	1	1.1	0	0.0	1	9.1	0	0.0	1	4.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Eye	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Ear, nose, mouth	1	1.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Systemic infection	1	1.1	0	0.0	0	0.0	0	0.0	2	9.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Unexplained fever	4	4.3	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Other	19	20.4	4	100	1	9.1	2	3.1	8	36.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Treatment	679	88.0	60	93.8	30	73.2	59	48.0	127	85.2	3	100	28	68.3	33	86.8	63	46.7	117	64.3
Urinary tract	191	28.1	10	16.7	8	26.7	25	42.4	60	47.2	1	33.3	11	39.3	15	45.5	23	36.5	43	36.8
Genital tract	5	0.7	1	1.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	9.1	0	0.0	0	0.0
Skin or wound	84	12.4	18	30.0	8	26.7	4	6.8	25	19.7	0	0.0	9	32.1	2	6.1	15	23.8	16	13.7
Respiratory tract	319	47.0	29	48.3	10	33.3	18	30.5	28	22.0	2	66.7	7	25.0	11	33.3	21	33.3	54	46.2
Gastrointestinal	24	3.5	1	1.7	0	0.0	3	5.1	3	2.4	0	0.0	0	0.0	0	0.0	1	1.6	1	0.9
Eye	2	0.3	0	0.0	1	3.3	0	0.0	2	1.6	0	0.0	0	0.0	0	0.0	1	1.6	1	0.9
Ear, nose, mouth	15	2.2	1	1.7	1	3.3	2	3.4	2	1.6	0	0.0	1	3.6	2	6.1	2	3.2	1	0.9
Systemic infection	6	0.9	0	0.0	1	3.3	2	3.4	3	2.4	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Unexplained fever	19	2.8	0	0.0	0	0.0	0	0.0	2	1.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Other	14	2.1	0	0.0	1	3.3	5	8.5	2	1.6	0	0.0	0	0.0	0	0.0	0	0.0	1	0.9

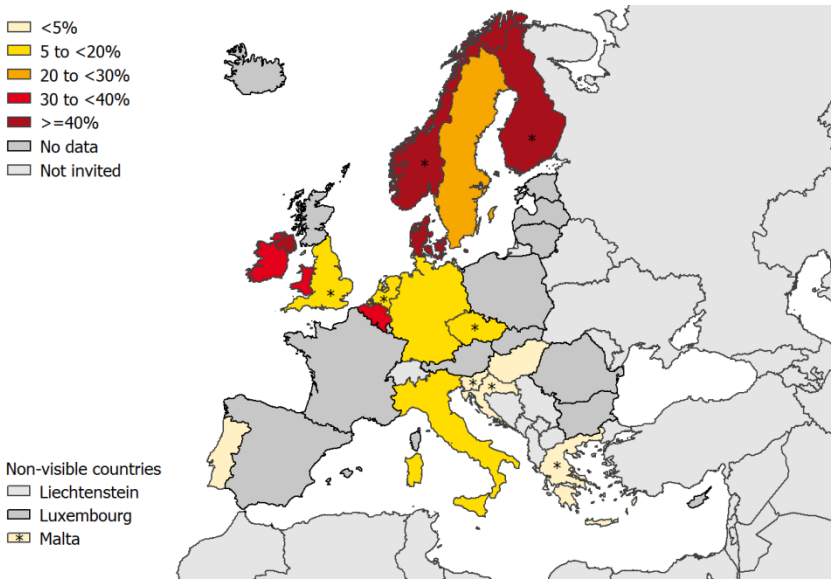
** Poor or very poor national representativeness of LTCF sample*

UTIs were the main indication for antimicrobial use in 14 countries. UTIs and RTIs were both the main indications for antimicrobial use in Hungary (n=63 of 159 for both) and in the Netherlands (n=13 of 41 for both). In Italia and Slovenia, RTIs were the most frequently reported indication (n=327 of 772 and n=2 of 3, respectively). In Malta, the main indications were RTIs (n=29 of 64) and skin or wound infections (n=18 of 64) (Figure 27 and Table 18).

The majority of the prophylactic prescriptions were for the prevention of UTIs (n=2 593 of 3 561, 80.9%, Figure 28). Uroprophylaxis accounted for 22.0% of all antimicrobial use, but this percentage varied greatly between countries. No uroprophylaxis was reported by Croatia, Malta and Slovenia, while the percentage of prescriptions for uroprophylaxis was above 30% in Belgium, Denmark, Finland, Ireland, Norway, Sweden, UK – Northern Ireland and UK – Wales (Table 18 and Figure 28).

The three dominant indications for therapeutic prescription of antimicrobials were RTIs (39.0%), UTIs (35.1%) and skin or wound infections (16.0%). These were dominant in all countries except for Croatia, where no treatment of skin or wound infections was reported, and England, where treatment of genital infections was more common than treatment of skin or wound infections (Table 18).

Figure 28. Percentage of antimicrobials prescribed for uroprophylaxis, HALT-2, 2013



* *Poor or very poor national representativeness of LTCF sample*

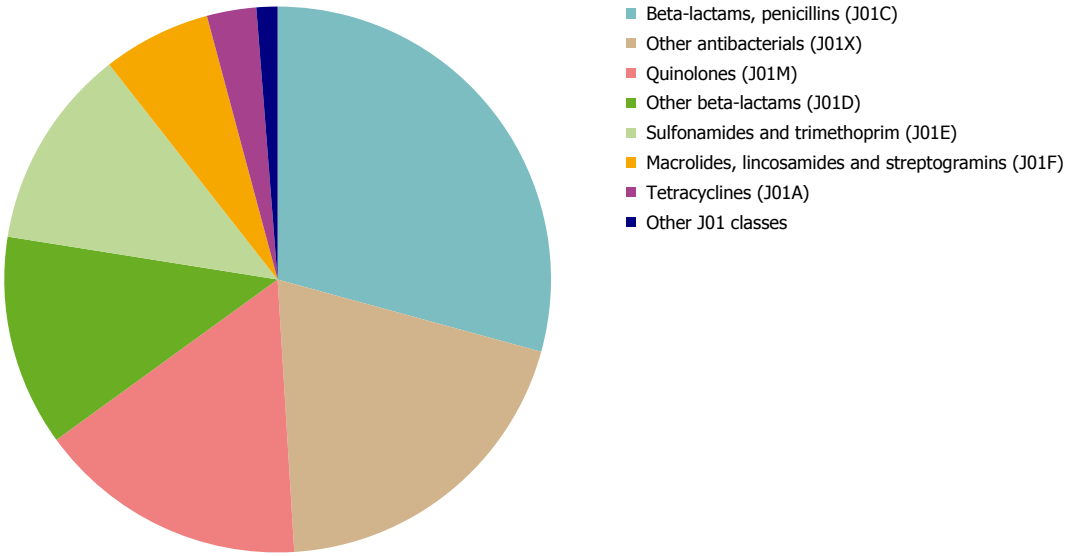
Antimicrobial agents prescribed in the LTCFs

Antibacterials for systemic use (ATC J01) represented 97.0% of all reported antimicrobials. Other groups were less common: intestinal anti-infectives (ATC A07, 0.3%), antiprotozoals (ATC P01, 0.7%), tuberculostatics (ATC J04, 0.6%), antimycotics for systemic use (ATC J02, 0.5%) and antifungals for systemic use (ATC D01B, 0.2%). The name, and therefore also the ATC code, was missing for seven antimicrobial agents.

Antibacterials for systemic use (ATC J01)

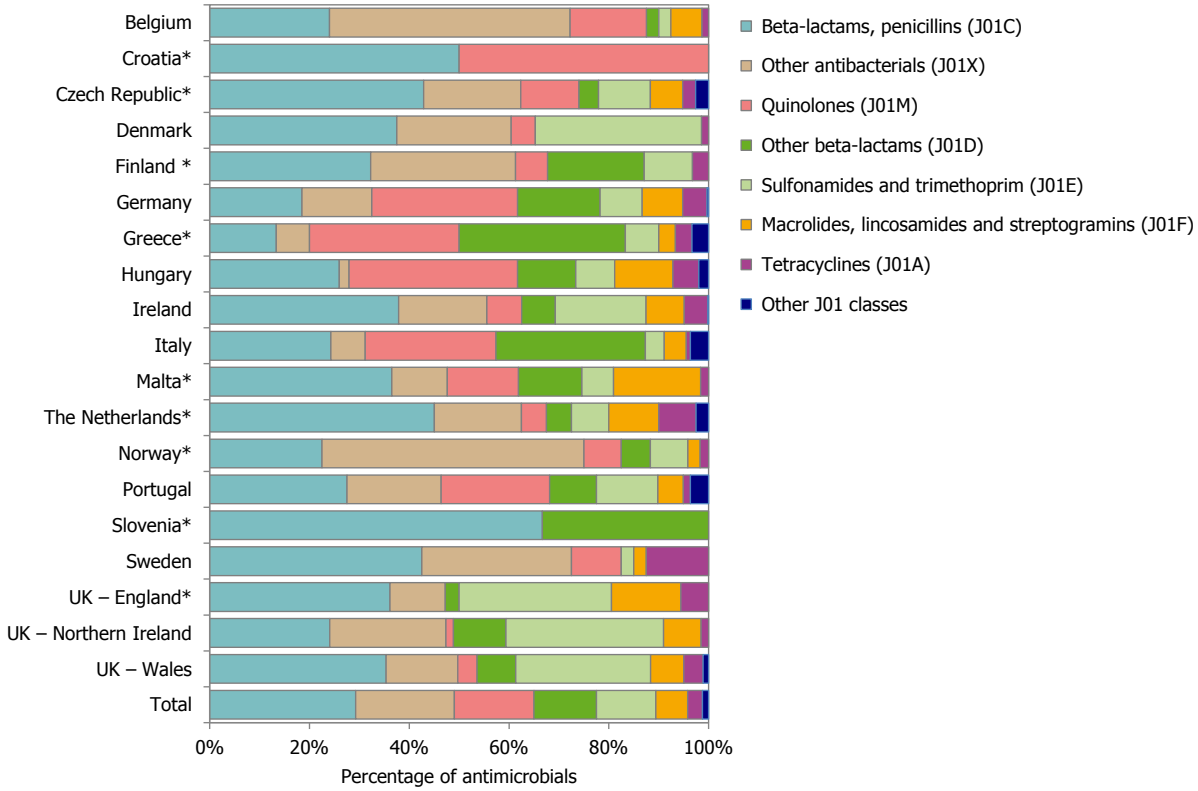
There were 3 455 antibacterials for systemic use (J01) recorded. The most frequently used classes within this group were beta-lactams/penicillins (J01C; 29.3%), other antibacterials (J01X; 19.8%), quinolones (J01M, 16.0%, Figure 33), other beta-lactams (J01D; 12.5%) and sulfonamides and trimethoprim (J01E; 11.9%) (Figure 29).

Figure 29. Distribution of use of antibacterials for systemic use (ATC J01), HALT-2, 2013



The percentage of beta-lactams/penicillins (J01C) within antibacterials for systemic use varied from 0.0% in Greece to more than 50% in Croatia and Slovenia (two countries with a very low number of antimicrobials prescribed) (Figure 30). A high percentage of 'other antibacterials' (J01X) was reported by Belgium (48.2% of all J01 drugs) and Norway (52.5%). In Germany and Hungary, the J01M quinolones group was most frequently used (29.2% and 33.8%, respectively). The percentage of quinolone use was also relatively high in Croatia (50.0%; n=4 of 8), Greece (30%), Italy (26.2%) and Portugal (21.7%) (Table 19, Figure 30 and Figure 33).

Figure 30. Distribution of use of antibacterials for systemic use (ATC J01), by country, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample*

Table 19. Distribution of use of antibacterials for systemic use (ATC J01) in the included LTCFs, by country, HALT-2, 2013

Antimicrobial class (ATC code)	All countries		Belgium		Croatia*		Czech Republic*		Denmark		Finland*		Germany		Greece*		Hungary		Ireland	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Tetracyclines (J01A)	**101**	**2.9**	6	1.3	0	0.0	2	2.6	2	1.4	1	3.2	15	4.9	1	3.3	8	5.2	36	4.8
Amphenicols (J01B)	**2**	**0.1**	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.1
Beta-lactams, penicillins (J01C)	**1 011**	**29.3**	108	24.0	4	50.0	33	42.9	54	37.5	10	32.3	57	18.5	4	13.3	40	26.0	287	37.9
Other beta-lactams (J01D)	**432**	**12.5**	11	2.4	0	0.0	3	3.9	0	0.0	6	19.4	51	16.6	10	33.3	18	11.7	51	6.7
Sulfonamides and trimethoprim (J01E)	**412**	**11.9**	11	2.4	0	0.0	8	10.4	48	33.3	3	9.7	26	8.4	2	6.7	12	7.8	138	18.2
Macrolides, lincosamides and streptogramins (J01F)	**221**	**6.4**	28	6.2	0	0.0	5	6.5	0	0.0	0	0.0	25	8.1	1	3.3	18	11.7	58	7.7
Aminoglycosides (J01G)	**40**	**1.2**	0	0.0	0	0.0	2	2.6	0	0.0	0	0.0	1	0.3	1	3.3	3	2.0	0	0.0
Quinolones (J01M)	**552**	**16.0**	69	15.3	4	50.0	9	11.7	7	4.9	2	6.5	90	29.2	9	30.0	52	33.8	53	7.0
Combinations of antibacterials (J01R)	**1**	**0.0**	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Other antibacterials (J01X)	**683**	**19.8**	217	48.2	0	0.0	15	19.5	33	22.9	9	29.0	43	14.0	2	6.7	3	2.0	134	17.7
Antibacterials for systemic use (J01) – Total	**3 455**		**450**		**8**		**77**		**144**		**31**		**308**		**30**		**154**		**758**	

Antimicrobial class (ATC code)	Italy		Malta*		Netherlands*		Norway*		Portugal		Slovenia*		Sweden		UK – England*		UK- Northern Ireland		UK- Wales	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Tetracyclines (J01A)	6	0.8	1	1.6	3	7.5	2	1.7	2	1.5	0	0.0	5	12.5	2	5.6	2	1.5	7	3.9
Amphenicols (J01B)	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.6
Beta-lactams, penicillins (J01C)	180	24.3	23	36.5	18	45.0	27	22.5	38	27.5	2	66.7	17	42.5	13	36.1	32	24.1	64	35.4
Other beta-lactams (J01D)	222	30.0	8	12.7	2	5.0	7	5.8	13	9.4	1	33.3	0	0.0	1	2.8	14	10.5	14	7.7
Sulfonamides and trimethoprim (J01E)	28	3.8	4	6.4	3	7.5	9	7.5	17	12.3	0	0.0	1	2.5	11	30.6	42	31.6	49	27.1
Macrolides, lincosamides and streptogramins (J01F)	33	4.5	11	17.5	4	10.0	3	2.5	7	5.1	0	0.0	1	2.5	5	13.9	10	7.5	12	6.6
Aminoglycosides (J01G)	27	3.6	0	0.0	0	0.0	0	0.0	5	3.6	0	0.0	0	0.0	0	0.0	0	0.0	1	0.6
Quinolones (J01M)	194	26.2	9	14.3	2	5.0	9	7.5	30	21.7	0	0.0	4	10.0	0	0.0	2	1.5	7	3.9
Combinations of antibacterials (J01R)	0	0.0	0	0.0	1	2.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Other antibacterials (J01X)	51	6.9	7	11.1	7	17.5	63	52.5	26	18.8	0	0.0	12	30.0	4	11.1	31	23.3	26	14.4
Antibacterials for systemic use (J01) – Total	**741**		**63**		**40**		**120**		**138**		**3**		**40**		**36**		**133**		**181**	

** Poor or very poor national representativeness of LTCF sample*

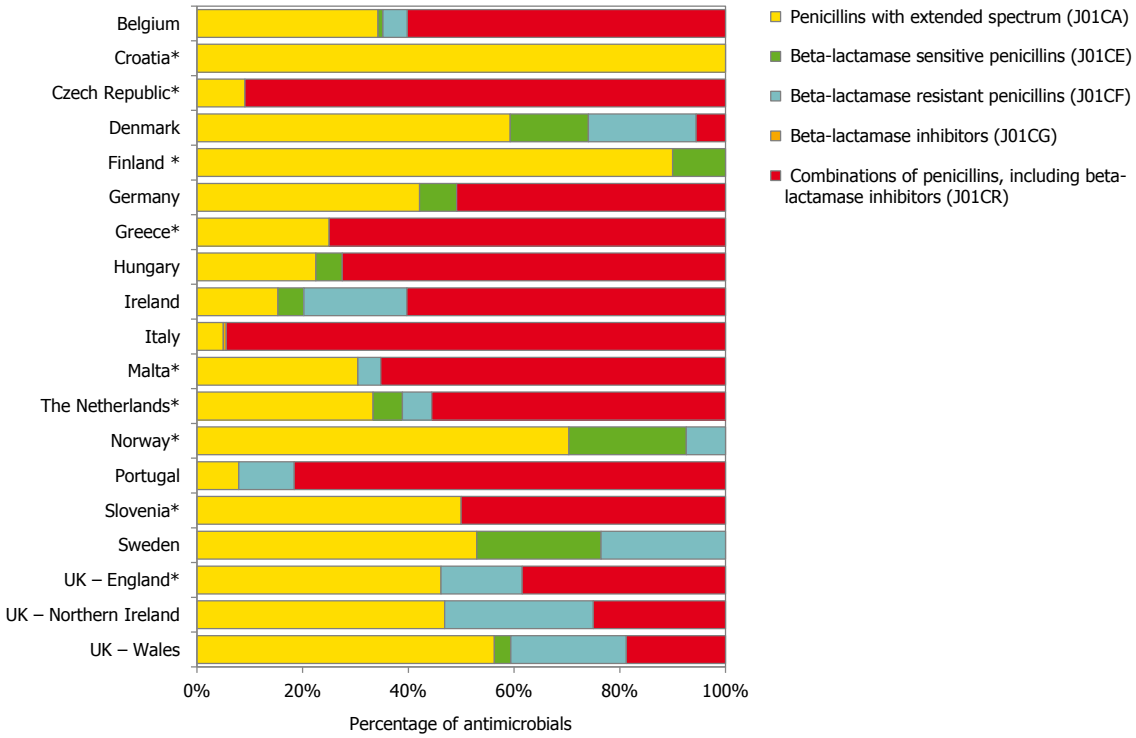
Beta-lactams, penicillins (ATC J01C)

Within the J01C class, combinations of penicillins, including beta-lactamase inhibitors (J01CR), penicillins with extended spectrum (J01CA) and beta-lactamase resistant penicillins (J01CF) were the most frequently prescribed subgroups (57.8%, 27.1% and 10.8%, respectively). Beta-lactamase sensitive penicillins (J01CE) and beta-lactamase inhibitors (J01CG) were less common (4.3% and 0.1%, respectively). The distribution of these J01C subgroups by country is presented in Figure 31.

Penicillins (J01C) were mainly prescribed for therapeutic treatment of infections (93.3%). Specifically, these were for RTIs (47.6%), skin or wound infections (23.9%) and UTIs (20.9%).

Prophylactic prescriptions (6.7%) were mainly for prevention of UTIs (36.8%), skin or wound infections (23.5%) and RTIs (19.1%).

Figure 31. Distribution of use of penicillins (ATC J01C), by country, HALT-2, 2013



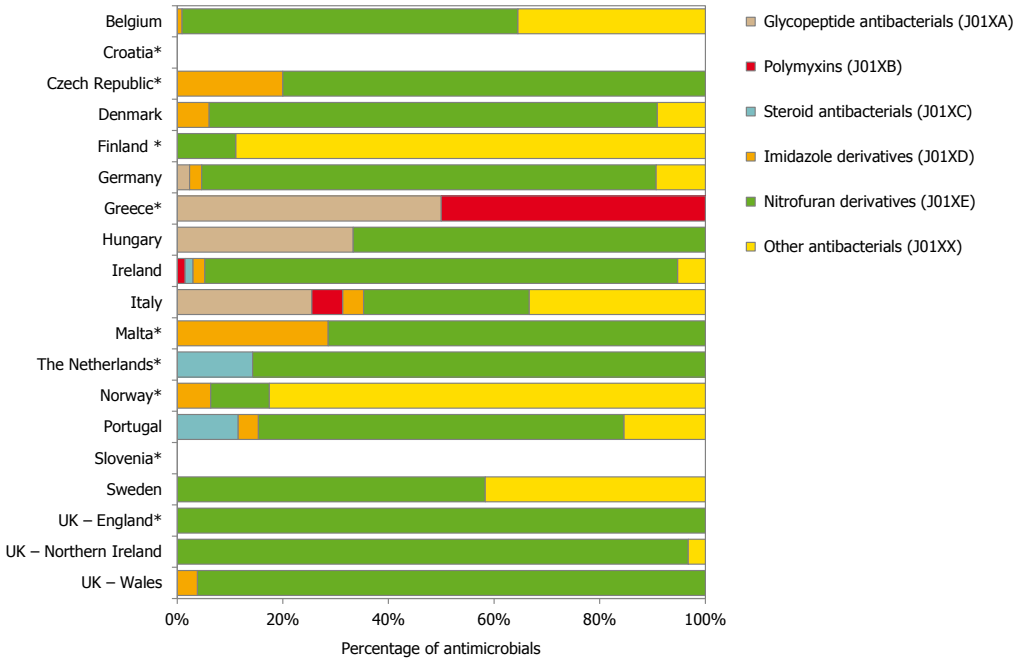
** Poor or very poor national representativeness of LTCF sample*

Other antibacterials (ATC J01X)

Within the 'other antibacterials' group (J01X), nitrofuran derivatives (J01XE) and 'other antibacterials' (J01XX) were the most frequently prescribed (66.8% and 26.1%, respectively). A small number of glycopeptide antibacterials (J01XA; 2.3%), polymyxins (J01XB; 0.9%), steroid antibacterials (J01XC; 0.9%) and imidazole derivatives (J01XD; 3.1%) were reported. Figure 32 displays the distribution of the use of this group by country. No J01X molecules were prescribed in the participating LTCFs in Croatia and Slovenia.

Other antibacterials (J01X) were mostly prescribed as prophylactic agents (65.9%), almost all for the prevention of UTIs (97.8%). The main indications for therapeutic use of other antibacterials (J01X) were UTIs (80.3%) and skin or wound infections (7.3%).

Figure 32. Distribution of use of other antibacterials (ATC J01X), by country, HALT-2, 2013



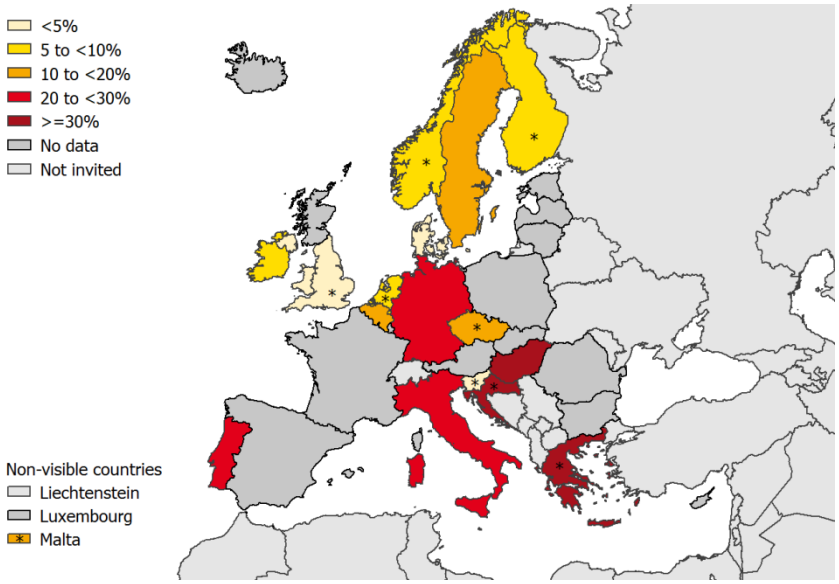
** Poor or very poor national representativeness of LTCF sample*

Quinolone antibacterials (ATC J01M)

All but one prescribed quinolone (prescribed in Hungary) were fluoroquinolones (J01MA). Ciprofloxacin (J01MA02) and levofloxacin (J01MA12) were the most commonly prescribed fluoroquinolones (61.9% and 23.6%, respectively).

The majority of quinolones (J01M) were prescribed therapeutically, mainly for the treatment of UTIs (53.3%), RTIs (29.5%), and skin or wound infections (10.0%). Prophylactic use (11%) was mainly for the prevention of UTIs (68.8%) and of other infections (14.1%).

Figure 33. Quinolone antibacterials (ATC J01M) as a percentage of all used antimicrobials (J01) on the day of the PPS, HALT-2, 2013



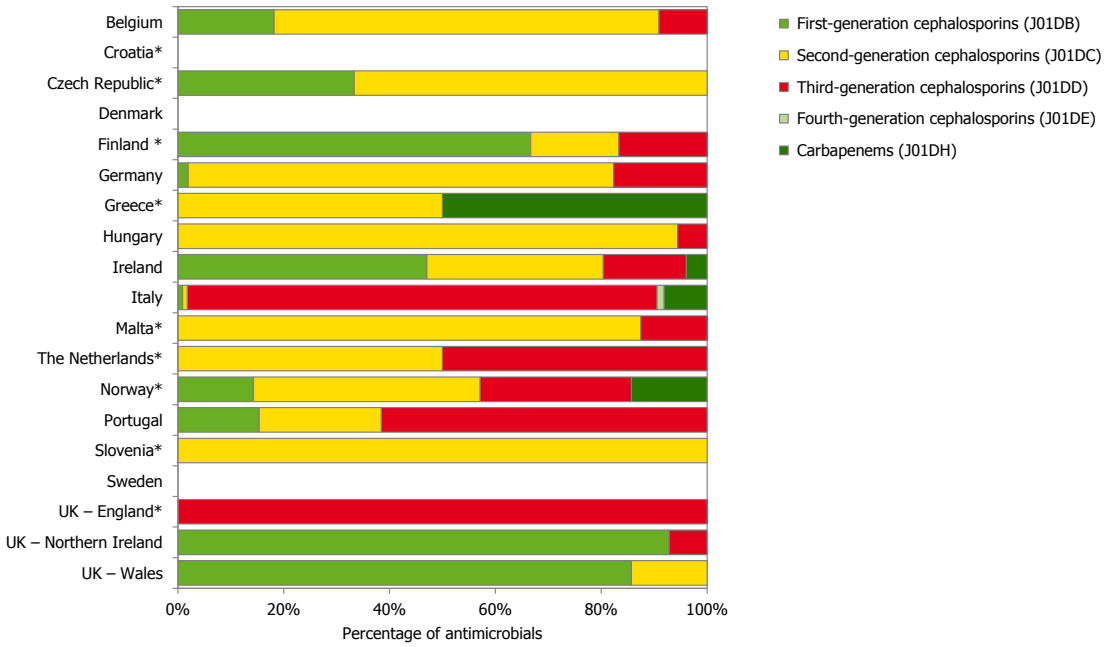
* *Poor or very poor national representativeness of LTCF sample*

Other beta-lactams (ATC J01D)

A large majority of 'other beta-lactams' used in the LTCFs were third-generation (J01DD; 53.5%) and second-generation cephalosporins (J01DC; 25.5%). First-generation cephalosporins (J01DB; 14.4%), carbapenems (J01DH; 6.0%) and fourth-generation cephalosporins were less frequently used. The distribution of the use of these J01D subclasses is presented in Figure 34.

Overall, 86.8% of the J01D antibacterials (other beta-lactams) were prescribed therapeutically while 13.2% were used in prophylaxis. RTIs (59.2%), UTIs (23.5%) and skin or wound infections (10.4%) were the main indications for therapeutic use of the J01D agents. The main reasons for prophylactic use of this J01D class were UTIs (64.9%) and RTIs (14.0%).

Figure 34. Distribution of use of other beta-lactams (ATC J01D), by country, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample*

Isolated microorganisms and antimicrobial resistance

There were 891 antimicrobial treatments (25.0%) for which it was reported that a sample had been taken for microbiological culture. (Therefore, equally and by the same token, no sample was taken to guide treatment for 75.0% of the antimicrobial prescriptions). Microbiological results were not available on the day of the PPS for a third of these treatments' samples (n=283, 34.8%), including 21 samples which awaited the microbiological test (2.4%). Microorganisms could not correctly be classified for 5.2% of the culture samples; 16 (1.8%) had a negative result, i.e. sterile examination.

In the three UK administrations and in Croatia, microbiological results were available for less than 1% of all prescriptions (Figure 35). The availability of microbiological results was highest (≥25% of all prescriptions in Greece, Portugal and Slovenia (Table 20, Figure 35).

Table 20. Number of courses of antimicrobials for treatment or prophylaxis, with a microbiological sample taken and with culture results in the included LTCFs, by country, HALT-2, 2013

	Antimicrobial treatment			Antimicrobial prophylaxis			All antimicrobials (treatment and prophylaxis)					
		With microbiological sample			With microbiological sample			With micro-biological sample		Samples with ≥1 microorganism identified		Identified micro-organisms
Country	N	n	%	N	n	%	N	n	%	n	%	n
Belgium	277	91	32.9	178	42	23.6	455	133	29.2	96	72.2	107
Croatia*	8	0	0.0	0	0	0.0	8	0	0.0	-	-	-
Czech Republic*	74	23	31.1	5	1	20.0	79	24	30.4	13	54.2	15
Denmark	74	30	40.5	76	20	26.3	150	50	33.3	4	8.0	4
Finland*	18	7	38.9	13	3	23.1	31	10	32.3	6	60.0	9
Germany	280	47	16.8	42	4	9.5	322	51	15.8	29	56.9	33
Greece*	28	18	64.3	4	1	25.0	32	19	59.4	18	94.7	20
Hungary	154	10	6.5	5	0	0.0	159	10	6.3	8	80.0	8
Ireland	481	139	28.9	296	79	26.7	777	218	28.1	123	56.4	143
Italy	679	174	25.6	93	5	5.4	772	179	23.2	143	79.9	177
Malta*	60	9	15.0	4	0	0.0	64	9	14.1	7	77.8	8
Netherlands*	30	8	26.7	11	0	0.0	41	8	19.5	1	12.5	1
Norway*	59	24	40.7	64	7	10.9	123	31	25.2	21	67.7	21
Portugal	127	55	43.3	22	1	4.6	149	56	37.6	47	83.9	48
Slovenia*	3	1	33.3	0	0	0.0	3	1	33.3	1	100.0	1

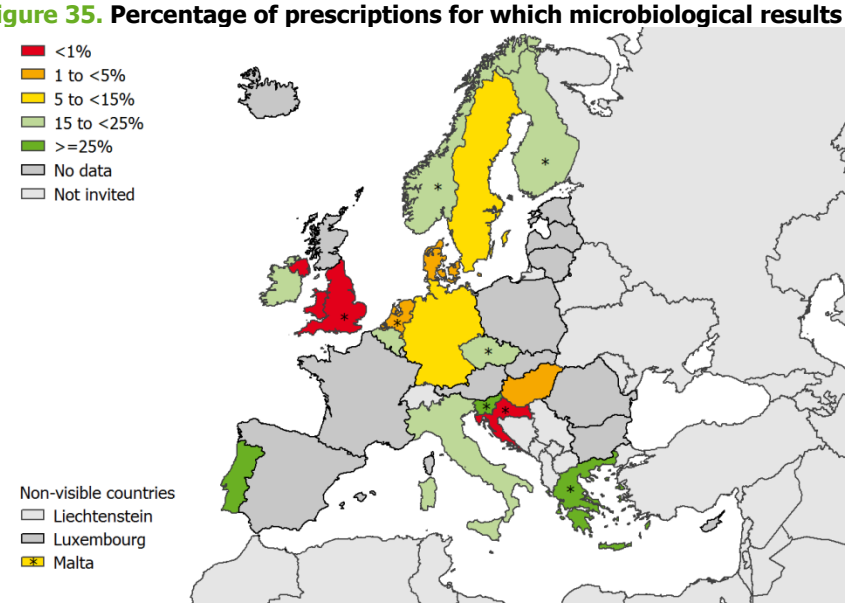
	Antimicrobial treatment			Antimicrobial prophylaxis			All antimicrobials (treatment and prophylaxis)					
		With microbiological sample			With microbiological sample			With micro-biological sample		Samples with ≥1 microorganism identified		Identified micro-organisms
Country	N	n	%	N	n	%	N	n	%	n	%	n
Sweden	28	7	25.0	13	5	38.5	41	12	29.3	6	50.0	7
UK – England*	33	7	21.2	5	0	0.0	38	7	18.4	0	0.0	0
UK – Northern Ireland	63	14	22.2	72	29	40.3	135	43	31.9	1	2.3	1
UK – Wales	117	27	23.1	65	3	4.6	182	30	16.5	1	3.3	1
Total	**2 593**	**691**	**26.7**	**968**	**200**	**20.7**	**3561**	**891**	**25.0**	**525**	**58.9**	**604**

** Poor or very poor national representativeness of LTCF sample*

In total, 604 microorganisms were reported. The ten most frequently isolated bacteria were:

- *Escherichia coli* (34.4%)
- *Staphylococcus aureus* (10.2%)
- *Proteus mirabilis* (8.1%)
- *Pseudomonas aeruginosa* (6.8%)
- *Klebsiella pneumoniae* (6.7%)
- *Clostridium difficile* (5.0%)
- *Enterococcus faecalis* (3.1%)
- *Providencia* species (2.5%)
- *Morganella* species (1.5%)
- *Acinetobacter baumannii* (1.3%)

Figure 35. Percentage of prescriptions for which microbiological results were available, HALT-2, 2013



** Poor or very poor national representativeness of LTCF sample*

Antimicrobial susceptibility results for selected bug–drug combinations are presented in Table 21. Overall, meticillin-resistant *Staphylococcus aureus* (MRSA) was reported for more than half (54.8%) of *Staphylococcus aureus* isolates. An equal number of glycopeptide-susceptible and -non-susceptible *Enterococcus* species isolates was reported, but the percentage of isolates with unknown susceptibility was high (53.3%). The observed percentage of Enterobacteriaceae non-susceptible to third-generation cephalosporins and susceptible to carbapenems varied from 0% in *Enterobacter* species and *Citrobacter* species to 100% in *Serratia* species. For *Pseudomonas aeruginosa,* the percentage of carbapenem non-susceptibility was 23.8%.

Table 21. Antimicrobial resistance markers in selected microorganisms, HALT-2, 2013

Microorganism	Number of micro-organisms	Susceptible	Specific non-susceptibility 1	Specific non-susceptibility 2	Unknown susceptibility results
		%	%	%	%
Staphylococcus aureus		Oxacillin-S	Oxacillin-R	NA	
	62	33.9	54.8		11.3
***Enterococcus* species**		Glycopeptide-S	Glycopeptide-NS	NA	
	30	23.3	23.3		53.3
Enterobacteriaceae, including:		Third-generation cephalosporin-S AND carbapenem-S	Third-generation cephalosporin-NS AND carbapenem-S	Third-generation cephalosporin-NS AND carbapenem-NS	
Escherichia coli	208	42.8	21.2	1.9	34.1
Klebsiella species	55	45.5	16.4	10.9	27.3
Enterobacter species	10	60.0	0.0	0.0	40.0
Proteus species	55	36.4	29.0	7.3	27.3
Citrobacter species	5	–	–	–	–
Serratia species	2	–	–	–	–
Morganella species	9	–	–	–	–
Pseudomonas aeruginosa		Carbapenem-S	Carbapenem-NS	NA	
	42	40.5	23.8		35.7
Acinetobacter baumannii		Carbapenem-S	Carbapenem-NS	NA	
	8	–	–	–	–

NA: not applicable; –: fewer than 10 isolates, percentage not calculated. S: susceptible; R: resistant; NS: non-susceptible (resistant and intermediate)

Antimicrobial susceptibility of the selected bug–drug combinations presented in Figure 36 should be interpreted with additional caution as relatively few reported isolates had antimicrobial susceptibility information. About a quarter of all reported microorganisms (n=143, 23.6%) were not susceptible to selected antimicrobials, including 20.9% microorganisms for which antimicrobial susceptibility reporting was required [15].

Most reports of antimicrobial-resistant bacteria were reported by the countries that reported microorganisms the most, i.e. Italy (68 resistant isolates out of a total 142 isolates), Ireland (34/123), Belgium (5/96), Portugal (13/47) and Germany (10/29) (Table 20 and Figure 36).

Figure 36. Antimicrobial resistance of the selected bug–drug combinations, by country, HALT-2, 2013 (n=484)

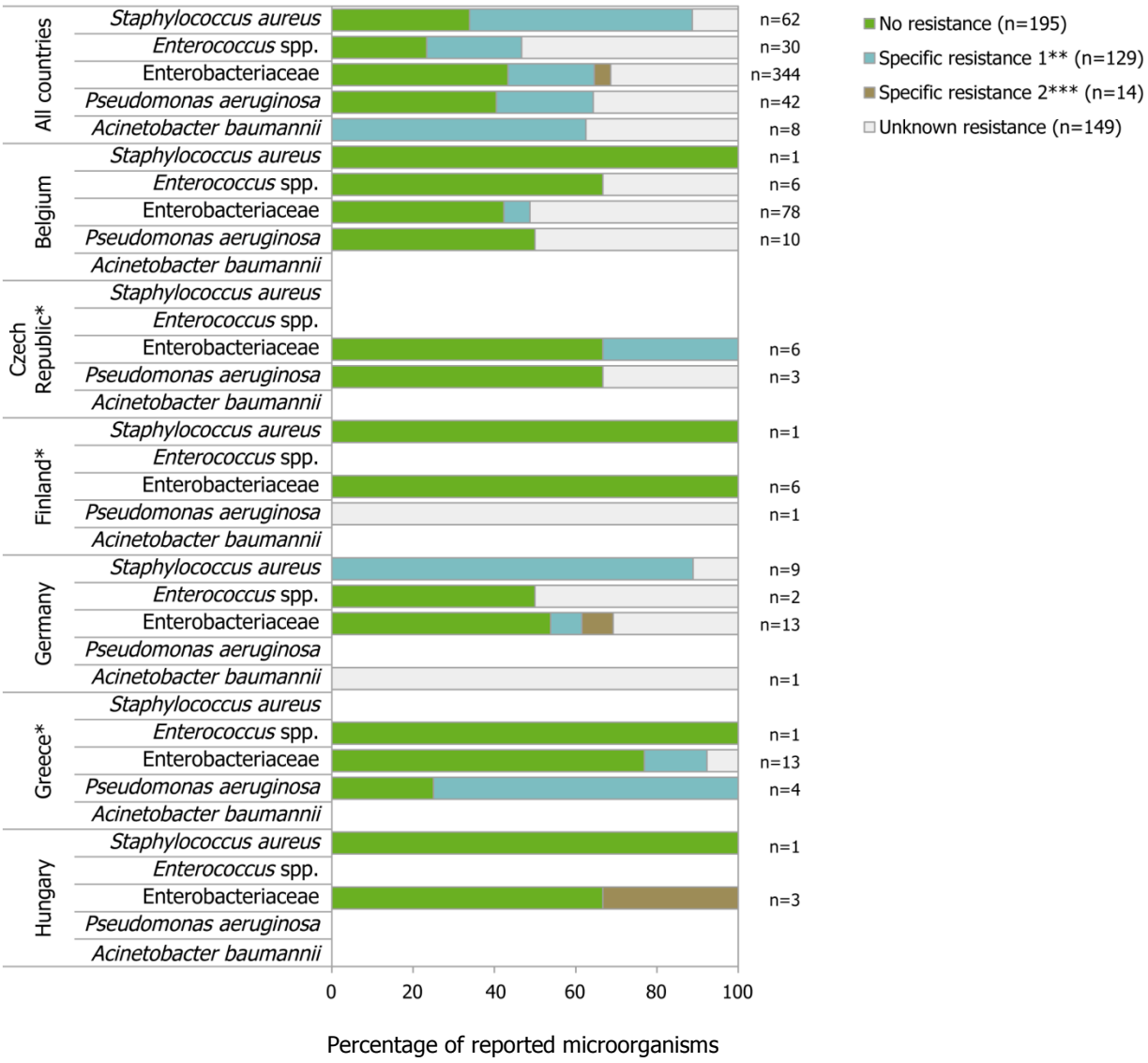
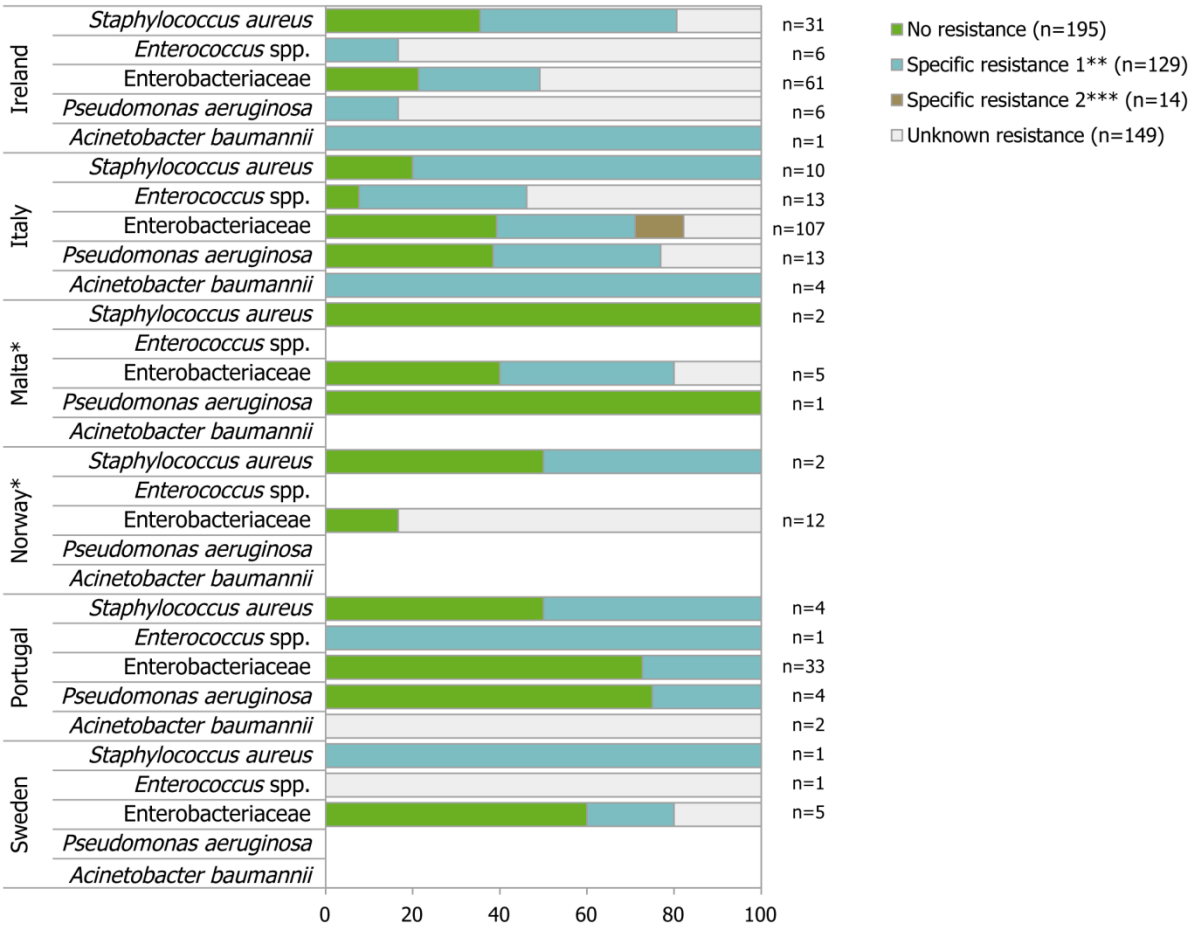


Figure 36, continued. Antimicrobial resistance of the selected bug–drug combinations, by country, HALT-2, 2013 (n=484)



Note: These results should be interpreted with caution as antimicrobial susceptibility was reported for relatively few reports. No data available for seven countries. None of the microorganisms in this figure were reported in Croatia, Denmark, UK – England, UK – Northern Ireland and UK – Wales. Only one Enterobacteriaceae was reported in Slovenia (no resistance) and in the Netherlands (unknown resistance). Enterobacteriaceae include Escherichia coli, Klebsiella *spp.*, Enterobacter *spp.*, Proteus *spp.*, Citrobacter *spp.*, Serratia *spp.* and Morganella *spp.*

** Poor or very poor national representativeness of LTCF sample*

*** The antimicrobial resistance marker specified by 'specific resistance 1' is dependent on the species: oxacillin-R (*S. aureus*), glycopeptide-NS (Enterococcus* spp.*), carbapenem-NS (*P. aeruginosa *and* A. baumannii*), third-generation cephalosporin-NS AND carbapenem-S (Enterobacteriaceae) (see Table 21)*

**** 'Specific resistance 2' refers to Enterobacteriaceae only: third-generation cephalosporin-NS AND carbapenem-NS.*

S: susceptible; R: resistant; NS: non-susceptible (resistant and intermediate)

Validation study

Twenty LTCFs from 10 countries took part in the validation study and information was evaluated for 1167 residents (Table 22) [11]. The specificity for all indicators was high, particularly so for HAIs and antimicrobial use (both >99%), which is common for such surveillance in healthcare settings [3]. It was lower for the institutional indicators, i.e. those collected through the institutional questionnaire, e.g. use of vascular/urinary catheters, incontinence and presence of wounds. The sensitivity of most indicators was also relatively high, lowest for HAIs (76%) and highest for antibicrobial use (90%).

These results suggest that the HALT-2 data are reliable, although participation in this validation study was low.

Table 22. Sensitivity and specificity of data on HAIs, antimicrobial use and institutional indicators in countries participating in the validation study, HALT-2, 2013 (n=10 countries)

	Sensitivity % (95% CI)	Specificity % (95% CI)
HAIs	76 (58–89)	99 (98–100)
Antimicrobial use	90 (89–100)	99 (99–100)
Institutional performance indicators	83 (78–87)	85% (80–89)

95% CI: 95% confidence interval

National denominators and burden estimates

Twenty-eight EU countries and all four UK administrations supplied information for an EU register of LTCFs and LTCF beds. Table 23 presents this denominator data for the LTCF categories analysed in this report, i.e. general nursing homes, residential homes and mixed LTCFs (EU countries).

Updated data were provided by 21 EU countries and three UK administrations (Belgium, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, France, Germany, Hungary, Ireland, Italy, Latvia, Lithuania, Luxemburg, Malta, the Netherlands, Norway, Portugal, Slovenia, Sweden, UK – England, UK – Northern Ireland and UK – Wales), seven countries could not provide recently updated numbers (Austria, Bulgaria, Finland, Poland, Slovakia, Spain and UK – Scotland), and data were unavailable two countries (Romania and Greece). Not all countries were able to provide data on the available number of LTCFs and LTCF beds for the requested categories. If updated data were unavailable for a country, data delivered for HALT (2010) were used whenever possible.

Estimates of the burden of HAI and antimicrobial use in LTCFs in the EU

These newly collected denominator data indicate that there were at least 63 224 LTCFs for older adults in the EU Member States in 2013 with a capacity of approximately 3 604 224 beds.

The reported total number of residents living in these facilities increased with 13.4% (+484 224 resident) since the previous HALT PPS (2010). This increase can probably be explained by an increasing capability for EU Member States to deliver national denominator data on these LTCFs, but is perhaps also partially a response to the ageing populations in EU.

This HALT-2 PPS reported has identified that an HAI was present in 2 626 (3.4%) of the 77 264 eligible residents and that 3 367 (4.4%) residents used an antimicrobial on the PPS day.

Based on point prevalence outcomes of this HALT-2 PPS and an estimated bed occupancy of 95%, we calculate that on any given day 116 416 residents living in the EU's general nursing homes, residential homes and mixed LTCFs have an HAI, and 150 657 residents are receiving at least one antimicrobial. With an average duration of an infection episode of 10 days, the total number of HAIs in LTCFs for elderly in EU Member States is estimated at 4 249 200 each year. As the duration of a resident's stay in LTCFs is generally long (two to 60 months on average [18]), the number of individual residents acquiring HAIs is likely to be substantially lower than the total number of HAIs.

Table 23. Number of LTCFs and LTCF beds in general nursing homes, residential homes and mixed LTCFs, by country, HALT-2, 2013

Country	General nursing homes			Residential homes			Mixed LTCFs			Total		% country population ≥ 80 years**
	Status	Number of LTCFs	Number of beds	Status	Number of LTCFs	Number of beds	Status	Number of LTCFs	Number of beds	Number of LTCFs	Number of beds	
Austria	NA	-	-	NA	-	-	HALT (2010)	817	72 602	817	72 602	4.9
Belgium	HALT-2 (2013)	1 211	122 273	HALT-2 (2013)	329	13 999	NA	-	-	1 540	136 272	5.2
Bulgaria	NA	-	-	NA	-	-	HALT (2010)	33	486	33	486	4.1
Croatia	HALT-2 (2013)	165	15 283	HALT-2 (2013)	196	19 257	NA	-	-	361	34 540	3.9
Cyprus	HALT-2 (2013)	2	54	HALT-2 (2013)	62	1 592	HALT-2 (2013)	28	1 013	92	2 659	2.9
Czech Republic	HALT-2 (2013)	73	7 204	-	-	-	-	-	-	73	17 204	3.8
Denmark	HALT-2	1 300	44 434	HALT-2	-	1 313	HALT-2	1 300	44 434	2 600	90 181	4.1

Country	General nursing homes			Residential homes			Mixed LTCFs			Total		% country population ≥ 80 years**
	Status	Number of LTCFs	Number of beds	Status	Number of LTCFs	Number of beds	Status	Number of LTCFs	Number of beds	Number of LTCFs	Number of beds	
	(2013)			(2013)			(2013)					
Estonia	HALT-2 (2013)	26	1 769	HALT-2 (2013)	138	6 680	HALT-2 (2013)	39	-	203	8 449	4.5
Finland	NA	-	-	NA	-	-	HALT (2010)	448	19 016	448	19 016	4.9
France	HALT-2 (2013)	608	34 187	HALT-2 (2013)	7 225	555 773	NA	-	-	7 833	589 960	5.5
Germany*	HALT-2 (2013)	*	*	HALT-2 (2013)	*	*	-	*	*	12 354	875 549	5.4
Greece	-	-	-	-	-	-	-	-	-	-	-	5.2
Hungary	HALT-2 (2013)	1 067	55 918	HALT (2010)	110	2 011	-	-	-	1 177	57 929	4.2
Ireland	HALT-2 (2013)	442	27 807	NA	-	-	HALT-2 (2013)	128	7 044	570	34 851	2.9
Italy	HALT-2 (2013)	-	285 007	-	-	-	-	-	-	-	285 007	6.1
Latvia	NA	-	-	NA	-	-	HALT-2 (2013)	82	5 798	82	5 798	4.5
Lithuania	HALT-2 (2013)	103	5 484	NA	-	-	NA	-	-	103	5 484	4.6
Luxemburg	HALT-2 (2013)	16	1 695	HALT-2 (2013)	12	585	HALT-2 (2013)	32	3 691	60	5 971	3.9
Malta	HALT-2 (2013)	2	294	HALT-2 (2013)	37	2 370	HALT-2 (2013)	6	1 958	45	4 622	3.6
Netherlands	HALT-2 (2013)	400	65 000	HALT-2 (2013)	1 300	100 000	-	-	-	1 700	165 000	4.1
Norway	-	-	-	-	-	-	HALT-2 (2013)	991	41 415	991	41 415	4.4
Poland	HALT (2010)	285	16 625	HALT (2010)	1 440	101 101	HALT (2010)	181	5 820	1 906	123 546	3.6
Portugal	HALT-2 (2013)	178	4 075	NA	-	-	NA	-	-	178	4 075	5.3
Romania	-	-	-	-	-	-	-	-	-	-	-	3.3
Slovakia	HALT (2010)	12	246	HALT (2010)	466	27 980	HALT (2010)	10	826	488	29 052	2.9
Slovenia	NA	-	-	NA	-	-	HALT-2 (2013)	90	20 777	90	20 777	4.3
Spain	HALT (2010)	5 490	331 200	NA	-	-	NA	-	-	5 490	331 200	5.2
Sweden*	HALT-2 (2013)	*	*	HALT-2 (2013)	*	*	HALT-2 (2013)	-	-	2 766	101 000	5.3
UK – England	HALT-2 (2013)	4 684	220 048	HALT-2 (2013)	12 789	248 610	-	-	-	17 473	468 658	4.8
UK – N. Ireland	HALT-2 (2013)	248	11 708	NA	-	-	NA	-	-	249	11 708	
UK – Scotland	HALT (2010)	929	38 228	HALT (2010)	1 893	-	NA	-	-	2 822	38 228	
UK – Wales	HALT-2 (2013)	254	11 437	HALT-2 (2013)	426	11 548	-	-	-	680	22 985	
Total beds			**1 299 976**			**1 092 819**			**229 880**	**63 224**	**3 604 224**	

NA: not applicable, i.e. this type of LTCF is not present in the country -: no data
** Country unable to make a distinction between types of LTCFs*
*** Source: Eurostat, 2012*

Discussion and conclusions

This second Europe-wide PPS in European LTCFs successfully collected data on HAIs, antimicrobial use and performance indicators on infection prevention and control and antimicrobial stewardship. In each LTCF, data were collected on a single day by a local data collector (i.e. a staff member of the participating LTCF) and/or by an external data collector (e.g. a national representative). Denominator data for each EU Member State were also collected, making calculation of burden estimates possible.

Fewer countries participated in HALT-2 in 2013 compared with HALT in 2010 (n=19 and n=28, respectively, UK administrations counted separately). However, a larger number of LTCFs participated in 2013 (n=1 181) than in 2010 (n=722) [3]. The representativeness of national samples of LTCFs for the 2013 PPS was 'optimal' (i.e. a systematic random nationally/regionally representative sample) in none of countries, 'good' in 10 of 19 participating countries, and 'poor' or 'very poor' in the remaining nine countries. To increase the homogeneity, and therefore the comparability of the data, responses from general nursing homes, residential homes and mixed LTCFs (n=1 051 LTCFs, 89% of all participating LTCFs) were amalgamated at country level for analyses.

One of the aims of HALT-2 was to develop a standardised tool to follow trends in the prevalence of HAIs and antimicrobial use, at local (LTCF), national and European levels. The fact that a smaller number of countries participated in HALT-2 than in HALT (2010), and that none of the countries was able to perform an optimal sampling of LTCFs demonstrates the need to improve the feasibility of sampling for future PPSs in LTCFs. Nonetheless, HALT-2 collected important information on HAIs, antimicrobial use and on the status of performance indicators in European LTCFs in 2013.

Adaptations to the HALT protocol were implemented by the HALT-2 project group and consulted experts, and finalised following the train-the-trainer meeting with NRs. These improvements, described throughout this report, included the incorporation of decision algorithms into questionnaires to simplify local identification of infections; simplification of microbiological reporting by only requesting data on selected drug–bug combinations; reformulating the wording and type of questions, particularly for performance indicators; updates and online provision of training material; and inclusion of a national register of LTCFs to provide more accurate and up-to-date denominator information. It is foreseen that the HALT protocol will improve with each repeated European PPS.

National and local engagement and training

The engagement of national staff in participating countries was excellent. NRs participated in train-the-trainer events, coordinated local training, and commonly performed or assisted in the data collection at each LTCF.

Staff from an estimated 1 072 LTCFs were trained in at least 60 training sessions using HALT-2 PPS training material. In some LTCFs, training only consisted of an update (e.g. using the HALT-2 training case studies, available online) as the staff had already participated in HALT (2010).

Training remains an essential element of the PPS process. Training sessions for LTCF staff serves not only to improve the manner in which PPSs are performed but also increases the surveillance skills and the awareness amongst Europe's LTCF staff of the importance of HAI surveillance and antimicrobial resistance in the long-term care setting.

Train-the-trainer sessions for NRs were a useful forum to troubleshoot the HALT-2 protocol, questionnaires, data entry software and training material. Future sessions, well in advance of future PPSs in LTCFs, should utilise the valuable input from NRs with experience of HALT-2 to share best practice and guidance to achieve LTCFs samples that are representative of LTCFs in these countries. These should include discussion of the challenges experienced by NRs at the local and national level.

Therefore, even in consideration of the limitations listed above, participation in training and/or the HALT-2 PPS served as a tool to increase awareness and prevention at the local, national and European level. Even if the benefits of this PPS were limited to a short-lived modification of IPC behaviour of LTCF staff due to observer bias (so-called 'Hawthorne effect'), the more rigorous application of IPC will have benefited LTCF residents [12-14]. HALT-2's design also potentiated more direct and immediate outcomes than this. For example, automated reports were sent to each participating LTCF after the PPS. These reports included a detailed comparison of the LTCF's results with those of other LTCFs at the national and European level. These reports also allowed NRs to compare their national results with European data. The reports were designed to increase the awareness of LTCF staff and promote critical evaluation of the local situation, thus empowering staff to take targeted IPC actions.

Healthcare-associated infections

The crude prevalence of LTCF residents with at least one HAI was 3.4%. The main HAI groups were RTIs (31.1%), UTIs (31.1%) and skin infections (22.8%). Overall, probable UTIs (21.1%), cellulitis, soft tissue or wound infections (20.0%), and lower RTIs other than pneumonia (18.3%) were the most common types of HAI.

The crude prevalence of HAIs in HALT-2 was higher than in the 2010 HALT PPS (2.4%), but both studies used a different approach to collect data on HAI. In HALT (2010), the McGeer criteria for surveillance of infections in LTCFs were modified (e.g. addition of the criterion 'diagnosis by the attending physician'); data collectors reported signs/symptoms of an infection, and definitions were applied during analysis [3,6]. The infection could be confirmed in only 59.6% of residents for whom at least one sign/symptom was reported. It is therefore possible that fewer cases were detected in HALT (2010) due to underreporting of signs/symptoms by local staff members. For HALT-2, data collectors were therefore asked to apply decision algorithms to identify infections, which forced them to look at all possible signs/symptoms. The algorithms were based on the CDC/SHEA case definitions, which are in turn based on the McGeer criteria [7]. In order to familiarise LTCF staff with the application of these algorithms, more emphasis on training was given in HALT-2 (see above).

Minor adjustments to the case definitions were made to correct for the more limited access to microbiological and laboratory tests in European LTCFs in comparison with institutions in the US and Canada. This mainly affected the definition of a UTI. In the US version, confirmation of a UTI is only possible when there are sufficient signs/symptoms and microbiological evidence. Urine cultures are not routinely performed in some European countries' LTCFs. Therefore, an additional infection level, i.e. 'probable' UTI was applied when sufficient signs/symptoms were present but there was no microbiological confirmation (i.e. a negative or unknown urine culture result, or test not done).

There was unequal use of the optional 'UTI module' that collected enhanced data on UTI cases compared with the main HALT-2 protocol and questionnaire; this added some imprecision to the UTI data. Specifically, the optional UTI module identified an additional 2.8% UTI cases (n=24 of 856). The causes of the discrepancy include the optional nature of the UTI module (only used by nine of 19 countries) and the fact that pre-submission data analysis steps were not pre-specified, or precluded. Even with the additional 24 UTI cases, the number of UTIs was still the near equal to the most commonly reported type of infection (i.e. RTIs, n=857) and more frequent than the third most common type (i.e. skin infections, n=629).

The overall magnitude and impact of this bias to the UTI data may be comparable to that applied to the data for other infection types and indicators, during the HALT-2 PPS data collection and analysis. Even though the HALT-2 protocol and questionnaire aimed to be unambiguous, bias during data collection is possible. The validation study for the HALT-2 PPS recruited two LTCFs in each of 10 participating countries and identified an overall sensitivity of 76% (95% CI: 55–89%) and an overall specificity of 99% (95%CI: 98–100%) for HAIs. As a comparison, validation studies performed in four countries during the ECDC PPS in acute hospitals showed an overall sensitivity of 71.9% (country range: 57.8–94.0%, four countries) and an average specificity of 99.4% (country range: 99.0–99.9%) for HAIs [10]. The results of these validation studies for the detection and reporting of HAIs in acute care hospitals and in LTCFs are therefore similar, although the accuracy of the HALT-2 validation study may be biased by having relatively few participating LTCFs.

Manual data entry is commonly associated with errors, and data correction is not unusual during data processing. This is a common feature of the standard operation of a surveillance system. Indeed, in the HALT-2 PPS we had the opportunity to document the magnitude of the data correction and scrutinise its overall impact. The magnitude of biases due to the PPS design, and the national representativeness of the LTCF samples, are likely to surpass those detected here in the UTI data, the most important of which being sampling bias. Although perfect data are in themselves desirable, the standard processes imbedded in the design and execution of the HALT-2 PPS should mean that, despite the imprecision, the identified themes remain valid.

Antimicrobial use

The crude prevalence of residents receiving at least one antimicrobial agent was 4.4%. Antibacterials for systemic use (ATC group J01) represented 97.0% of all reported antimicrobials, and beta-lactams/penicillins (29.3%), other antibacterials (19.8%) and quinolones (16.0%) were the most commonly used classes of antimicrobials.

These results are almost identical to that of the HALT PPS in 2010, which identified a crude prevalence rate of 4.3%, and 96.2% of all antimicrobials were antibacterials for systemic use. In 2010, beta-lactams/penicillins, other antibacterials and quinolones were also the most frequently used antimicrobials (28.7%, 19.4% and 15.5%, respectively).

Antimicrobials were most frequently prescribed for treatment of an infection (72.8%) with remaining prescriptions concerning prophylactic courses (27.2%). These percentages were also similar to that of the HALT PPS in 2010 (72.4% vs. 27.7%, respectively).

Isolated microorganisms

For HALT-2, the data collection method was adapted to be in line with the ECDC PPS of HAIs and antimicrobial use in European acute care hospitals 2011–2012, i.e. antimicrobial resistance data were only collected for selected bug–drug combinations [10,17]. The main difference between HALT-2 and the ECDC PPS in European acute care hospitals is that for acute care hospitals resistance data were collected for microorganisms isolated from HAIs, while resistance data for LTCFs in HALT-2 were collected from residents receiving antimicrobial agents. This is due to historical reasons in place since the ESAC nursing homes studies; this practice was maintained in HALT-2 to facilitate data collection in participating LTCFs.

The results on isolated microorganisms and antimicrobial resistance should be interpreted with caution as there were several potential causes of bias. Firstly, there were relatively few data as culture samples to guide treatment were only taken for 25.0% of antimicrobial prescriptions. In addition to this, the results of the microbiological tests were not yet available, or could not be found or consulted for 31.8% of these samples. Both of these factors were especially notable in Denmark and in the UK administrations. Also, PPSs inherently underestimate such results because PPSs are performed on one single day with no follow-up thereafter. These factors, combined with the great variation in national representativeness of the data, may be the reason for the large differences in the numbers of reported microorganisms.

The top seven most frequently reported microorganisms were the same as in HALT (2010), with the three most frequent being *Escherichia coli* (34.4%), *Staphylococcus aureus* (10.2%) and *Proteus mirabilis* (8.1%).

In addition to the apparently low accessibility of culture sample results for LTCFs, there appears to have been poor access to, or poor reporting of, antimicrobial susceptibility results. The rate of unknown resistance results varied from 0% in *Serratia* species to 53.3% for *Enterococcus* species (susceptibility to glycopeptides). Most of the reported antimicrobial-resistant bacteria were reported by countries that reported large numbers of microorganisms (e.g. Italy, Ireland, Belgium, Portugal and Germany). In other words, there may be a reporting bias in which participating countries with more comprehensive reporting of microbiological results from their participating LTCFs are overrepresented.

Structure and process indicators

The development of the HALT performance indicators for IPC and antimicrobial stewardship were published recently [16]. Three IPC structures were explored in HALT-2: presence of a person with training in IPC, access to IPC advice, and presence of an IPC committee. In 2013, about one third (31.3%) of LTCFs had all three IPC structures, while only 10% had none of these structures in place. In HALT (2010), 21.1% of the participating LTCFs had all three structures in place, while 9.0% had none of these three structures. The percentage of LTCFs without access to any IPC structure was remarkably low, though it should be emphasised that the indicator does not provide any information on the work time (number of person-days) dedicated to IPC in the LTCFs.

In HALT-2, a new question was added on the most frequently used hand hygiene method. Most LTCFs reported that they mainly disinfect their hands with an alcohol-based solution, but the percentage (56.2%) was lower than expected. Liquid soap for hand washing was available in a higher percentage (98.2%) of LTCFs than alcohol-based rub solution (90.7%). Alcohol-based hand rub consumption was reported by 80% of all LTCFs, which was a surprisingly high percentage and suggests that the feasibility of collecting this indicator in LTCFs is better than anticipated. The mean alcohol-based hand rub consumption was 8.0 (median 4.2) litres per 1 000 resident-days, which is much lower than the mean consumption of 23.9 (median 18.7) litres per 1 000 patient-days reported in European acute care hospitals in 2011–2012 [10]. The lower number of contacts between LTCF staff and residents (hand hygiene opportunities), as compared with the number of contacts between healthcare workers and patients in hospitals, probably accounts for an important fraction of this difference. Nevertheless, the large variability of alcohol-based hand rub consumption between LTCFs in HALT-2 also shows there is still much room for improvement in this area.

In addition, there is still a lot of room for improvement with regard to antimicrobial stewardship in LTCFs as 46.0% of all participating LTCFs declared that they have none of the explored antimicrobial stewardship elements in place.

The most frequently reported antimicrobial stewardship elements in HALT-2 were different from those reported in HALT (2010). In HALT-2, the most frequently reported structures were 'therapeutic formulary, comprising a list of antibiotics' (33.6% of LTCFs), 'advice from a pharmacist for antimicrobials not included in the formulary' (20.7%), 'written guidelines for appropriate antimicrobial use (good practice) in the facility' (20.0%), and 'data on antimicrobial consumption' (16.0%). The importance of taking microbiological samples to guide antimicrobial choice dropped from being in the first place in HALT in 2010 to the fifth place (14.1%) in HALT-2 in 2013.

Burden estimates

The survey of LTCF denominators in EU/EEA Member States collected and collated recent information on the number, type and size of LTCFs in each country. This information will make it possible to monitor how Member States cope with the increasing number of LTCFs which provide care for Europe's aging population. These national denominator data also permit the estimation of the burden of HAIs and antimicrobial use for the LTCF population, using the prevalence results from the HALT-2 PPS.

As described above, interpretation of the number of received antimicrobial agents – and particularly the number of HAIs detected in this survey – should be interpreted with caution due to the likely biases. Still, the burden for residents of general nursing homes, residential homes and mixed LTCFs in 2013, as estimated by HALT-2, indicates the scale of the HAI hazard faced by residents in European LTCFs and the resulting challenge for European health professionals.

We estimated that, in 2013, 4.2 million HAIs occurred in general nursing homes, residential homes and mixed LTCFs. Since the length of stay in these LTCFs is long, and given that the most vulnerable residents acquire more than one HAI per year, the number of residents acquiring these 4.2 million HAIs is expected to be substantially lower and could not be estimated. The number of LTCF residents with an HAI on any given day was estimated at 116 416 and the number of LTCF residents receiving at least one antimicrobial on any given day at 150 657.

Future steps and recommendations

In 2009, EU Member States committed to a set of actions in light of the Council Recommendations on patient safety, including the prevention and control of HAIs (2009/C 151/01) [8]. A first evaluation of the steps taken by Member States and at EU level was conducted by the European Commission in 2011 [9]. This evaluation acknowledged that a variety of actions had already been taken, while pointing out that there still was considerable room for improvement. The following priority areas for LTCFs were identified for those working at the national and EU level:

- Extend patient safety strategies and programmes from hospital care to non-hospital care (Member State level).
- Ensure adequate numbers of specialised IPC staff with time set aside for this task in hospitals and other healthcare institutions (Member State level).
- Reinforce tailored basic IPC structures and practices in nursing homes and other LTCFs (Member State level).
- Repeat national point prevalence surveys of HAIs as a means to monitor the burden of HAI in all types of healthcare institutions, to identify priorities and targets for intervention, to evaluate the impact of interventions and to raise awareness (Member State level).
- Continue the development of guidance on the prevention and control of HAIs, including tailored guidance for nursing homes and other LTCFs (EU level).

The following recommendations can be made for future PPSs in European LTCFs:

- Continue monitoring HAIs and antimicrobial use, using a standardised methodology across different countries.
- Explore measures to increase the representativeness of the sampled LTCFs before the next survey(s) and to increase the number of participating countries and LTCFs.
- Promote, with national authorities, the importance of having a good national/regional register of LTCFs and LTCF beds to calculate burden estimates of HAIs and antimicrobial use in LTCFs.
- Continue to provide training to LTCF staff to harmonise the interpretation of case definitions and to improve IPC skills.
- Perform further validation studies at the national level, giving special attention to HAI case definitions.

The HALT-2 project collected valuable information on HAIs and antimicrobial use in LTCFs using a standardised and feasible methodology, and through this process helped improve surveillance skills in chronic care facilities. This skill will be highly beneficial for LTCF staff tackling the threat of antimicrobial resistance. The automated reports for participating LTCF provided LTCF staff with awareness of their local situation in comparison with national and European data, empowering them to take targeted actions against HAIs.

Infection prevention and control resources in LTCFs should be strengthened, although implementation will be challenging as workload levels can be extremely high in LTCFs due to the high care load and the lack of sufficient personnel. Moreover, IPC expertise and diagnostic support (e.g. microbiological and laboratory confirmation) should still be improved. Also, medical care is often poorly coordinated. This survey should help raise awareness for HAIs and antimicrobial resistance at the national and European level.

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